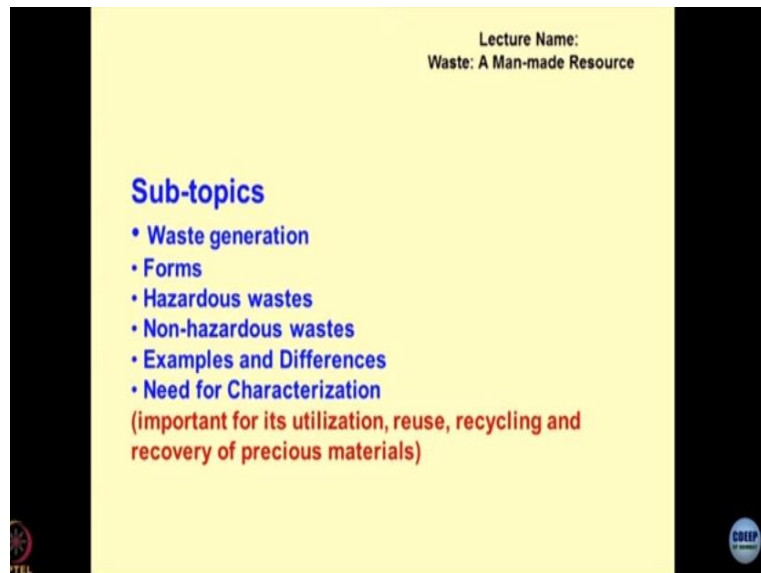


Environmental Geomechanics
Prof. D. N. Singh
Environmental Geotechnology Laboratory
Department of Civil Engineering

Lecture – 20
A Manmade Resource -1

In the previous lecture we talked about the particle energy field, and I described the components of the particle energy field and what are the particle energy fields which normally we talk about and our interest is to understand how the particle or the geomaterial is going to behave in these electric fields, and this is where we also talked about possibilities of different new concepts which have to be researched and applied in day-to-day life.

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I will henceforth I will move on more focused areas of environmental geomechanics and particularly the waste the context is like this that human beings also create waste and hence human beings are the best species which should be utilizing the waste which they create and if this happens this becomes a zero discharge concept which is being enforced by most of the industrial units where they say it is a zero discharge unit nothing comes out of the industry everything is consumed there everything is recreated there and so on.

So this is becoming an exciting philosophy that so-called waste which was not having any value how this is becoming a man-made a source and if I can convert any of the waste materials into a

man-made resource that would be an engineering or that would be a technology that would be a very interesting initiative to safeguard the humanity or the mankind against this curse of unattended material which is lying on the surface of the earth.

So with this in context, the subtopics which I am going to talk about would be the waste generation what are the forms of the waste which are typically generated we will talk about the hazardous waste. We will speak of the nonhazardous waste and then we will talk about the examples and differences between these two types of garbage and then what is the need for characterization of the material because the waste itself is material.

As you must have noticed, I have written this is a man-made source. So any resource you would like to understand to the precise details before you start utilizing it or before you create the strategy for its utilization. Now when we talk about the need for characterization the most important thing is that we would like to talk about the issues which are related to its utilization its reuse its recycling and if I can recover some of the precious materials from the waste.

So this is what the complete cycle is where the waste is treated as a man-made resource, and the present-day circumstances are like this that there is no way except to treat the waste as a resource material and this resource could be for infrastructure development, a different type of composites development and so on. So the first thing is that we have to understand what is the generation or what is the source of so-called waste.

We usually do not use the word waste this is a shift in recent times some time back people used to talk the unwanted material which is coming out of the industries or from the municipal activity as a waste material now we say that this is a man-made resource. So the more emphasis is on man-made resource rather than the waste. So nothing is a waste for me in this universe provided I do judicious thinking investigations and then if I develop an approach to utilize it in the most ingenious manner.

So as far as the source of generation of this metal is concerned that is, I hope you are aware of mostly it comes out of the industries or the municipalities. So the material depends upon from

where it is getting generated its toxicity will rely upon that. Normally it is understood that the industrial wastes are going to be more toxic as compared to the municipal wastes all right because of the level of activities which are quite different.

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Another exciting aspect is the waste may degrade in harmless products or sometimes this may also be a harmful product also. Garbage could be hazardous and non-degradable and sometimes the dangerous wastes depending upon their cumulative effect or cumulative different detrimental effects they might become very critical to handle. So these are the four forms of the waste which we usually tend to deal with solids.

A good example would be an industrial process you take these solids that generated mine tailings particularly different types of fly ashes which come out of the system, slags which comes out of the system, red mud which comes out of the system. Alright there could be the soil, which is disintegrated completely, and you are trying to create an infrastructure, and somebody has recommended that remove this soil and fill it up with the right material, granular material.

Now the question is where to dump this type of soil. So these are the solid form of the waste similarly dredged material could also fall in the category of the solids whatever you are taking from the out from the water bodies, beach, sea, oceans, lakes whatever you are dredging, and you are keeping aside this could be in the solid phase. Liquids are also associated industrial process,

domestic process sees where sludge could be of any type it could be industrial output be domestic.

Different type of sludges and sludge is normally contained gaseous phase and liquid phase and solid phase all right. So these are the four situation which normally we have to deal with and so solids, liquids, sludges and gases and then there could be a combination of all this depending upon the multi-phase system which we might be interested in dealing with as I said it would depend upon the source and sometimes the waste may get disintegrated or degraded into harmless products.

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This concept is now being researched by Arif, my student, so we are more interested into degradability of the materials geomaterials, and I have been emphasizing since the first lecture that the practical situation is where the material does not remain as it is always. So modelling becomes very difficult, that means the properties of the geomaterials, including the waste materials they keep on changing with respect to time.

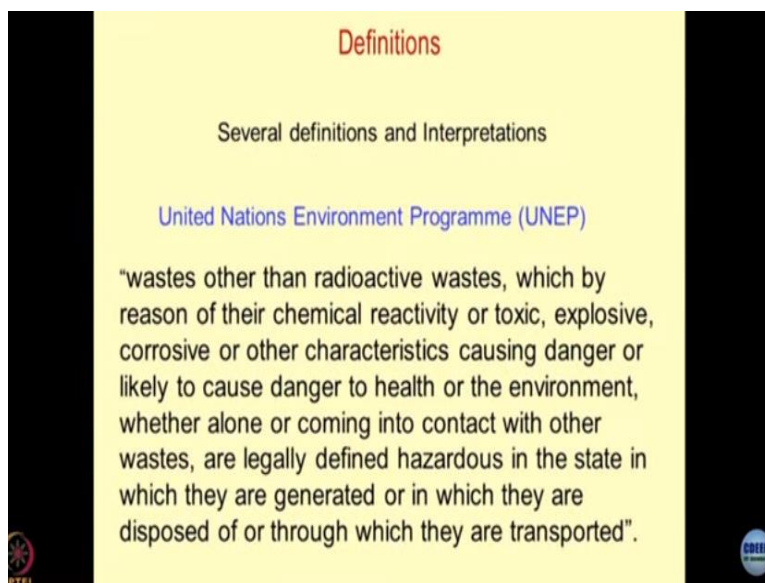
So this is a new dimension which now everybody is trying to work on they are trying to see how degradability of the geomaterials these soils beat rocks be it industrial byproducts waste products and so on is taking place number one and how to model it mathematically so that it can be

employed in day to day life sometimes this could be non-degradable also. Now the question is which one is better degradable material or non-degradable material what will be your answer.

So this question itself is a philosophy called question it might be having different types of answers depending upon the type of material you are working with so sometimes we want waste to this to degrade like municipal solid waste there is the whole idea of putting into landfills so that it gets disintegrated degraded and then after ten years when I come over there its all in the passive form very nice.

But you might not be able to convert all the waste into this type of passivated form because they are not degradable and then the problem lives along with the material for several years. I hope you are getting a feel of this; sometimes the materials could be hazardous, sometimes the materials could be toxic. So these are the attributes associated with the material which we will be talking about in details.

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So it is very interesting to understand what are the definitions which people have given for defining the waste as such. So there are several definitions and interpretations and why I am citing it here is that it gives you an idea about that how abstract and incomplete the definition of the waste are and hence many of you question that what are the research components associated with the subject.

So when you start reading these definitions and interpretations, a lot of ideas come to your mind, and those idea has become a very glaring example of contemplative research. So if you read the first definition which is given by the United Nations Environment Programme this being a UN body, their emphasis or their focus is entirely on a different aspect of the waste. Hence, if you read the first sentence that itself says waste other than radioactive wastes.

I hope you are getting a feel of why the directly they talk about radioactive waste only why any reason for this "**Professor - student conversation starts**" sir actually always wastes are not reactive so active it starts as like why UNEP should be talking about all the waste put together in one class and radioactive waste put in another class that is the question all that is fine first try to understand the language.

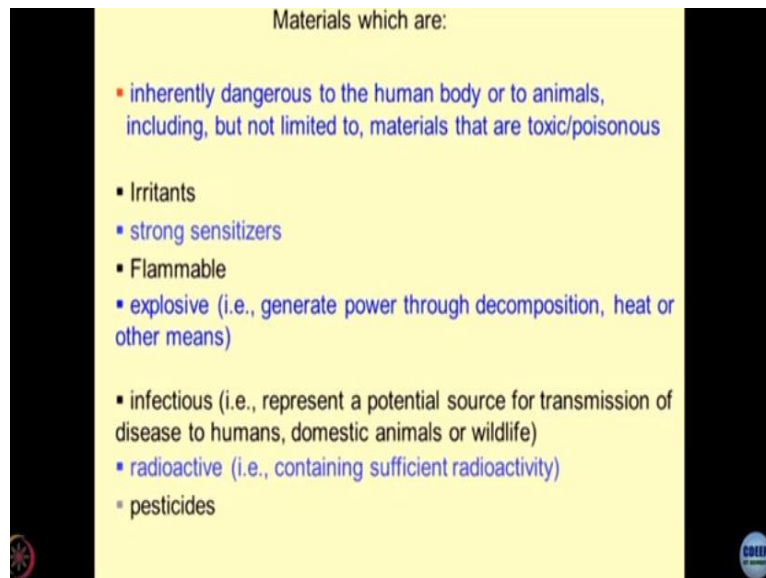
Why UN is more interested in all the categories of waste on one side and radioactive wastes on the one side obvious reasons try to understand "**Professor - student conversation ends**" anyway so waste other than the radioactive waste which by reasons of their chemical reactivity or toxic explosive corrosive or other characteristics cause danger or likely to cause danger to the health or the environment.

Whether alone or coming into contact with other waste are legally defined hazardous in the state in which they are generated or in which they are disposed of or through which they are transported. So a lot of things have been talked about the materials alright transportation, disposal, utilization, reutilization, the combination of different ways interacting with each other any chemical reaction which might occur in the system all right.

In isolation and in combination. So I hope you realize that this is how you read the text and then you form research ideas are you getting this idea or no that is the genesis of the research. So when you think about all these issues, then the research develops. So if you read these words that they connate to some phenomena a process is this okay. I think I am trying to tell you how to imagine something which you should be working on in the days to come.

So this is how newspaper headlines might bother you, and you might start working on those topics.

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So materials which are inherently dangerous to the human body or to animals including but not limited to materials that are toxic and poisonous. These are the attributes of the waste which have been talked about they are irritants. I might see you, and I might get irritated so for me a person whom I do not like might be an irritant you agree that could be a situation. So it is an attribute it these type of materials are strong sensitizers they are strong sensitizers means what sensitization is.

So it is one of the sensitizing agents so if you are travelling in locals and maybe can just add malls what do you feel you get sensitized the smell of the sulfur which bothers you suppose a person like me walks through a fish market I know many of you would not get sensitized a person like me will get sensitized because I normally I am a vegetarian but those who are not for them there is no sensitivity, but those who are they get sensitized just by seeing, just by feeling or just by smelling and so on this could be flammable also.

I think we have talked about these issues in the previous discussions that many times it happens that the waste in the landfill under certain conditions of chemical activity or environmental temperature and pressure might become flammable. A good example would be a different type

of oils or the hydrocarbons which are lying in the landfills, and when peak summer comes, there is something known as their flashpoint index.

Or there is something known as vapour pressure, they may catch fire, and once these materials catch fire in the landfill, the landfill system is going to become unstable. Then we could have explosions also because of fire or vice versa, there could be a fire, and there could be an explosion, or there could be an explosion, and there could be fire. So I am sure when you were a kid maybe 10-15 years back when the Iraq war took place.

And a lot of Indian companies, they brought this scrap from Iraq to India particularly the steel scrap. So the chances were that when they brought it and they were smelting this material there were unexploded bombs also in the scrap and when they put it in the furnace their whole industry got blasted this happened in Delhi a lot you must have read about this no. So I mean this is something we directly influence society all right.

This is the waste material from another country which I thought that I would carry along with me to my country and I can flourish and ultimately what happens there were some unexploded shells live shells and the moment you put them in the furnace they exploded all right they could be infectious. So many times the attribute of the waste is that they are infectious either by themselves or when this material comes in contact with some other material.

So this is a potential source of transmission of disease to human's domestic animals or wildlife all right. So these are the attributes which normally we talk about this could be radioactive also the waste could be radioactive material which I have been discussing. So sufficient radioactivity and it so happens that nowadays because India is becoming an atomic major, we have to establish several atomic waste disposal sites.

So that our atomic program goes uninterrupted and this is a lot of association of geotechnical engineers has to be, and I think I have discussed about these issues in earlier classes where the question was how to isolate the radioactive wastes from the geoenvironment how to dispose it

after disposal how to monitor what is happening in the geoenvironment and so on. So these are beautiful examples of why environmental geotechnologist should be very active in today's world.

Pesticides so the more and more agriculture you are trying to have in the country the more and more issues we have discussed this. So more and more fertilizers more and more pesticides and ultimately either this goes to the plants which are known as plants uptake capacity or sometimes the soil itself might get deteriorated because of application of pesticides and fertilizers particularly chemicals and hence people are nowadays talking about the organic fertilizers.

So I am sure you can imagine how different types of situations which might occur in the society a farmer would be having a different type of issue associated with farming and hence the production of the waste products as compared with the guy who is coming from industry and he or she is facing another type of problem, but the magnitude and the type of the problem remains same