Environmental Geotechnics
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Lecture - 20
Introduction to Characterization of waste

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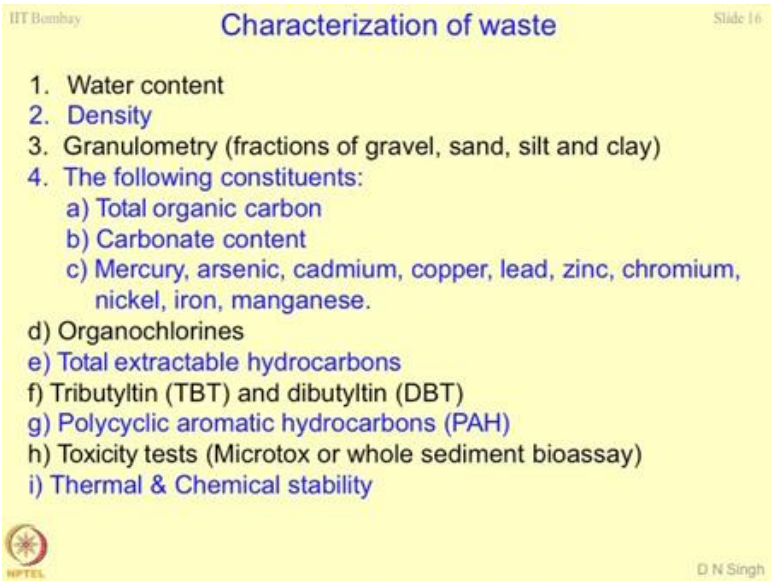

Now, how to characterize this waste that is becoming a very big question, because applications we have seen and two, three application I have talked about in today's class. The issue is how to characterize the waste. So, the first characterization is that if waste can be defined based on its water content. A sludge, how do you treat sludge? If you can filter out water, you are recovering a precious material or resource. The moment water is reduced, the volume gets reduced, you can handle it better. So, water content is the most important parameter when we talk about characterization of the waste. Is this correct?

Why do you do incineration, so that the volume gets reduced. Density of the waste is very important again. If you have waste like organic soil, which is coming out of the dredging process, what will you do with this is of no use, so density is very important. A dredge material, ideal dredge material should be dense; it should be rock pieces or gravel pieces or sands, so that they are more stable. So, density is a physical parameter which talks about the strength of the dredge material, particularly if infrastructure project. You call it as particle size distribution, we normally call it as granulometry. Particle size

distribution has a limitation; it talks about only components or the fractions of gravel silt, stone, sand, clay and so on. Is it not?

So, in what way granulometry is different than the particle size different characteristics. I was talking about the rheology how easily these materials will flow in water in a slurry flow. So, this is where you have to define the you know complete morphology of the grains in the waste, which will fall under the category of granulometry study. Ideally, you should prefer a waste material which is rounded completely, so the analogy becomes very easy. You do not require much of energy to push it in a stream, so pumpability increases.

Apart from these physical attributes, what are the other constituents we are more interest in to finding out the total carbon component. Why it is so? If more carbon is there, what happens. The water demand of the system is too much. If you have more carbon, the carbon basically acts like a lubricant, you agree or no? You have carbon brushes in electric motors, why, less friction, less resistance.

So, idea is if more carbon is present the water demand goes up that is why class of fly ashes is more carbon or not suitable for concrete, the water retention capacity increases. So, you have to incinerate these ashes, so that the carbon component is lost, and then their reactivity becomes better. Second thing is as carbon is a lubricant, you cannot compact a system where carbon is too much, clear, so that is another reason why you want get rid of organic carbon.

And of course, organic carbon is always easy to decompose over a period of time. So, you should understand a waste material or a byproduct how much carbon it has so that you can use it for a certain application. Carbonate content, where do you use this concept of carbonate content that is in the water. If you have sands with more carbonate content, what is going to happen, you will prefer this type of sands or not? Why, in case of any contamination this carbonate is very vulnerable particularly acid contamination.

See this type of situation occurred in your which project in the country. Bindya, I think you should be able to tell, very famous project related to Indian Navy, Seabird Project at Mangalore. Seabird, it is a very big navy base which has been developed some 5, 6 years back. There was a time when we used to sit on our lab analyze may be 10,000 samples of the sand to check what is the carbon carbonate content of these soils. Now, if you have

more carbonate content in the sand, whether it is a good material for construction or not? No idea?

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Why? Crushing strength of sand is more or the carbonates is more, this is a simple question. Sand is more. So, the moment more and more carbonates come into the sand, the burying capacity and crushing strength of the deposit decreases. So, you should not construct anything you know on a system even on sands unless you know what is the carbonate content of this material, this is becoming a very big issue. And you will not believe that because of this simple thing the project was on hold for a very long time, Government of India was paying a very heavy penalty to the contractor, and there was a very big mess all around. [laugher]

And, then comes the third issue mercury, arsenic, cadmium, copper, lead, zinc, chromium, nickel, iron, manganese. So, whenever you are using this type of by products or the waste you should be sure, what is the concentration of all these elements or the metals which can leach out very easily. So, the moment you lift it from the or from some source or dump it somewhere, the system is going to become again hyperactive. So, this where you have to make it very sure that the leachability of the materials happens to be very less.

Have you heard of organochlorines? Well, this is a form of contaminant, and this is become a very common these days this a form of a chloride which is present too much in the sea. And once you bring it on to the ground or onshore, it becomes a secondary source of contamination or pollution. Total extractable hydrocarbons, most of these places there could be oils slick, oil spill and so on. So, you would like to understand how much amount of hydrocarbon is associated with the waste or the soil or geomaterial before you start using it. A heavily oil contaminated sand or the geomaterial will show you very less shear strength alright. So, you should be careful while recommending the material for its application anywhere.

Similarly, TBT and DBT that is tributyltin and dibutyltin, these are the compounds which are becoming very important to be ascertain in any project related to infrastructure. Design of underwater, underground petroleum tank, do you think that this is the structural engineering problem or geotechnical engineering problem? And let me

add here suppose soil has lot of lead into it or mercury into it. So, the moment you construct a tank underground, there could be a leaching of lead and mercury into oil reservoirs clear. And the moment entry of these elements takes place into the hydrocarbons, they are totally spoiled, you cannot use them for any purpose. So, truly speaking this is the geoenvironmental engineering problem where later on structural engineer takes over.

Polycyclic aromatic hydrocarbons, they are becoming very big bug on the entire construction industry. So, this is where you have to ascertain the properties in terms of toxicity test. I will be talking about these types of test later on, where you do complete bioassay of the material. Bioassay is nothing but understanding the material in totality that what are the contaminants or what are the elements which are present in it which may leach out into the environment. And of course, thermal and chemical stability of the material whether it will remain stable or not. So, these are the things which you have to take into account when you are characterizing the waste.

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So, when we say characterizing the waste, there is a need for complete characterization which includes physical, chemical and mineralogical properties, and thermal properties and electrical properties. So, as you can guess very easily now this lecture onwards, I will pick up characterization of the waste or the material geomaterials. And then second issue associated with the characterization of the waste would be what is the basic

objective of characterizing something you are trying to understand the behavior, how it will behave. And why do want to understand the behavior, so that you can recommend a proper utilization for this material, is it not. So, this is the very big subject in our activity where most are the people are trying to spend lot of time, money and energy in understanding the material itself.

Now, interesting thing you have to understand is that when we say material, the hidden you know communication is that no material is a waste material clear. So, idea is even if you are dealing with by-products from industry, if you can utilize it is for some good applications, it becomes a manmade resource. So, this is where most of the efforts are diverted in understanding the behavior of the material and recommending its proper utilization scheme there may be a slight gap between the moment I pickup characterization schemes because what is still pending is, how we can use different energy field concepts in characterization of the material.

So, I will take up that issue also side by side. So, that will tell you how the behavior can be mapped by doing simple test in the laboratory alright. I will finish my lecture here today, but I will like to show you one information which I received sometime back through email.

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So, this email was sent sometime back by one of my friends where the title says try to guess what the following images are. You might have seen also, I am sure. No? Nobody in the class? You have seen?

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Ok, let us go for some quiz.

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What is this?

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TV screen.

TV screen?

(Refer Time: 12:46).

Sorry.

Stones.

Stones?

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TV screen with.

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(Refer Time: 12:52).

Can you guess now?

(Refer Time: 12:57).

Sorry.

(Refer Time: 13:01).

(Refer Slide Time: 13:09)

Bricks, why not know food grains. This is the photograph of e-waste. You should read this carefully, 426000 cell phones discarded daily. So, this is the magnitude of the problem.

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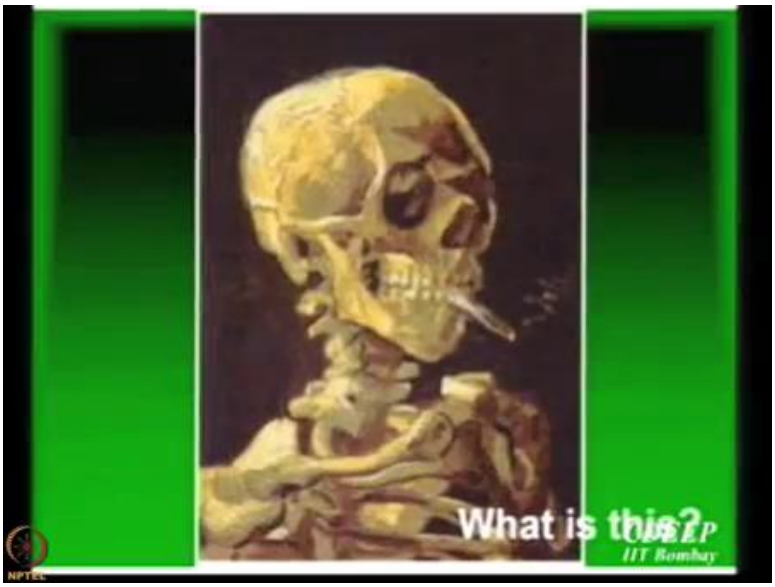

Like this figure smoking, but the question is what is this figure, earlier human being.

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And today ok, good interpretation. What it is now, any guess?

Pen.

Pen?

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Two lack cigarette packs the same number of Americans who die every 6-month due to smoking, [laugher] alright. So, if you retrace it, this is how it looks like, any way good imagination. I like this email, so I thought I will share with you because the central theme of today's discussion was waste industrial waste.

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What is this? Swimming pool or something else?

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Set up of thousands of small pictures showing the traces of 11,000 planes, the number of commercial flights taking place in the US every 8 hours, the amount of pollution ok, the emission which are coming out of the planes and their numbers and the amount which is going to toxicate the entire atmosphere.

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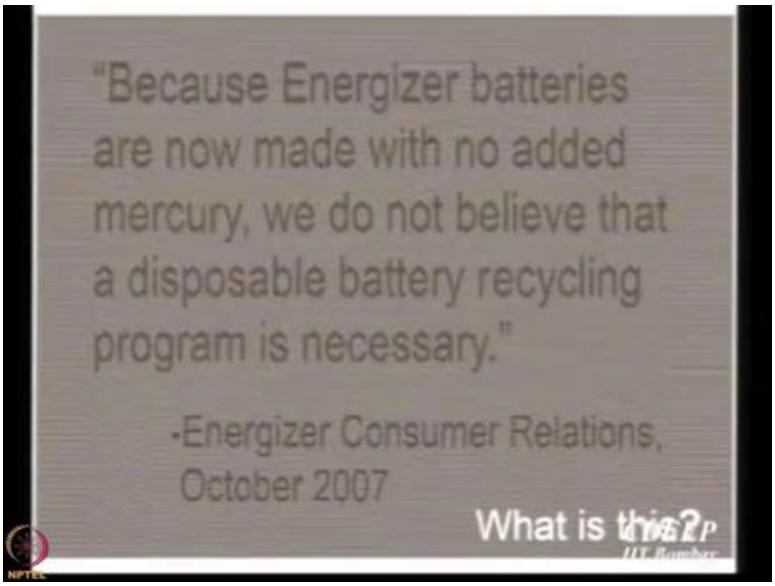

So, this is the interesting message. But look at the next slide.

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1,70,000 batteries are produced every 15 minutes.

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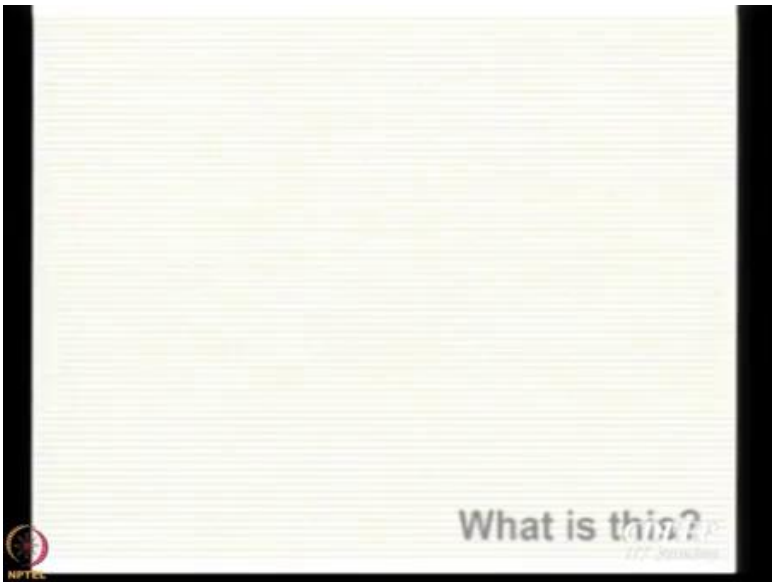

What is this? It is difficult to guess, I think.

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It is becoming a little bit clear now.

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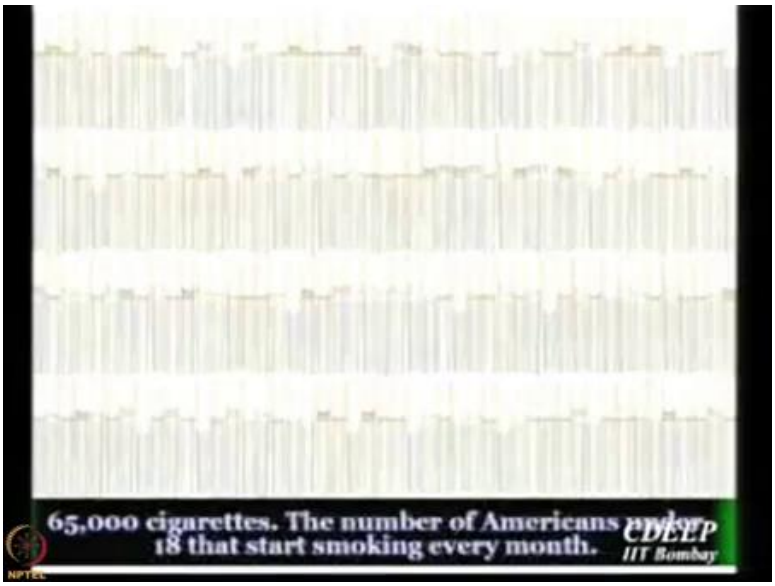

65,000 cigarettes: the number of Americans under 18 that they start smoking every month.

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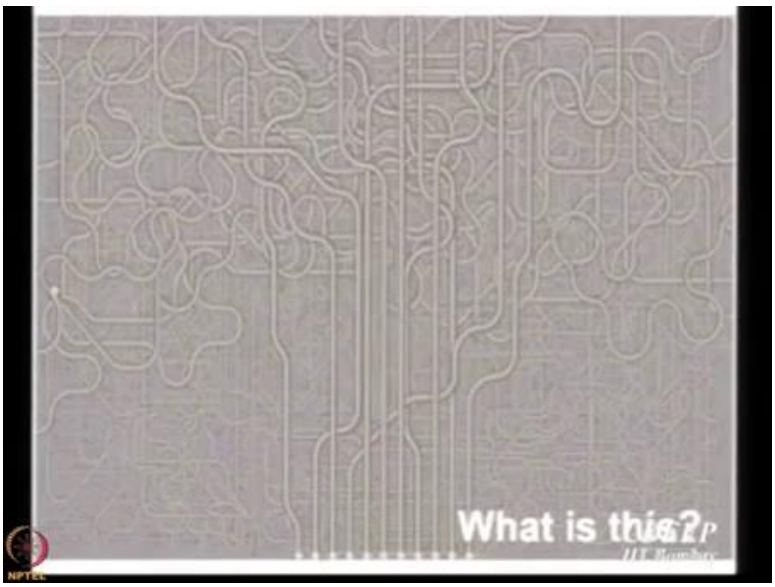

What is this system? Wires, some circuit.

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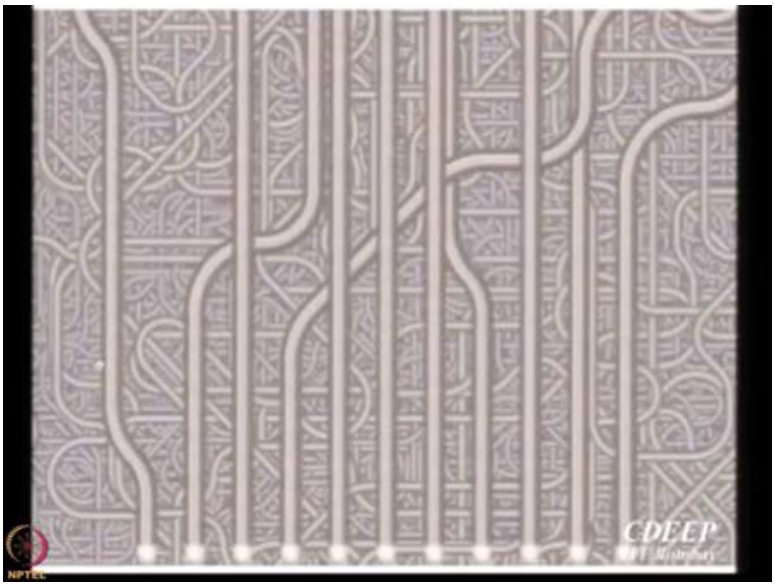

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1 million of plastic cups trashed every 6 hours in commercial flights.

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This is most interesting. Any guess?

Bottles.

I do not know your guess seems to be correct. Now, they are bottles?

Towels.

Towels.

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And you are quite close, 60,000 plastics bags discarded every 5 seconds.

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What is this?

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2 million plastic bottles dumped every 5 minutes.

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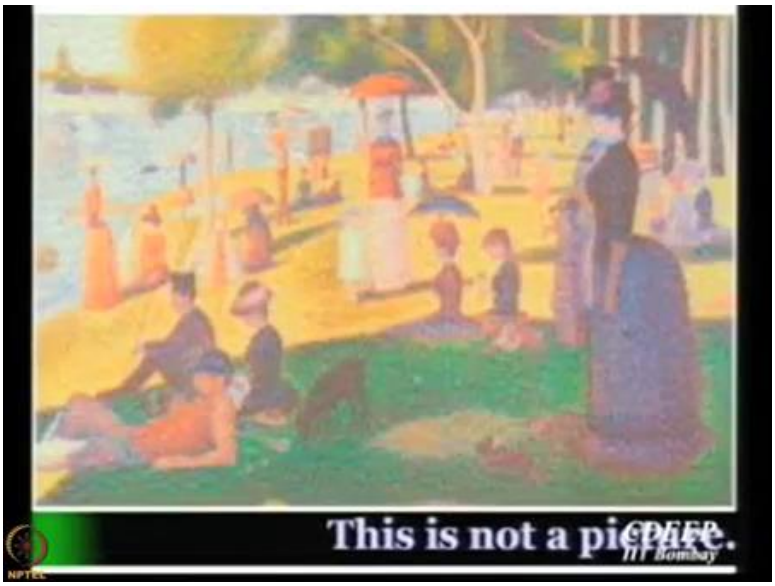

It is a beautiful painting, but this is not a picture. Any guess what it is?

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See theme of a lecture is industrial waste.

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Aluminum cans thrown into the garbage every 30 seconds.

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So, this is waste art. These pictures are part of the exhibit Running the Numbers, an American Self Portrait, of photographer Chris Jordan, highlighting the millions of objects that accumulate in the planet, well beyond our sight. The numbers mentioned were obtained from the quantities of waste discarded only in the United States Imagine what world figures are.

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So, this fellow, Durga, he asked me to circulate this message. Environmental degradation is a cumulative effect of the actions each one of us takes. Therefore, the solution also lies

within a each one of us. Help our planet. Think before you use. Reduce, reuse and recycle. So, with this, I finish my today’s talk. I hope you enjoyed this.