Health, Safety and Environmental Management in Offshore and Petroleum Engineering

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Module – 02
Operational Safety
Lecture –10
Accident analysis

Welcome to the tenth lecture on module 2 on HSE Practices in Offshore Engineering. We are talking about lectures on module 2 where we are focusing on operational safety.

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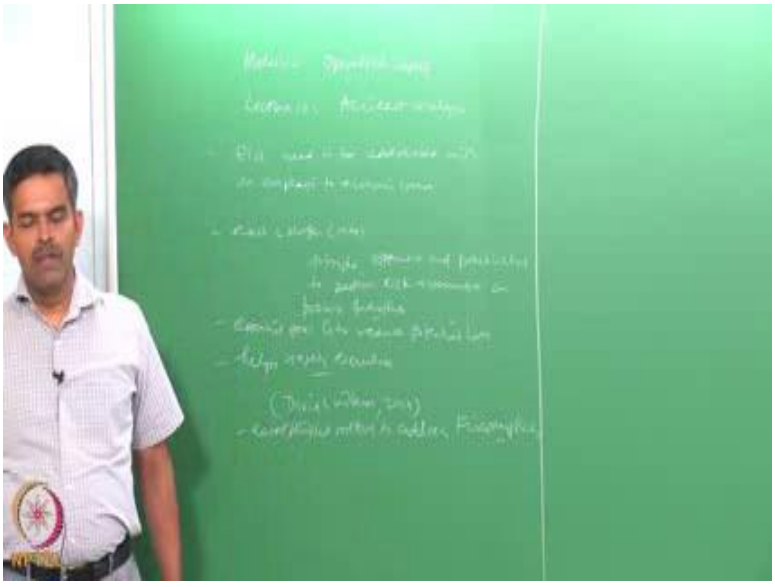

Today in the tenth lecture, we will talk about something more detailed on accident analysis. Let us quickly rewind and see what we discuss so far in the last lecture. We have understood that risk need to be addressed with an emphasis to economic losses, human loss can also be one of the part of risk assessment, but economic loss also vital it should be addressed. So, Frank and Morgan method in early eighties, basically 79 is a simple efficient and practical tool to perform risk assessment on process industries.

Objective of this method was to reduce the potential loss. The essential goal is reduce

potential loss by identifying the important contributor within the plant while the crucial department within the plant will be taking care of because it has got potential of high risk. This method also helps safety executives HSE executives to pay attention to departments that are crucial Morgan's method is conservative of the best employed tool for addressing such problems as seen in the literature and possibly one of the easiest methods to attempt financing risk as stated by David and Williams, 2007. So, it is one of the easiest and simplest methods to address financing risks. Now, lets us talk about some more definition and understanding on accident process.

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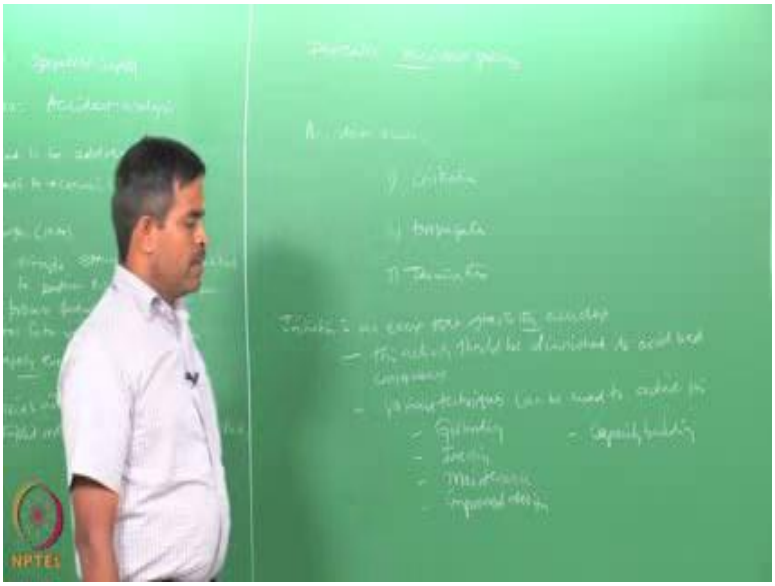

Let us say, my objective is to defeat the accident process at the first place. I do not want the accident to happen, what are the different steps that can be taken or considered during an accident. Let us say an accident occurs due to initiation propagation and can be controlled with termination. Initiation is an event which starts the accident. So, it actually starts the accident, in general it is always advisable and recommended that this activity or this event should be diminished to avoid catastrophic consequences. How this can be done? This can done by various techniques by which this initiating event if at all accident is going to be initiated can be controlled or put down can be used to achieve. This objective could be what we call as grounding, proper maintenance or routine maintenance improved design and it can also do it by capacity building that is continuous

training offer to the safety personnel to avoid human error. Next one is the propagation.

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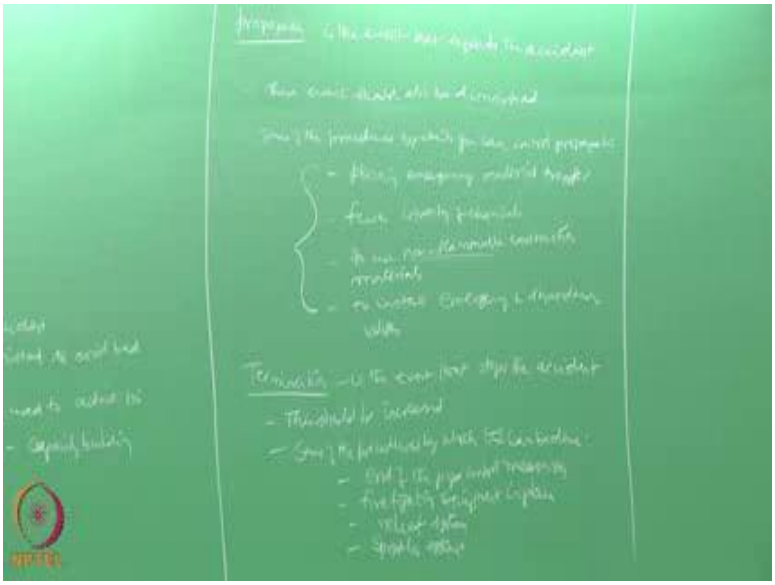

Propagation is actually the event that expands the accident. Initiation is one which starts the accident. The propagation is one which is carrying a forward for a longer duration as desired. These event should also be diminished, some of the procedures by which can control the propagation can be some of the procedures by which you can control propagation. You can always plan for by planning emergency material transfer because you know in most of the cases, the accident occurs only when the material stock is available in the places. So, plan for in emergency material transfer always try to have only fewer inventory of chemicals down stock. Large volume of chemicals in the work place is always advisable to use non flammable construction materials, nowadays you see the top sites of offshore platforms which are essential and increase in become a composites do have a temperature with standing characteristics or fire resisting design characteristics.

So, let us use or plant use non flammable construction material then also plan to install emergency and shutdown installation walls. So, these are the methods or procedures by which one can always control the propagation which is nothing, but the expansion of the accident, the third one could be the termination, termination is a actually event which

stops the accident. So, what terminate refer to stopping for a better design this should be increased for better and effective control over the accident. Some of the procedure by which this can be done could be end of the pipe line control measures wherever you have the flanged dummy under the pipeline in a given process line end control measure should be very, very carefully designed firefighting equipment in place third could be relief system and lastly sprinkler system.

Friends, we have been talking about the risk assessment in offshore industry. We also said in the beginning, some of the lectures that offshore structures or let us say offshore industry in general by and large has something call pre declined acceptable risk. So, what is an acceptable risk?

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In offshore industries, we all now agree at least some extent risk cannot be avoided. You cannot avoid risk; you cannot make certain zone 0 risk zones, certain zones on petroleum industry cannot be made as 0 risk zones. Let us see, what are they drilling exploration and production? These are the areas where risk will be present implicitly because of the nature of the process and we all agree to some extent.

In fact, to a larger extent that there are many inherent factors which lead to unforce in

incidents which subsequently become accidents. So, depending upon the environmental condition prevailing, these incident matured to become accidents is therefore, important to realize and understand that risk should have a level of acceptance in offshore industry up to a pre-acceptable level. So, let a say according to risk is acceptable and permissible in offshore strictures. So, all regulatory norms accept rather permit risk to certain level in offshore industry. Let us quickly see what are they now first and for most agency, which is popularly practiced in accepted globally is environment protection agency.

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EPA, United States according to this by definition, EPA states that risk in 1 million is acceptable, if this risk is originated from carcinogens. For non-carcinogens hazard index is calculated and if the value is lesser than 1 it is acceptable that is an acceptable risk by EPA.

The next agency which is also recommending acceptance level of risk is a United Kingdom Health and Safety Executive. According to this, any fatality accident rate which is equal to unity or lower than that is acceptable, one can ask me a question is actually risk involved only in offshore industry or any process production or any mechanical industries the answer is very interesting. In fact, we have risk indicators.

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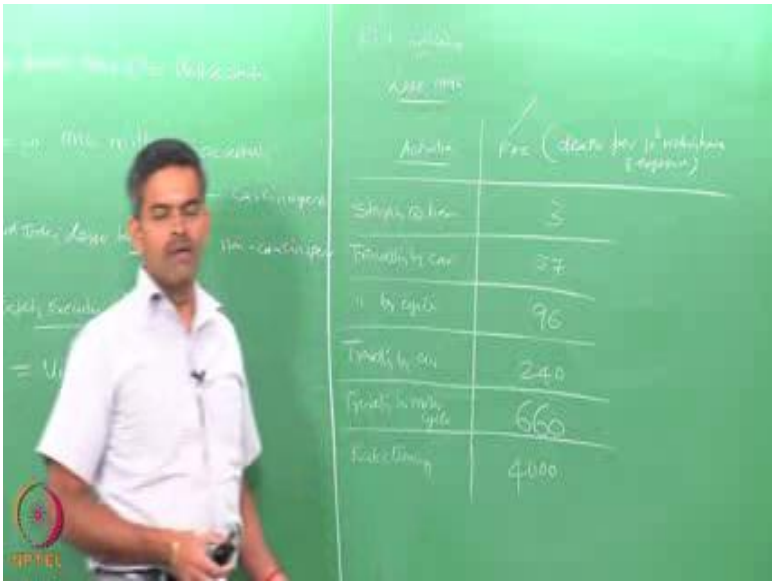

Even a routine part of life there are different fatality statistics available for common non industrial activities as given by Leas in 1996. There are fatality statistics of non-industrial activities. Let us see, what are the activities? And what is the FIR in terms of deaths per 10 power 6 working hours of exposure.

Even staying at home having without doing any work, non-industrial domestic still it has a FIR of three, that is if you continued stay at home, wherever you are expose to 10 powers 6 working hours by staying at home for that kind of exposure still three people would die. So, fatality extent rate could be three traveling by car FIR is slightly higher is 57 traveling by cycle is a day today activity FIR is higher still 96, traveling by air FIR is still higher 240, traveling by motor cycle still higher 660 and rock claiming which is one of the mountaineering excise, which people do for physical fitness which has got the highest FIR which is 4000. All these are non-industrial activities still they have a fatality extent rate. So, there is no assumption that an oil and gas industry which deals with high degree of hazards has also an acceptable fatality accident rate.

Interesting, lets us look at this table and ask the question which we need to answer. Let us say the table shows has said by leas in 1996 traveling by air has got the very high fatality extent rate compare to that of traveling by, let us say cycle or traveling by car. So,

do we really say the traveling by air is risky because the fatality extent rate is much higher compare to that of traveling, by cycle or traveling by car, but; however, we generally here is the news and we see from the media that road accidents are very common.

However, air accident are not that not common at least in any parts of the world so, but the figure shows do you things is a reverse concept that to traveling by air is having a very high fatality extent rate compared to that of driving on road by a car. The answer is not please look at this figure traveling by air has a very high FIR, but remember if you travel by air equivalent to 10 power 6 working hours of exposure. Then only this will happen, however, if you want to go from a place of A to B, what time maybe the distance between A and B, if travel by car, it may take about let us say 20 hours whereas, if travel by air, it may take about let us say, for example, half an hour or one hour.

So, expose a time is very, very short compare to air travel. However, fatality extent rate of the risk involved in air travel is much higher compare to that of a road travel, but since you are exposed for longer duration maybe 24 of that event even though FIR maybe lower depending upon the statistics shown in this table, but your risk exposed to the condition is much larger. So, that is it is got to be defined. So, we need not simply take this number and try to get confused that traveling by air is got a very high FIR. In fact, rock claiming is 4000.

So, we should not claim rock at all no mountaineering at all that is not the idea you have to not only look into the number, but look into the denominator of the numbers that is you need to expose yourself a 10 power 6 working hours of flying. If you are really wanted to enjoy or really wanted to force here, 240 FIR against this, whereas if you drive car for 10 power 6 working hours if your FIR is only 557. So, that is the idea let us say after briefly understanding the accident analysis techniques, let us talk about risk assessment which is very vital and very interesting and very necessary for an offshore engineer.

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A safety executive to know risk assessment can be two forms. You can also do it qualitatively you can also do it quantitatively. So, risk in general refers to a situation and a recognized hazard. So, prior to risk assessment you should do hazard identification. So, hazard identification is need to be done prior to risk assessment why because risk assessment by definition needs recognize hazards to be identified a prior of that quantitative risk assessment which is also q r a involves in estimating both the magnitude of the potential loss and the probability of occurrence of that potential loss. So, basically risk in terms of q r a that is quantitate quantitative is a product of magnitude of the potential loss multiplied by the probability of occurrence of that potential loss. So, the moment I says magnitude intelligently now we will include the economic losses also not only the fatality

Now, the risk evaluation deals with the events and therefore, it is qualitative risk is also identified by continuously observing the changes in risk parameters. So, risk identification is observation made continuously on the changes in risk parameters. So, it is very important that the risk parameters changes should be monitored continuously on the existing process and therefore, risk identification is a continuous process where as risk estimation is done by the determining the probability of occurrences of the event.

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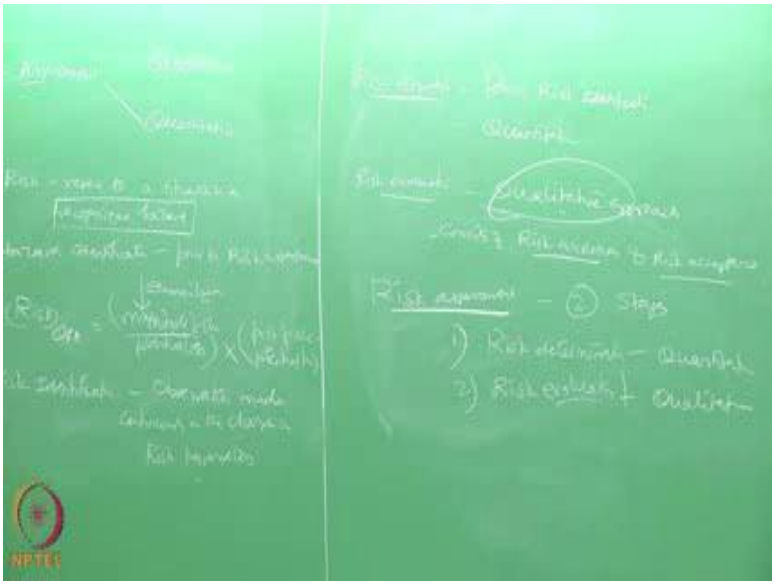

And the magnitude of the consequences which is post processing of the data identified during risk identification process. So, risk estimation follows risk identification it is purely quantitative it works on the data which is in prepared during the risk identification risk evaluation deals of cause to that events and is the qualitative approach.

So, therefore, risk evaluation consist of risk aversion and risk acceptance therefore, risk assessment consist of two stages; stage 1 risk determination, stage 2 risk evaluation, risk determination deals with the numbers therefore, this is quantitative risk evaluation deals with analysis in terms of the comparison therefore, this is qualitative lets what we said here. So, risk assessment can be both quantitative and qualitative because it deals with two stages, one is a determination other is evaluation let us slightly look at risk evaluation in a better form.

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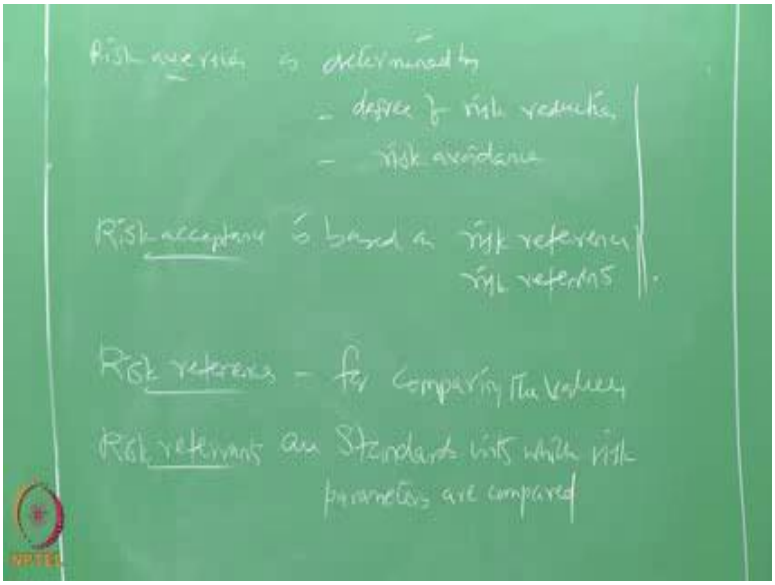

Risk evaluation consists of risk aversion and risk acceptance. We already said that here risk aversion it consist of risk aversion and risk acceptance risk aversion is determined by the degree of risk reduction and risk avoidance where as risk acceptance is establishing risk reference or is based on risk reference and risk referents what are risk references risk references are for comparing the values or meant for comparing the values risk referents are actually standards with which the risk parameters are compared.

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So, now national academy of sciences, identify four steps for chemical risk assessment, please understand risk assessment has got two stages determination and evaluation; one is quantitative other is qualitative risk. Evaluation has got risk aversion and acceptance there is aversion is based on the degree of risk reduction you adopt, and the risk avoidance policy what you have in your company or in your plan, whereas risk acceptance is purely based upon your referents and your reference.

So, it all depend upon what do you call as a referent to compare risk. So, therefore, acceptable level of risk or risk acceptability can be dynamic it can vary from company to company can vary on the same company from country A to country B because it is all depending upon under the global act of that particular region where the company or where the oil and gas company is located or exploration is located what are the risk referents the global standards are referring too.

It may always vary. So, therefore, the norms for risk acceptance can vary for one country to another country though both the countries have the same potential oil and gas company who is doing exploration. So, for chemical risk assessment, the moment I say chemical risk assessment, it is very clear that we are talking about assessing risk for people or for their plants which are exposed to chemical. There are four stages involved

in this one, first stage is the hazard identification, second stage is the dose response assessment, third stage is exposure assessment and four stages is risk characterization which will discuss in detail in next lecture.

So, in this lecture we talked about accident processes, accident analysis. We also learnt different terminology is involved in risk evaluation assessment identification. We also said why hazard identification preludes risk assessment by definition and we have now understood to some extent that acceptable level of risk can vary from country to country from company to company in the same country depending upon what are the risk referents the company or the global standards are using and what are those references which you are comparing for risk assessment parameters, I hope you are following the lectures I want you and I will request you to follow all the lectures regularly, keep on re visiting them and hearing them continuously.

Thank you.