

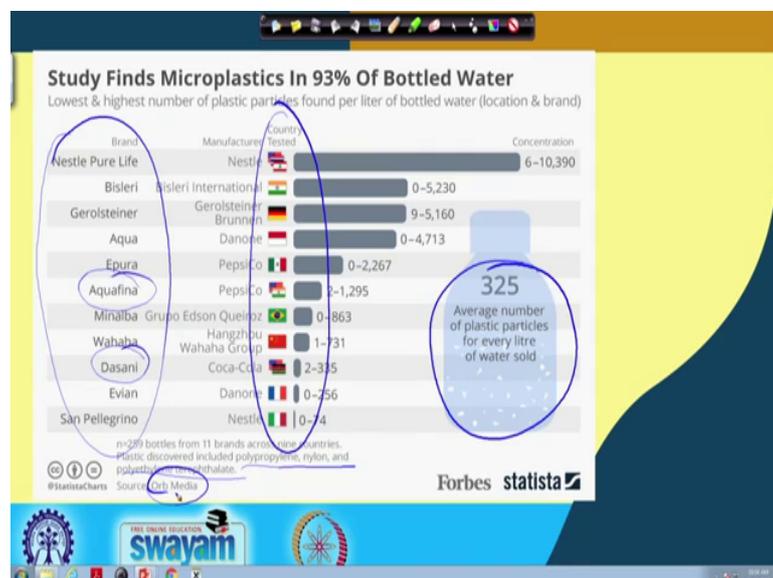
Plastic Waste Management
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Lecture – 25

Plastic Pollution: Health and Environmental Impact (Contd...)

Hello, so welcome back. So, we are in the last video last module for week 5. So, we will continue our discussion on Plastic Pollution Health and Environmental Impact which we were discussing in the earlier video as well.

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So, looking at the where we left exactly in the previous video, we were looking at this particular slide, if you remember where we were looking at the presence of microplastics in the bottle water. So, this particular study was done taking water bottle from several countries as you can see the flags of several countries are presented here. This countries that was tested and several brands starting from Nestle, Bisleri which is more common in India. We also like Aquafina, we have Aquafina sometimes we see Dasani also in Indian market too. So, Aquafina and so many of the some of the Indian brands and many of the international brands and they were all tested for microplastics.

So, what is this microplastics? This is actually tiny pieces of plastic which is which you usually cannot see with naked eye, but if you when you look at in under microscope, you identify them. So, in terms of the bottles they were 325 numbers of plastic particles for

every litre of water sold. And this was for many brands many countries sample taken from 9 countries and plastic discovers were polypropylene, nylon, and polyethylene terephthalates.

So, and this was done by Orb Media that Organization which did that. So, as you can see there is piercing contamination of plastic in our bottle water from almost all major brands that you find in the in the world. Similarly we also found plastic in salts. So, many of these salt particles many of these salt brands was tested very recently. One of the study also came out from IIT Bombay, I think few months back which you can again you can Google it and you will be able to find it.

So, there the plastics are showing up microplastics are showing up in the salt and we need salt for pretty much every meal we consume we do put salt in there. So, there are issues of microplastic exposure to humans through water, through salt, through a like different in the fish, and some other sources. So, even air people are looking at micro plastics in air. So, that is also another concern that we have in terms of these plastics showing up. So, this is where we left in the previous video.

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Impacts of uncontrolled plastic burning

- Increases risk of heart disease
- Aggravates respiratory ailments such as asthma and emphysema
- Causes skin rashes, nausea, or headaches
- Damages the nervous system
- Damages the kidneys and liver
- Disrupts the reproductive, endocrinal and development systems
- In particular, burning polystyrene such as Styrofoam cups, plates and food trays releases styrene gas which disrupts the central nervous system.

Source: <https://www.climatecentral.org/news/where-trash-is-a-burning-problem-17971>

So, and then if you there are issues of a uncontrol plastic burning. So, whenever there is a burning of plastic it increases because there is a dioxin furans all sorts of nasty organic chemicals getting released. So, what it in terms of for health impact? It increases risk of heart disease. So, you have a heart disease increases the risk of heart disease, aggravates

respiratory ailments such as asthma and emphysema. Causes skin rashes, nausea, headache, damage the nervous system, kidneys, and liver, disrupt reproductive endocrinal and development systems. In particular burning polystyrene, and Styrofoam cups and plates and food trays releases styrene gas which disrupts the central nervous system.

So, as you can see open that is why we say open burning of garbage and these days as you know 12 percent of our municipal solid waste is essentially is plastics. So, when we do open burning of garbage, we are burning plastics there. These are Styrofoam's cups which that white colour plates do you have that use and throw ones, which many you use it you go to any these days any like eateries they give you those kind of plates because it is cheap and its if you just its light as one. So, it is easy to transport its cheap, its light, and you can use it and throw it.

So, so they are its being used in many places and when the it ends up in the waste disposal side whether it is a known whether its burning intentional or burning accidental in both the cases it releases because, burning is burning does not matter whether its intentional or on purpose. Or like or either on purpose or through by accident, it does lead to lot of air pollutants which causes all these different issues associated with our with our body. And, of course it to the other species as well which were gets exposed to these chemicals.

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Dioxin emissions from plastic burning

- The most dangerous emissions can be caused by burning plastics containing organochloro-based substances like PVC. When such plastics are burned, harmful quantities of dioxins, a group of highly toxic chemicals are emitted.
- Dioxins are the most toxic to the human organisms. They are carcinogenic and a hormone disruptor and persistent, and they accumulate in our body-fat and thus mothers give it directly to their babies via the placenta.
- Dioxins also settle on crops and in our waterways where they eventually wind up in our food, accumulate in our bodies and are passed on to our children.

Source: <https://www.climatecentral.org/news/where-trash-is-a-burning-problem-17071>

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So, that is a one issue in terms of the uncontrolled burning. Dioxins which we talked about quite a bit even in the those of you who may have taken the solid waste in the solid waste as fair also we talk about dioxins and furans from open burning of garbage. And open burning, open burning of waste is considered the number one source of dioxins and furans today and one of the reason, for dioxins and furans is because of the presence of plastics. So, the most dangerous and these dioxins and furans are potential carcinogens they are and they cause cancer and these are at very very low concentration it is harmful. So, as a stated here; for the most dangerous emission can be caused by burning plastic containing organochloro-based substances.

So, whenever the chlorine is there and organics are there, is like PVC when such plastics are burnt the harmful quantities of dioxins a group of highly toxic chemicals are emitted. So, dioxin are most toxic to human organisms, they are carcinogenic and hormone disruptors and persistent. So, they do not degrade very easily. And the accumulate in our body fat, so, it they are lipophilic as well. So, it goes from mother to babies through placenta. So, it goes from so from the mother to the baby. So, it is a affects small babies too. dioxins can also settle on crops and in our waterways, where they eventually end up in our food, accumulate in our body and passed on to our children.

So, that is why dioxin is a big deal in terms of emissions especially from waste burning facility. most of the engineered or modern waste to energy plants have the system in place to remove these dioxins, to bring the dioxins concentration way below of what is the regulatory limits are. But whenever we go for open burning as you can see in this picture over here, and you see these kind of scenarios in many cities around the world many cities in India.

When as you go around in India, you see that people just like they will do some street sweepings which will have all sorts of potato chips packet, biscuit wrappers packets some plastic bags and they will torch it. So, because the volume actually goes down and they feel like that is the that is what they are supposed to do, because they are not a really aware of the dangerous associated with that.

I myself when I was like doing some work for Bihar Government on looking at the waste management plants like review in the waste management plants, so did some site visits. And in one of the sites, I found that municipal workers were actually burning all those

Styrofoam's, plastics, and other stuff and then and the when we ask them that why you are doing it? The answer was this is too much too bulky. Its a when to transport it, it is because it takes too much space on the truck and then we cannot put other garbage on there. So, we just burn them and then they disappear because, it is all gets most only around 10 to 30 percent remains as a ash, rest just volatile it goes into the atmosphere.

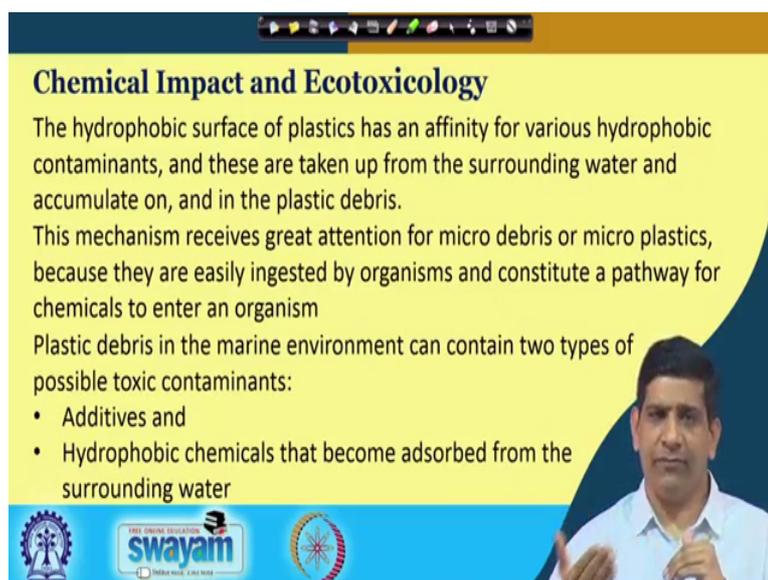
But they are were not aware that the fumes and they were just sitting around it. So, that fumes that they are inhaling because of the burning of these gas these Styrofoam polystyrene and other stuff, is actually going to cause lot of lot of health effect to them. So, they were they were not aware of it. So, it is also that the capacity building the knowledge transfer is to our workers who are working in the field, who are just who are handling this garbage they should be aware that burning these stuff especially something containing plastic burning them is totally no because it creates lot of human health impact.

And since many of these workers they are not aware, they just burn it because that is it have what it has been done in the past. Earlier say 20, 30, 40, 50 years ago, there was no plastic in the garbage.

So, burning of those garbage is still created problem in terms of particulate matter, shoots and other stuff, but at least since the plastic was not there. So, organochloro-based substances were not there these dioxins and furans and other issues were not that were not that common. But now, since plastic ends up everywhere and thats the reason why we need a robust plastic waste management program, within the municipal solid waste program of every city, every ULB's is every town and it also in the rural areas, because plastics are showing up in the rural areas too.

So, this is a, so dioxin is a big deal in terms of in. So, you should not burn plastic that is a totally no. You should not burn plastic in open plastic can be used as a energy source, but which will talk about in the next week. The plastic can be used as a energy source, but it should be done in a controlled environment with proper air pollution control system. Not just burning it in a in an open atmosphere.

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Chemical Impact and Ecotoxicology

The hydrophobic surface of plastics has an affinity for various hydrophobic contaminants, and these are taken up from the surrounding water and accumulate on, and in the plastic debris.

This mechanism receives great attention for micro debris or micro plastics, because they are easily ingested by organisms and constitute a pathway for chemicals to enter an organism

Plastic debris in the marine environment can contain two types of possible toxic contaminants:

- Additives and
- Hydrophobic chemicals that become adsorbed from the surrounding water

The slide also features a video of a presenter in the bottom right corner and logos for 'swayam' and 'THE ONLINE EDUCATION' at the bottom.

So, next we will talk about the effect of the chemicals that chemical, chemical impact and some of the ecotoxicological issue. So, plastic is hydrophobic. Now what is hydrophobic? We talked if you remember there is something called hydrophilic and there is something called hydrophobic. Hydrophilic means, philic means affinity. So, if something has affinity for water, it is hydrophilic. And if something has affinity for water usually it tends to dissolve in water because it will get into the solution with water. If an object if a material is hydrophobic; that means, it has the phobia for water. Phobia means that does not like water, its afraid of water. If something is hydrophobic, it does not dissolve in water.

So, that is hydrophobic, will not dissolve. Hydrophilic will dissolve. So, hydrophobic plastic is hydrophobic. So, since it is hydrophobic, the its it has affinity for various hydrophobic contaminants. the contaminants is specially big molecular big molecular organic compounds which is a they are they are hydrophobic in nature. So, they are and these are taken up from surrounding water and accumulates on and the plastic debris. the mechanism gets greater attention for micro debris or microplastics, because they are easily ingested by micro organisms. So, you have microplastics which the high molecular organic compounds which were put contaminants of different nature is sitting on top of microplastics.

Now this microplastics gets consumed by organisms and that gives a pathway for these contaminants to enter into those organisms. So, plastic debris in the marine environment, that is why the plastic debris in the marine environment they contains a possible contaminants like the additive chemicals and hydrophobic chemicals which comes absorbed from the surrounding water. Since they have absorb on this plastic surfaces, and then when smaller when any species is consuming this tiny microplastic they are also getting these chemicals into their body and which can accumulate in the body and go up the food chain. So, that is how it becomes a problem in terms of chemical impact.

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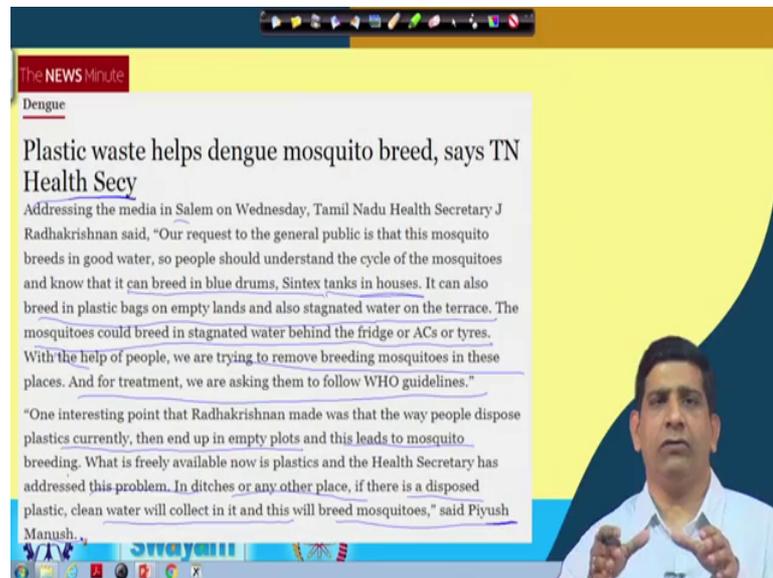


Plastic waste also promotes breeding places for mosquitoes that is you go to many big cities today and look at the big drains, you will see lot of floating plastic there. And that becomes a good breeding ground for mosquitoes. I was in Mumbai recently in that Mulund Thane the Check Naka area, there is a big drain which it seems to be there was a kind of a big [FL] and with a Calvert on top of that which we just crossed over to come from Mulund to Thane area. And there I could see that very similar picture of what we are seeing here a there was huge plastic floating on to the surface. And as we know that Bombay does have a lot of issues of malaria and all that lot of mosquitoes issues are there.

So, if we these kind of as if these kind of scenarios exist in any city, that creates a additional breeding ground of a for our plastic right there, so for the mosquitoes. So, this

is can becomes like a breeding ground for mosquitoes, where it will it finds a house and then mosquitoes will bring there. So, it is a this picture is from Hospet, but, but there are you will find these kind of pictures everywhere in the country, where if a many big cities.

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So, and this there are reports as well where plastic waste helps dengue mosquitoes to breed says Tamil Nadu Health Secretary. So, addressing the media on Salem on like a Tamil Nadu Health Secretary say our request to general public is that if the mosquito breeds in good water. So, people should understand the cycle of mosquito that it can breed in blue drums, Sintex tanks in house, it can also breed in plastic bags on empty land, also stagnated water on the terrace. The mosquitoes could breed in stagnated water behind the fridge or ACs or tyres. So, they are trying to remove breeding mosquitoes in these places and for treatment asking to follow WHO guideline.

So, one important point he made was that, people to dispose plastics currently they end up in empty plots, this leads to mosquito breeding. What is freely available now is plastics and the Health Secretary has addressed this problem in ditches or any other place there is a disposed plastic clean water will collect in it and this will breed mosquitoes said Piyush.

So, plastics floating on water even on clean water is becomes actually a better breeding ground for a dengue mosquitoes. Because dengue mosquito as you know, they breed on clean water. So, that is why in coolers in ACs behind ACs behind fridge or whenever you

can find a clean water stagnant clean water that is where dengue mosquitoes breed. Now plastic in coming up on the surface water around the different in different different areas of the city is becoming another source of a breeding places for these type of mosquitoes.

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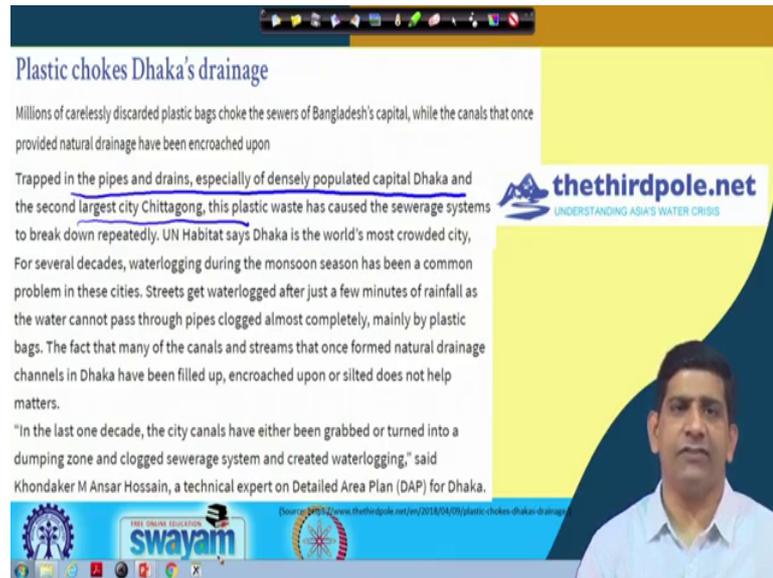


And then a drains it chokes drains and canals as you can see its becomes and this is a I am just putting some pictures there. You will find similar pictures in your city as you go around and you can take lots of pictures of these and even put on discussion forum if you find some interesting photograph. And you can for us to for all of us to see.

So, as you can see that this is this drain is totally clogged. You can hardly see water there only a small patch of water is visible in this particular area, otherwise most of it is just covered with floating garbage. And most of these garbage is plastic which is there, because plastic since it does not biodegrade and it does not dissolve in water and it does not even. Say if a paper, it will get soggy and once it will interact with water, it will get heavier than water and then it will try to go down to towards the sediments, towards the bottom of the water body.

So, plastic its lighter it is always stays most of it is lighter. So, and especially the thin plastic, thin plastic, single use plastics, most of them are very light and thats why they just float and creates a nuisance and covers the entire the water body. So, that becomes a problem in terms of like a clogging of drains and canals.

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Plastic chokes Dhaka's drainage

Millions of carelessly discarded plastic bags choke the sewers of Bangladesh's capital, while the canals that once provided natural drainage have been encroached upon

Trapped in the pipes and drains, especially of densely populated capital Dhaka and the second largest city Chittagong, this plastic waste has caused the sewerage systems to break down repeatedly. UN Habitat says Dhaka is the world's most crowded city, For several decades, waterlogging during the monsoon season has been a common problem in these cities. Streets get waterlogged after just a few minutes of rainfall as the water cannot pass through pipes clogged almost completely, mainly by plastic bags. The fact that many of the canals and streams that once formed natural drainage channels in Dhaka have been filled up, encroached upon or silted does not help matters.

"In the last one decade, the city canals have either been grabbed or turned into a dumping zone and clogged sewerage system and created waterlogging," said Khondaker M Ansar Hossain, a technical expert on Detailed Area Plan (DAP) for Dhaka.

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There was this is this one like a report from Dhaka from our neighbor. Its again, this is just one example. You will find similar examples in mostly many of cities in our country as well. its they say that we discarded plastic bags choke the Bangladesh capitals canal that when the canals that was once provide in natural drainage has been encroached upon. Now, the plastic is trapped in pipes drains especially densely populated Dhaka and second largest city of Chittagong and this plastic waste has cause the sewerage system to break down repeatedly.

Dhaka is the world's most crowded city for several decades water log into in the monsoon has been a common. Now, the streets gets waterlogged just a few minutes of rainfall. A water cannot pass through the clogged pipes and mainly by plastic bags. And this is this is report from Dhaka, but you can relate it into your own city as well based on whichever city you come from. You see that these kind of a water clogging, water floating whether in Gurgaon or whether in even in Hauz Khas in Delhi I have seen that. its many cities you see that, once it rains it clogs clogged storm water system cannot handle it.

So, its water gets flooded and you have flooding and water does not it takes lot of time for water to receipt. So, now, plastic bags a mismanagement of plastic waste is creating, another adding another dimension to it because all these drains are getting chocked with a plastic bags. So, it is so it is becoming a has been its water logging and clogging of the

sewerage system those things are becoming problem in terms of plastic waste mismanagement. If we that is the so one of the another reason to have a good management of plastic waste.

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The economic effects attributed to the loss of use of the environment for tourists and other economic purposes are:

- Loss of tourist days;
- Damage to the local tourist infrastructure (loss of income for hotels, restaurants bathing resorts, other amenities, etc.);
- Damage to tourist-dependent activities (loss of income for clothing manufacture, food industry, general commerce, etc.);
- Damage to fisheries activities (reduction in fish catch, depreciation of the price of seafood);
- Damage to fisheries-dependent activities (fishing equipment production and sales, fisheries products, etc.);
- Damage to the image of the coasts as a recreational resort at both national and international levels

Now, there is a whenever used these kind of effect happens, so you have economic loss as well. Because if you have environmental pollutants are there and there is a economic lose of use of environment for tourist and other economic purpose. So, if you have water clogging and all that you have loss of tourist days. damage to local tourist infrastructure because and then if you have loss of tourist days if there is no tourist, no tourist people are coming then hotels are empty.

So, if restaurants are empty bathing resorts and other amenities, nobody is using them. So, you have loss of income for hotels restaurants bathing resorts and other amenities. Damage to tourist dependent activities, loss of income for clothing, manufacture, food industry, general, commerce, etcetera, damage to fisheries activities, reduction and fish, a catch depreciation of the price of seafood so, you see that reduction in fish catch as well. Damage to fisheries dependent activities like: fishing equipment, fishery product, fishing equipment, sales, damage to the image of the as the recreational resort to both national and international level.

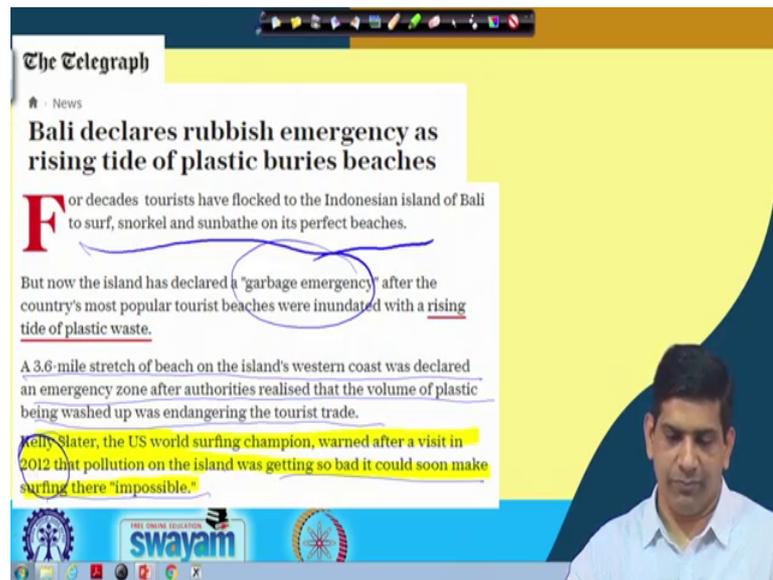
So, whenever you have environmental impact a from in terms of say if your beaches are totally polluted by this plastic pollution, and if you have lot of plastic waste along the

beach which we see at many beaches around the world sum beach cleanup days are also be given. One of the biggest one was done in India in Mumbai, which again keep some happening from time to time, because we those beaches we are getting lot of waste coming into those beaches as which needs to be cleaned. But whenever you have these kind of a mismanagement of waste, it is not that there are lot of direct and indirect impact.

Direct impact is of course, you have you can see that it does not it looks bad, its creating a nuisance it is chocking the drains, so becoming problem for storm water runoff. Indirect impact is with a mosquito breeding, more mosquitoes, more people getting sick. If it becomes to filthy, people that you have loss in tourism, loss in tourism means impact on several industries like the hotel industry, restaurant industries, car industries, taxis. So, the many cities which depend on tourism, they cannot really afford to have mismanagement of waste in that particular city. Otherwise that really impact some very very hard, so that is the reason like some countries like I have, I have seen personally in like for example, in New Zealand, since tourism is one of their major focus, they try to keep the country as clean as possible.

So, you go to New Zealand, you find it lot of cleaning initiative. They try to keep the entire country as clean as possible. So, that it is welcoming to the tourist because, tourism is one of the major source of revenue for a New Zealand as a country. So, that is why it they take it very very seriously. So, it is again those things come in picture; economics kind of rules.

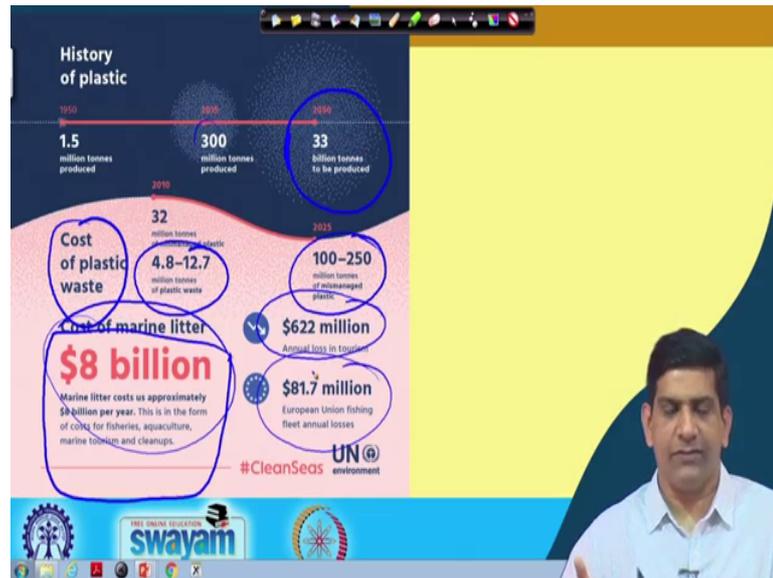
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So, some examples here, Bali declares rubbish emergency as rising tide of plastic buries the beaches. So, Bali as we know it is one of the famous destination for international tourist for surfing, snorkeling, sunbathing in its perfect beaches, but now the island has declared a garbage emergency. After the country is most popular tourist beaches were inundated with a rising tide of plastic waste. So, 3rd 3.6 mile stretch of beach on the islands Western Coast was declared an emergency zone after authority realized that volume of plastic being washed up was endangering the tourist trade.

So, that is and there you a surfing champion warned after a visit in 2012, pollution on the island was getting. So, bad that it could say make the surfing there impossible. So, they did get the warning upfront many years ago and, but now like. So, they have they will essentially have to go for clean up, because this it the whole economy of that area kind of develops on the tourism. So, it is if you do not manage your waste properly, you have impact on other areas. So, managing waste is very very important.

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So, if you look at kind of little bit of we talked about waste impact. And so, put it in a little bit of historical perspective, and try to look at the cost. What is the cost of this plastic pollution? So, it is a of course, there is a human health cost, the environmental impact cost, but we putting all those things together. If you look at the history of plastic and then totally cost associated with that in 1950's when around the time when plastic we got started getting used to plastic, we had 1.5 million tonnes produced. And 55 years after that by 2015 that number increase to 300 million tonnes.

So, 1.5 multiplied by 200, so in 55 years only 50 plus say 15, 65 years sorry, in 65 years the increase was 200 times and it was during the period most of this between 1950 and 2015 say up to 1919's. it was mostly dominated by Europeans and Americans so those countries. Now, after 1990's the 2000's, 2010's this developing countries, the emerging economies with a huge population with a bigger middle class are also catching up. So, with them into the picture, so we have now 300 million tonnes of produced in 2015, but as these countries are becoming dominating into this sphere, we are saying it it will go up much higher to 33 billion tonnes.

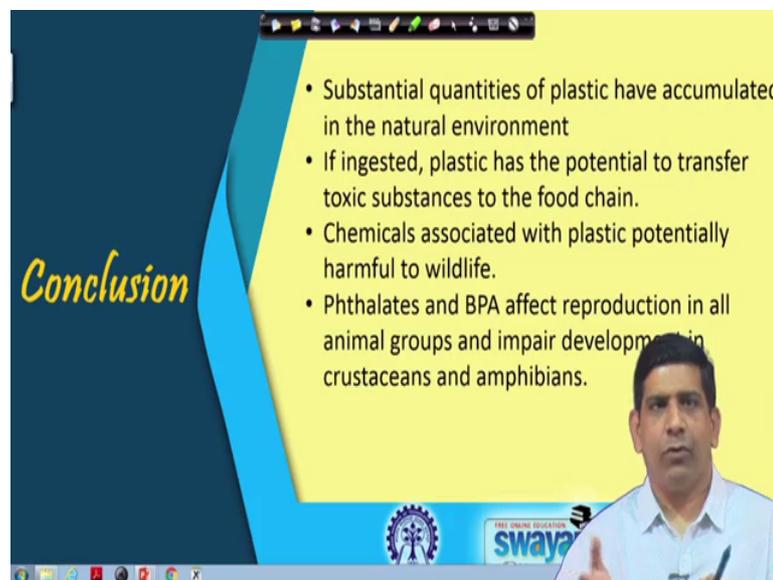
So, we will have 33 billion tonnes of plastic that is produced. So, this is the plastic produced, not the plastic waste produced, but the plastic produced. And if you look at the mismanagement, since we have do not have the data for the old part, but from 2010 32 million tonnes of mismanage plastic. So, 32 million tonnes of more than say around 10

percent if you take this number as a benchmark, so 32 million tonnes of mismanage plastic, 4.8 to 12.7 million tonnes of plastic waste that is like a plastic waste showing up and 100 to 250 million tonnes of mis plastic plastic is expected in 2025. So, if you look at the cost associated with that, cost of marine litter is 8 billion dollar and that's the cost which will be in the form of cost of fisheries, aquaculture, marine tourism, as well as for clean up.

So, if you do not manage the plastic waste properly, you are looking at cost even it's just a part of the cost actually because it's just the marine litter part, 8 billion dollars, that is a lot of money. If and if you do all of us kind of manage the plastic waste that we produce properly, we can save this money and can be used for many better things that the planet needs the country different countries need.

So, they are looking at 622 million annual loss to tourism, 81.7 million European union fishing fleet annual losses. So, that is a UN Environment UNEP has come up with this data just to raise awareness on the issues related to the plastic waste.

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Conclusion

- Substantial quantities of plastic have accumulated in the natural environment
- If ingested, plastic has the potential to transfer toxic substances to the food chain.
- Chemicals associated with plastic potentially harmful to wildlife.
- Phthalates and BPA affect reproduction in all animal groups and impair development in crustaceans and amphibians.

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So, being on that note if you look at, just kind of that was kind of a summary to show you that if we do not manage plastic properly, plastic waste properly this is what we are getting into lot of revenue loss, human health loss, environmental impact, and this micro plastics showing up in different is sphere.

So, in summary for this particular week if you look at, we are looking at substantial quantity of plastic is getting into in into natural environment that is the kind of looked into. If it gets into the body plastic has potential to transfer toxic substance to the food chain. There are chemicals associated with plastic which are harmful to wild life to humans. Phthalates and biphenyl, they affect reproduction in all animal groups and impair development in amphibians and crustaceans.

So, overall its we are what we are looking at in this particular week, we have try to show you the environmental impact. what is the human health impact, what are the causes have a, what we what we call kind of a risk assessment overview of a plastic and plastic waste.

So, with that we have cover the week 5 of this particular course. So, we will move to week 6 in the next video. So, far I hope that you are enjoying the course and keep the discussion forum active as I keep on saying that. We are trying to respond back to you within 25 hours most of the time. So, that is and anything you find put it on the discussion forum, so that we can discuss in detail.

Thank you.