Health, Safety and Environmental Management in Offshore and Petroleum Engineering

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Module – 01
Lecture – 03
Drilling accidents

Welcome friends, we are discussing the online course title HSE, that is Health Safety and Environmental Management in offshore and Petroleum Engineering.

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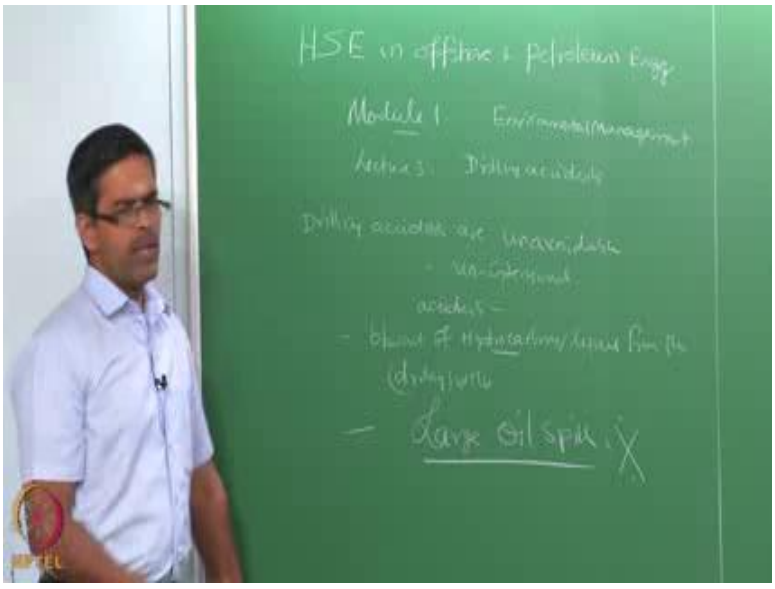

We are now, discussing through module 1 where we are going to discuss in detail the environmental impact caused by offshore and petroleum industries, so Environmental Management. In lecture 3 today, we will talk about the consequences which essentially come from drilling accidents and how the drilling discharges can disturb the ecosystem balance in marine environment.

In the last lectures we already seen, various factors which actually affect the environmental impact caused by the activities caused in offshore and drilling fields. We have already said the different stages in drilling exploration production etcetera how in

difference stages we can have environmental impacts caused to marine ecosystems. Now to be very specific let us now see how the drilling process alone can focus on the environmental issues or impact cause to the ecosystems. Drilling accidents offshore occur due to unexpected; we know that drilling accidents are unavoidable. We can say they are unintentional in real sense they are actually accidents, but essentially they result in heavy blow out of hydrocarbons from the well of course, hydrocarbons and liquids let us say from the well to be very specific from the drilling wells.

And the main consequence of such blow out is the result in very large oil spill. That is one of the important consequences which arise from drilling accidents, very interestingly the literature data very shows that one of the major accident, which is still being spoken in oil and gas industry.

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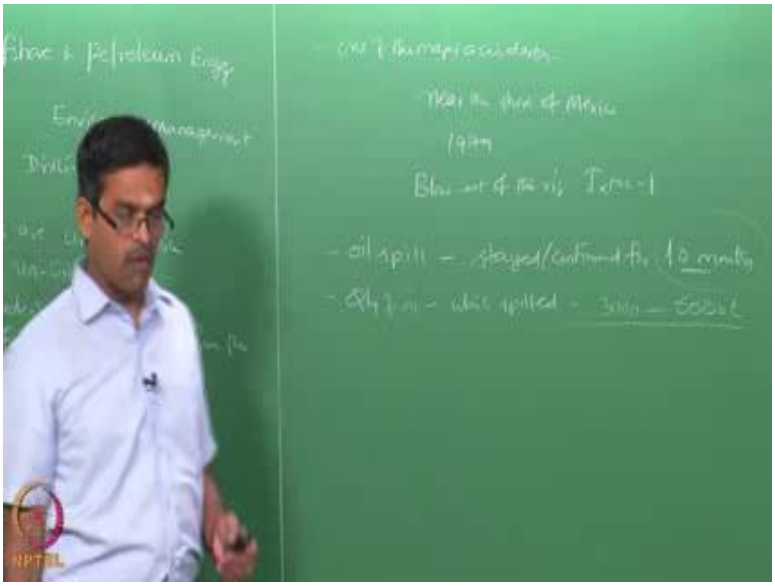

One of the major accidents which occur near the shore of Mexico, in of course, as old as 1979 in the blow out of the rig Ixtoc, 1 the interesting fact as you are aware or you as will be reading from the open domain sources is that, the oil spill resulted from this specific blow out stayed there or let us say continued for about 10 months, this fairly a large period and the quantity of oil which filled out, is about 3000 and some where the concentration is so high as 6000 terms. So, one can seriously see the quantitative impact

caused by such blow out accidents, and the period with which it effects the ecosystem. So, both them are parallel important for us to really know the seriousness of any such consequences which occur from the drilling accidents on offshore environment.

Now, to understand this further better, let us classify drilling accidents into two parts. So, drilling accidents can be classified essentially into 2 parts.

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Class 1 type and class 2 types: class 1 type actually refers to the catastrophic situation which involves very instance and prolong hydrocarbon discharge. Let us say gushing, gushing is a phenomenally high discharge, the second class actually refers to a routine hydrocarbons spill, this essentially comes out during even the normal drilling operations, this is very common even during normal drilling operation. There is no reason that it should always happen only as an accident.

Therefore, the second class of drilling accidents generally are not frequently reported because is more or less a routine part of the offshore industry process and more over it is also not responsible for causing series pollution. So, they do not cause serious pollution. We are more bother about the intense and prolong hydrocarbon gushing which, actually

results in catastrophic situation. So, when we say drilling accidents we refer to type one or classification one of drilling accidents.

The next important source which actually causes imbalance in ecosystem; is accident caused in the under water storage reservoir we know offshore platforms are built for various purposes.

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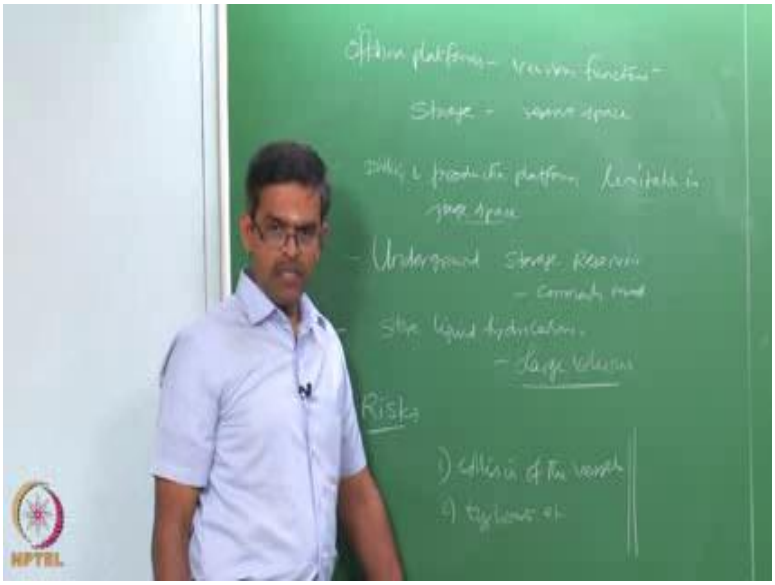

So, offshore oil production systems are, let us say offshore platforms are built for several functions storage is one amongst them. The storage if it is a part of the function of the platform it requires lot reserve space due to limitation in the reserves space available in the platform especially in production platforms. So, in drilling and production platform generally there is limitation in storage space. So, to overcome this difficulty people construct, what we call underground storage reservoirs, a large tank will be constructed which are actually commonly used in the present terms, because in the present scenario the production and drilling platforms, which are essentially semi complaint in nature have a serious limitation in terms of storage space.

So, there has been an improved usage of underground storage reservoirs. So, essentially these reservoirs are used to store liquid hydrocarbons. They actually store liquid

hydrocarbons, there is no harm in allowing them to store the hydrocarbon, and the difficulty here is they store them in comparatively a large volume. That is the problem here; they are used when the tankers are deployed for oil transportation instead of pipelines. So, there are 2 ways you can transport oil from the production platform to the shore for processing either you can use pipelines or you can use settle tankers essentially underground reservoirs are used, wherever people generally use oil tankers or shuttle tankers instead of pipelines.

Now, where are the risks rising, when use underground reservoirs. So, the causes for risks in underground reservoirs can be one due to collision of the vessels, which is the settle tanker with that of the reservoir. There can be also collision which is caused by the tug boats etcetera. So, the risk occurrence of these kinds of incidences in offshore industry is comparatively on the higher scale. Now the question asked very commonly is when such accidents can occur.

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The answer is very simple, such accidents usually occur when the tanker is in the loading process alternatively. It can occur when there is a severe weather condition because, during loading process the tanker has to be enabled to come as close as possible to the reservoir. Now the question comes when damage occurs, what happens when damage

occurs to the underground reservoirs? What happens that is, what we are interested to know as I said in the beginning; underground reservoirs have very large volume of hydrocarbons.

So, on damage they will become a concentrated source of marine pollution because, this will toxicate the marine environment or marine ecosystem with methanol content, with the methanol content of high concentration that is one bad news. Now there is good news here, the good news is there will you contain they will be contained or restricted only to a concentrated area.

They will not spread easily, but; however, their concentration in that area are this extent of pollution may not be there, but the concentration of pollution will be very severe. The concentration of pollution is very severe which affects the ecosystem very badly. Therefore, it is a matter concern for all the environmentalist alternatively. You do not allow the shuttle tankers to transport oil from the underground reservoirs to the on shore for processing and discharge. Let us say of using pipelines, now let us see what are consequences caused, when use pipelines for transporting oil from the underground reservoir or from the production platform to the coast.

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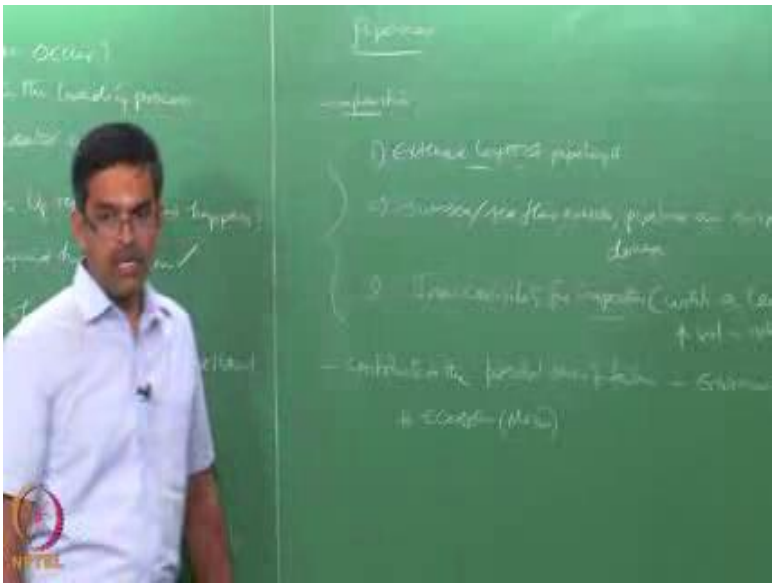

Let us say, pipelines there also hazards there are hazard free. So, pipelines are generally used to transport the explored crude oil to the shore for further processing. We all know the crude oil not be used as a commercial product, you need to process that. So, you transport the explored crude oil from the production platform because, you cannot do the processing in the production platform itself, because the space availability on a production platform is very highly limited, neither you can store this oil in the production platform because, the storage volume is also not available in such production platforms. So, you need to transport it either on daily basis or then basis from the production unit to rather castle side.

Now, what are those complexities which arise essentially from pipeline usage? The foremost complexity is extensive length of the pipeline. Why are you bother about extensive length the movement is extensive length, I have got lot of connections and there is always a probability that these connections can be subjected to leakage. The second issue is because, subsea or sea flow erosion these pipelines are subjected to damage. So, they can also result in leakage of oil directly most importantly these pipelines laid on the sea flow or not available for inspection. So, inaccessibility for inspection until you actually notice a leak of high volume is noticed. So, periodic maintenance of these kinds of pipelines against leakage is not day to day affair because, is first expensive. Secondly, people actually do not plan for a continuous inspection process on pipelines.

So, now these three reasons which add to the complexities of using pipelines. When i transporting oil from the production unit to the coastal side actually contribute to the potential source of failure, which results in environmental imbalance to the marine ecosystem, there are other factors also which do effect the or which do contribute to the increase in the potential source of failure the pipelines. So, let us say what are the other factors could be a material defect.

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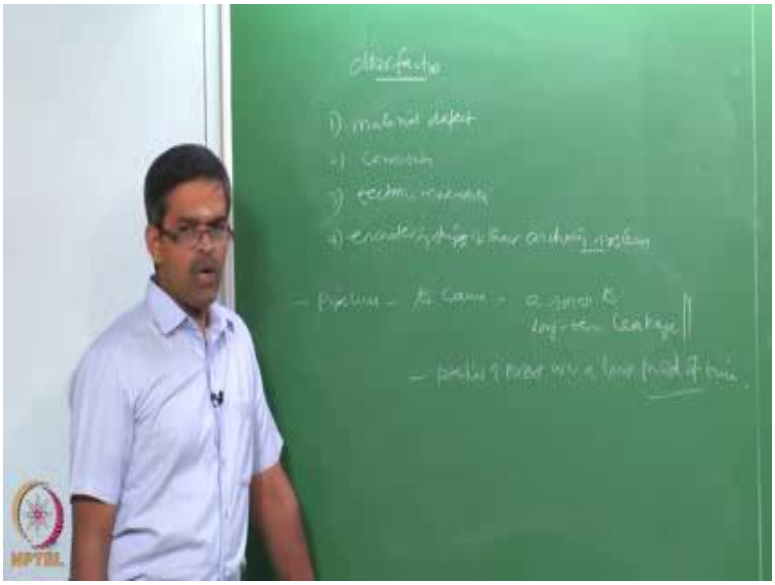

Second could be corrosion, third could be the tectonic movements, that is sea quakes and earth quake is sea belt next could be the encountering ships and their anchoring system that is a very important problem. Therefore, pipelines can cause a small to a long term leakage. So, pipelines are responsible to cause a small too long term leakage, which is actually botheration because, this will remain as a potential of thread over a large period of time which is a problem. Now if you ask me a question; what would be the factors or what would be those contributors which will affect the intensity and scale of the impacts.

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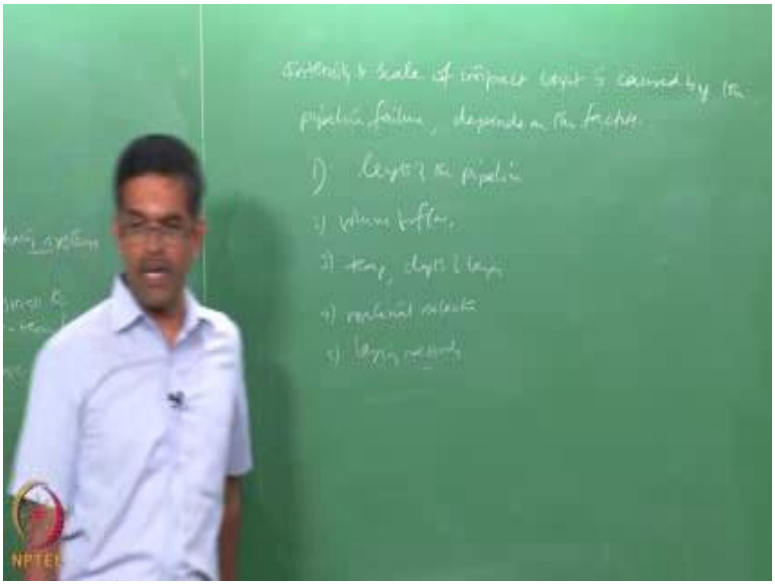

Intensity and scale of impact that is caused by the pipeline failure vary depending upon the following factors.

Let us say, what would the impact on marine pollution, there are several factors depending upon length of the pipeline volume of flow temperature depth of laying fourth material selection, fifth even i should say laying methods because, laying methods sometimes introduces residual stresses in the pipelines which can avoided. If you are able to smoothly lay the pipeline in the shore. Now, once we understood that either the underground storage reservoirs or the pipelines, which are essentially two means of sources of collecting the explored crude oil, which can be further transported from the production unit to the other course for further processing both of them or both methodologies have equal risk which causes impact the ecosystems in marine environment.

Now, let us see what an impact on the marine pollution are impact caused by the marine pollutants is essentially 3 in nature.

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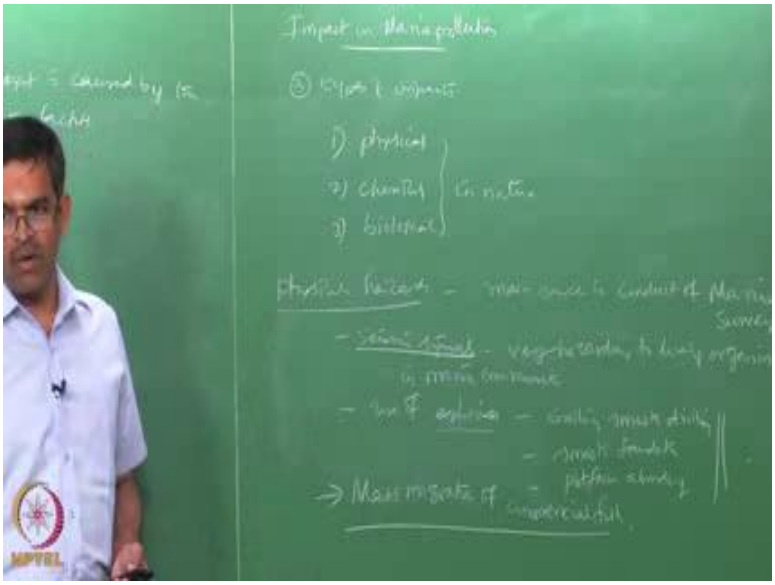

So, there are 3 types of impact cause, one as we all know physical, two chemical, three biological in nature physical i should say hazards arise essentially during the conduct of marine service, the main source is conduct of marine service to elaborate, this let us say if i send seismic signals which are generally generated during the marine survey, they are very hazards to the living organisms in marine environment.

So, the first source comes from the generation of seismic source. The second could be use of explosive activities it can either for enabling for the smooth drilling or it can be for enabling smooth drilling or for smooth foundation. Even it can be for platform abandonment in all these 3 cases generally people use a exposits, in such cases this will result in a mass migration of the commercial fish from the source of the platform to a different location. So, that is main reason why this can result in a physical hazard which, is essentially arising from the drilling activity which is one of important variety or type of impact caused in marine pollution.

The second of course, could be the chemical pollution.

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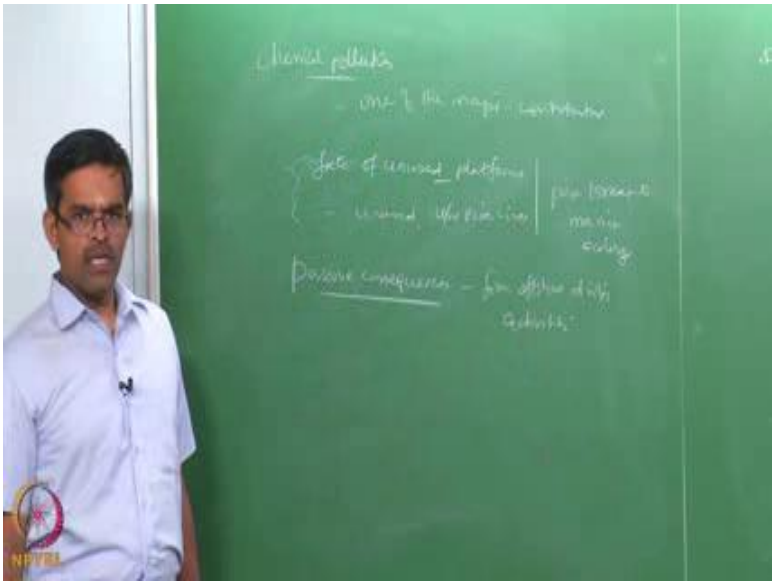

As we have seen in the last lectures we have made a table to understand, what are the difference sources which are actually contributing to the pollution marine environment? So, chemical pollution has been seen as one of the major contributor of marine pollution the most important you cause the more important impact on marine pollution because large offshore accidents has resulted in oil spill in the past, they are let to be serious ecological consequences and very importantly the use of i mean the fate of unused platforms is a point of serious concern the fate of unused under water pipelines is another very and they actually pose again a parallel threat to marine ecology. So, we can call them as passive consequences which arise from offshore drilling activities.

Let us try to understand the composition and consequence of oil hydrocarbon separately in detail.

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Let us say oil hydrocarbons what is their composition and consequence based upon the literature review conducted by various researchers in the recent past, one can easily see from the literature that there is global distribution of oil pollution, which essentially originate from offshore platforms. In the last lectures we already said that how one local regional and global effect of different elements can present in the hydrocarbon; however, in general the literature studies very clearly indicate that there has been a global distribution of oil pollution which essentially originate from the offshore platforms sources having said this. Let us now talk about what are concerns in terms of the scale and consequence of pollution which are arising or which are rather increasing in the last few decades.

We all agree one statement that oil input is undoubtedly seen as one of the serious threat to marine environment let us talk about import composition let us say crude oil crude oil has got a wide difference and property which will lead to physical and fictionalizing of crude oil in the ocean environment the movement crude oil mixes in ocean environment it gets disintegrated. What we call as physical fictionalizing happens of the crude oil?

Which causes impact to marine environment in different forms crude oil that contains hydrocarbons with the few hydrate composition such as Paraffins Naphthenic Naphthine

aromatic compounds, that are present in crude oil are essentially sources of marine pollution the complexity is actually the study of the behavior and the biological impact they are actually governed by the physical and physio chemical properties. So, the behavior of crude oil which is essentially require to study the impact of the crude oil on the marine environment depends on various factors these factors globally or physical and physio-chemical in nature they are governed by certain specific characteristics one is the specific gravity two the volatility three the water solubility.

Now, if you look at crude oil at a different prospective, it is present in a ocean environment in different forms each form has got a special kind of threat imposed on the marine environment. Let us see what are these forms of crude oil crude oil is present in different physical states.

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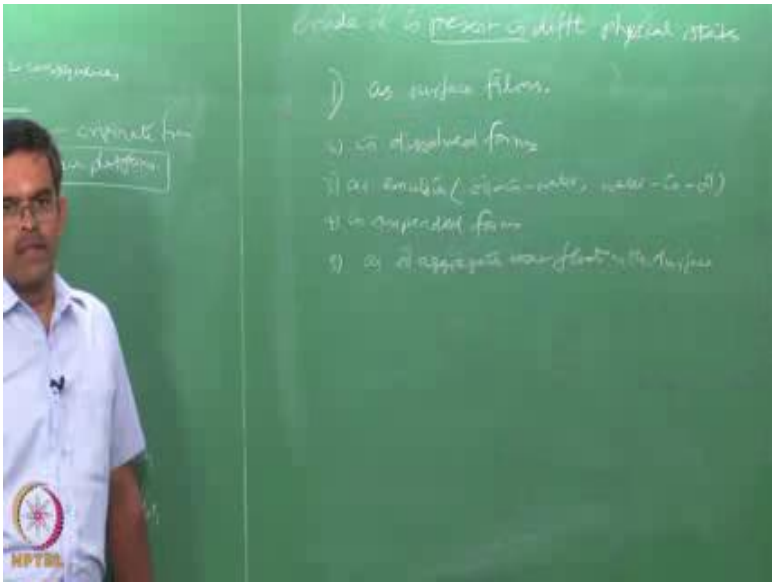

It can be present or seen as surface films, it can be also seen in dissolved forms it can be seen as an emulsion essentially oil in water or water in oil it is available both the forms it is also seen in suspended forms. It can be also seen as an oil aggregate that floats on the surface, their fractions are generally observed by the suspended particles the solid and viscous components gets deposited at the sea bottom and other compounds get accumulated in the water organisms.

So, they get dispersed in different forms some of fractions will be absorbed by the suspended particles percent in marine environment the solid of viscous components will get dissolved and deposited to the sea bottom. Whereas, other compounds will be accumulated in the water organisms and they create lot of parallel serious threads to marine ecosystem. Now the question comes, if we all know that crude oil of different content present in both physical and physio chemical properties which contribute seriously in different forms to marine pollution can be deduct them can be see them in advance. So, what are problems when we identify or try to detect the oil content in marine pollution?

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So, presence oil content in marine pollution. If you discuss this as a point detection of this is a main problem, the question is why because the presence of this in marine environment is exactly similar to that produced by the marine living organisms.

So, it is very difficult for you to identify whether the source is from the crude oil generated from the platform or it is from the marine pollution. So, detection becomes even more difficult when, the oil presence is very low with very high concentration the concentration can be high, but the presence is low if this combination occurs and then detection becomes much more difficult. So, one can always adopt progression duration

and results of this transformation because, a depend on properties and composition of the crude oil the one which is spread on the oil free surface which occurs under the influence of gravitation forces can be always blocked on the oil spill can be prevented by mechanical means which will see in the last lectures.

Now, let us try to understand oil spill as a physical review.

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Let us talk about oil spill as a physical review, oil spill actually undergoes various stages in each stage it pollute the marine ecology very significantly, what are those various stages which an oil spill undergoes. So, the various stages an oil spill undergoes could be a physical transport during which, it also pollutes the second could be microbial degradation. The third stage could be aggregation and the fourth could be self purification during all this stages it pollutes the marine environment the marine environment significantly.

So, will talk about the mechanical methods by which an oil spill can be contained control and what are those further difficulties leading to association or detection of factors, which results in biological ecosystem imbalance, which are source essentially from oil and gas industries alone. So, in this lecture we talked about oil spill, we talked about

drilling accidents, we talked about the complexities arising from the crude oil present in different forms and we also said how an oil spill in different stages is going to affect the marine environment.

Thank you very much.