**Health, Safety and Environmental Management in Petroleum and offshore Engineering**

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**Module No. # 01**

**Lecture No. # 04**

**Organizing for safety**

Now, we shall talk about the next lecture on organizing for safety.

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First, let us see, what do we understand by safety. Major accidents in the past in oil and petroleum industry are important source of information to understand safety. They are very helpful to prevent the occurrences of similar accidents in the future. For the past 15-20 years, major accidents in offshore industry are declining. I want to ask you a very critical question, this news what you see in the slide do you understand, is it good or bad?

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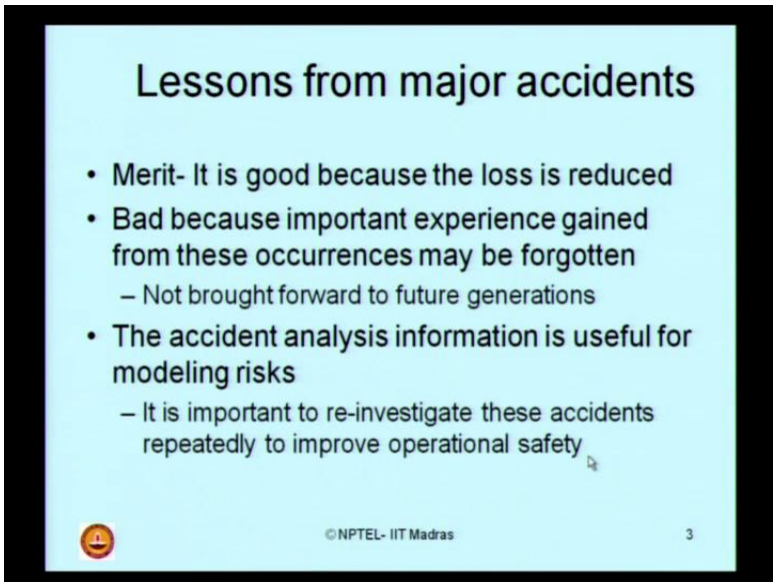


Ladies and gentlemen, I can read and tell you that, you will always be happy to know that the accidents declination is good news, but let's see there is a merit in this declination, because the loss is reduced. However, it is bad, because important experience gained from these occurrences may be forgotten. If accidents do not occur or they are not basically retrieved back for case studies, if they are not brought forward for the future generations to understand, then it is very difficult to really model these kinds of risks in oil and petroleum industry. Because the accident analysis information is useful for modeling risks, therefore, it is important to re-investigate these accidents repeatedly to improve operational safety or to basically avoid such accidents in the future.

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Now, what are the common hazards groups on offshore and petroleum industry; that is a very famous question which one likes to answer, before talking about risk analysis? The hazard groups can be classified as follows, the top in the group is what we called as blow outs; the next one is hydrocarbon leaks on installations; the third one is hydrocarbon leaks from the pipelines or marine risers; the fourth one is structural failures. These are the four broad groups of hazards that can occur in an offshore and petroleum industry. I am re-emphasizing them just forever understanding.

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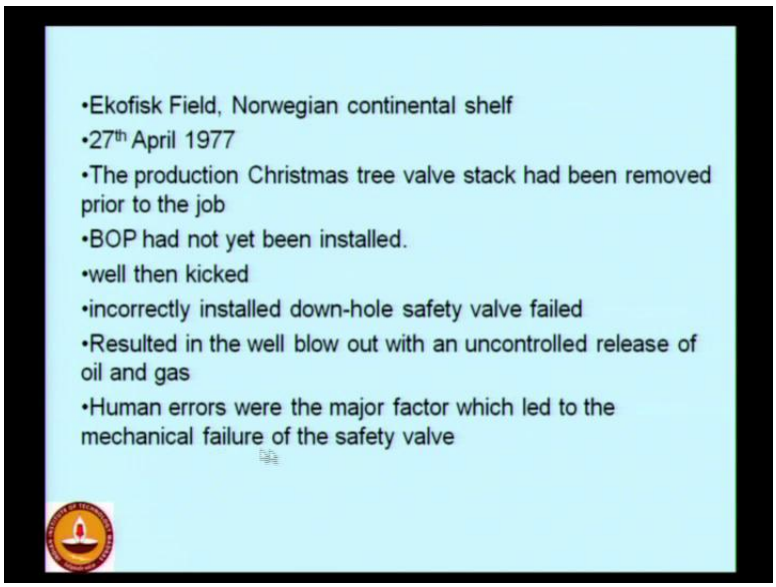

Let us now talk about one of such series of accidents happened in the past. On April 27, 1977, the Ekofisk Field in Norwegian and continental shelf experienced a serious accident. The production Christmas tree valve stack has been removed prior to the job. The BOP had not been installed in the field; the well at that time then kicked off, the incorrectly installed down-hole safety valve failed, this resulted in well blow out with an uncontrolled release of oil and gas. Ladies and gentlemen, this accident happened in Ekofisk field, is attributed to human errors and they were considered to be the major factor which led to the mechanical failure of the safety valve.

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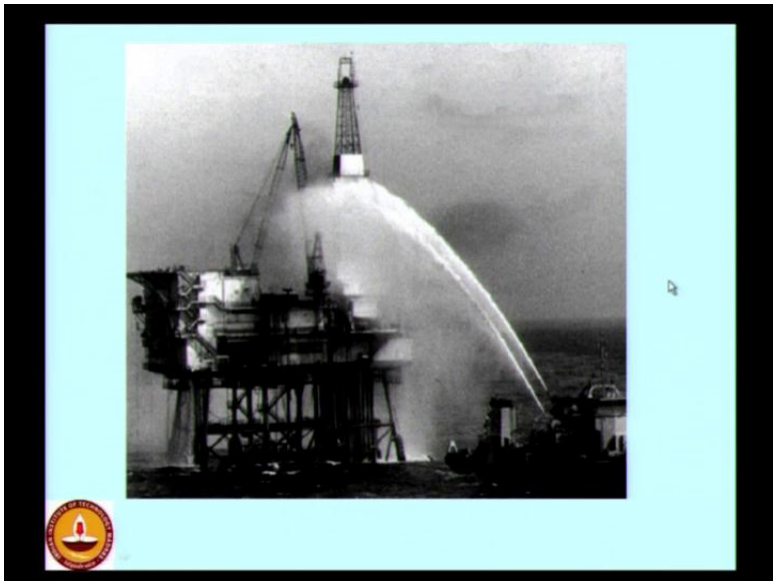

This is a very interesting picture which you can recollect easily from the literature, addressing the specific kind of accident.

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The second accident which we will discuss here happened in 16th August, 1984, and subsequently on the same location on 24th April on 1988. Ladies and gentlemen, closely within a span of about four years, we have got two successive accidents happened on the same location, Enchova field, Brazil. In the first case, it happened on 16th August, 1984, a blowout occurred followed by explosion and fire. In the second incident, the well suffered a gas blow out the BOP did not shut the well completely, attempts to kill the well completely failed, and that resulted in this accident.

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The pictures, what you see here refer to the accident occurred in 1984.

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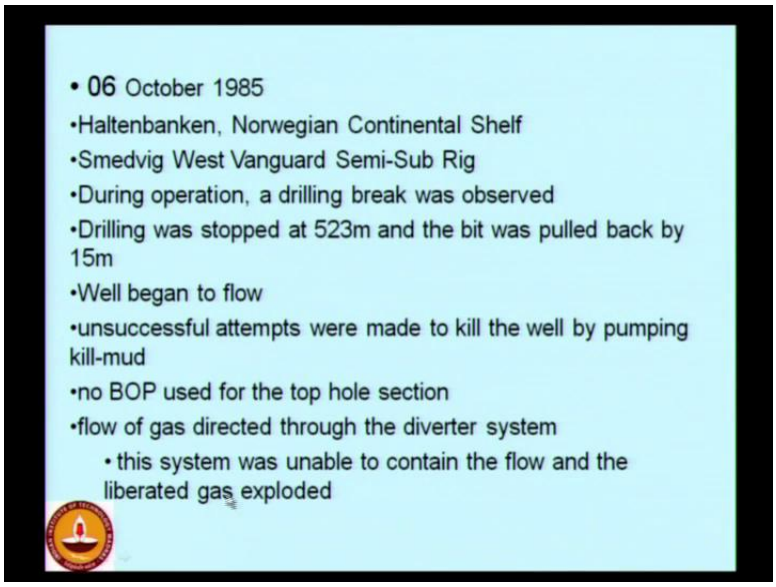


The next case what we like to address here, happened on 6th October, 1985. It happened on Haltenbanken in Norwegian continental shelf. Basically, it was a semi submergible rig accident, the famous Smedvig West Vanguard semi submergible rig. During operation a drilling, break was observed in the rig. The drilling was stopped at about 523 meters and the drill bit was pulled back by about 15 meters, because of this the well began to flow subsequently. Unsuccessful attempts were made to kill the well by pumping what we call as kill-mud, remember, no blow out preventer was employed for the top-hole sections in this specific problem. The flow of gas was directed through a diverter system, this diverter system was unable to contain the flow, and therefore, the liberated gas got exploded

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And that is the fee what you see here subsequently in these pictures.

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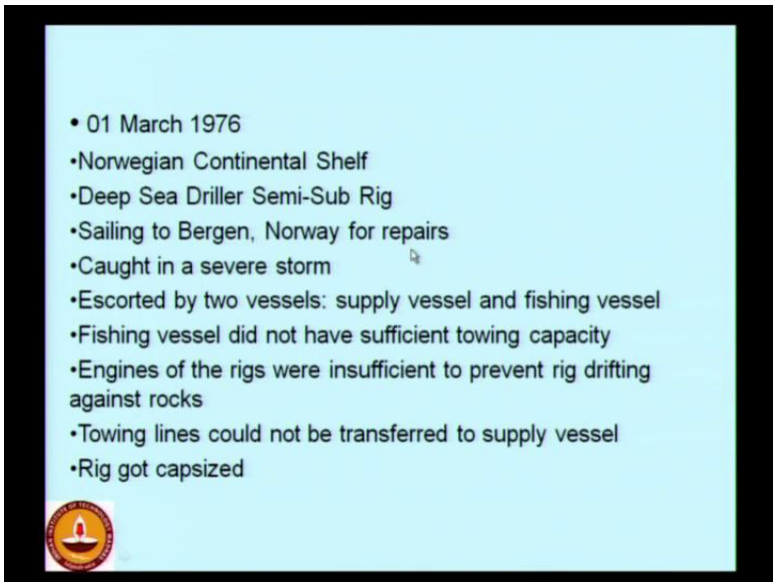


The next case happened in March 1st, 1976, what we will discuss. It happened in Norwegian continental shelf. Again, it is an incident related to semi submergible rig, the deep sea driller. But, here it is really interesting to know, that the rig is fail not during operation, but actually during transportation. The rig actually was sailing to Bergen, Norway for repairs, the rig got into a severe storm on its way. The rig was off course escorted by two vessels: one is a supply vessel, other one is fishing vessel.

The fishing vessel did not have sufficient towing capacity. The engines of the rigs were insufficient to prevent the rig drifting against the rocks. The towing lines could not be transferred to the supply vessel successfully, as a result of which, the complete rig got capsized; that is a major financial and operational loss to the company. And remember, this accident did not occur when the rig was in operation; this accident occurred when the rig was being transported for repair to Norway.

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And that is the capsize rig what you see in the picture.

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The next accident case, what I like to highlight you again, is the BP oil disaster according Gulf of Mexico on 20th April, 2010. This is considered to be a fateful day in the oil industry. The blow out preventer failed despite all critical efforts carried by the company, of course, this case has been discussed in detail in the literature and you can also see lot of information on the Wikipedia of this specific disaster.

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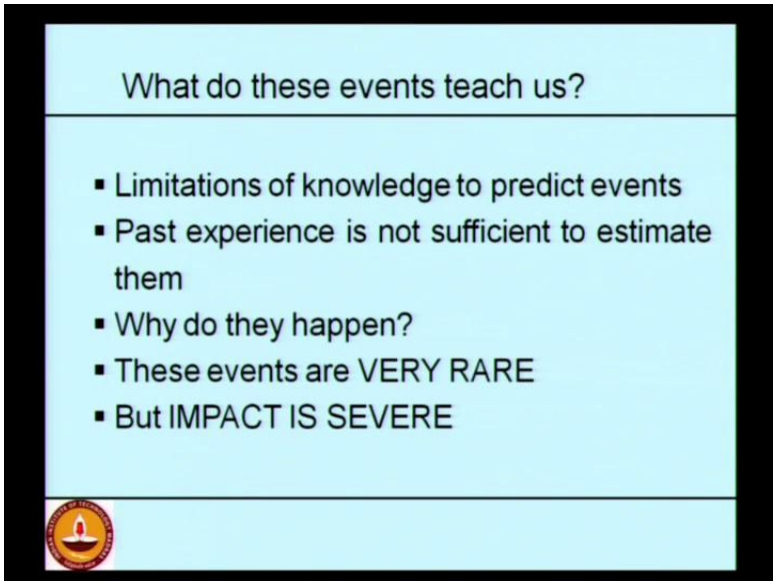


What do these events actually teach us? There exists limitation of knowledge to predict such events there is no doubt on this statement at all. The past experience is not sufficient to estimate them; otherwise these accidents could not get repeated. The fundamental question asked in the oil industry is, why such accidents actually happen? That is a first question which everybody is interested to answer, but before we answer this, let us try to understand again these events what we discussed or very rare in the scenario. Therefore, the frequencies of such accidents are very, very less, but the consequences of these accidents are very high, because the impact cost with these accidents financial, operational, economical and even administrative issues and even legal issues related to these accidents and the impact resulting from these accidents is very severe.

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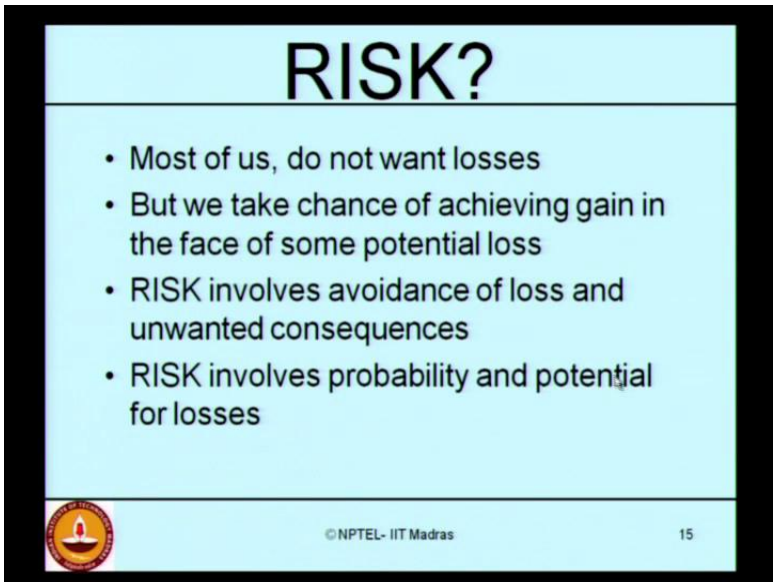


Then comes the question, how do we link these case studies these understandings to a term called risk in HSE? Most of us, do not want losses, correct? Because losses are un-expectable in financial as well as administrative ideology, but we all take chance of achieving gain in the face of some potential loss. Risk involves avoidance of loss and unwanted consequences; risk involves probability and potential for losses.

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Therefore, how do we define risk? The risk definition is very interesting in the HSE literature. Risk is actually defined as a potential for realization of unwanted, negative

consequences of an event. The risk is not to address how to completely avoid any kind of such scenario. Risk is actually addressing the potential for realization of unwanted or negative consequence of any event, this definition is classically given by Rowe in 1977. The risk aversion is therefore, the action taken to control or reduce risk. For safety and health, risk is commonly defined in terms of quantitative concept basically the risk involved or the risk for seen is actually converted to a quantitative number.

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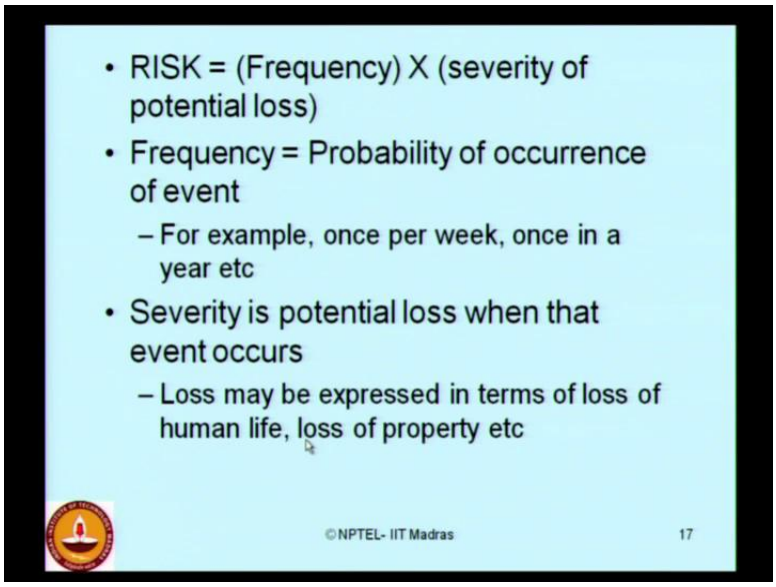


Mathematically, we can say, risk is a product of frequency and severity of potential loss. Frequency is nothing but the probability of occurrence of any event; it may be for example, once in a week, once in a year etcetera. So, actually it is a probability of occurrence of any event; it is actually a number 1 by 365, 1 by 7 etcetera; it is actually a number. So, frequency is basically a quantitative index of probability of occurrence. Similarly, severity is the potential loss when any event of that kind occurs. The loss may be expressed in many terms, for example, it may be in terms of financial loss, in terms of loss of human life, in terms of loss of property etcetera.

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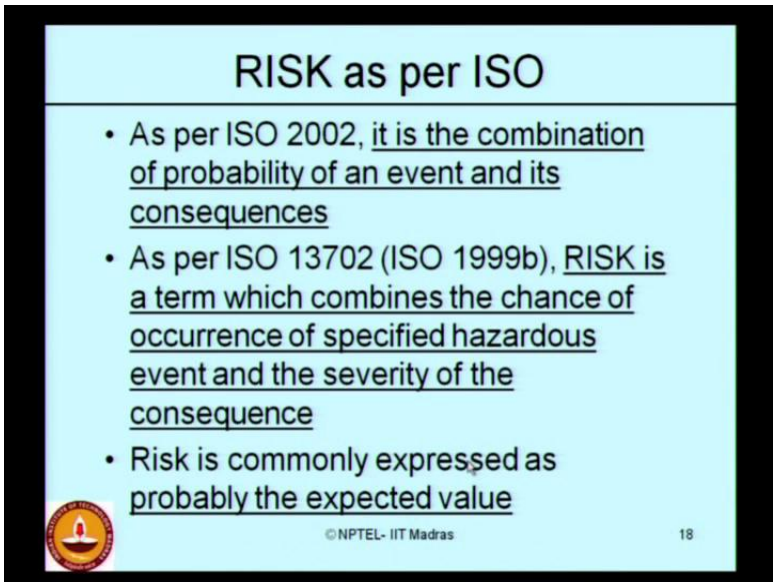


Then obviously, risk definition become highly subjective. Because, for you, risk is defined in terms of financial loss, for the other person, risk may be defined in terms of property damage, for the third person, risk may be defined in terms of human loss. Therefore, is any standard way? Is any standard method of defining risk? Yes. Risk is also defined as per international standard organization as the following. As per ISO 2002, risk is the combination of probability of any event and its consequences. As per ISO 13702 - subsequently ISO 1999b, risk is a term, which combines the chance of occurrence of specific hazard and the severity of the consequence. Generally, risk is commonly expressed as probably the expected value.

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Now, the question comes, if a term there is an accident, if at all I have methodology to define the accident in terms of probable risk, any accident will always result in a loss. Now, the loss can be expressed in terms of human terms, in financial terms, in legal terms. For example, in human terms the loss of life, serious injury, serious illness etcetera. If we considered the loss in financial terms then cost to replace the equipment, cost of shut down or the down time etcetera; if you look at the loss in legal terms it can be assist as claims, insurance, liability etcetera.

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Now, pertaining to oil and gas sector, how do we actually look at risk? Risk in the sector is closely related to loss. So, if I say risk reduction, it means I am talking about loss reduction. If we talk about risk mitigation, then I am going to talk about the prevention of loss or methods to improve loss prevention. Therefore, closely related to risk is loss control; loss control is actually the controlling conditions that can be responsible for loss. Loss control reduces the likelihood of an occurrence or reduces its severity. As we all understand, risk is the product of frequency and occurrence and damage cause to the system. So, the loss control can address the reduction to the likelihood of any occurrence; it can also address the reduction to the severity if at all any such event occurs.

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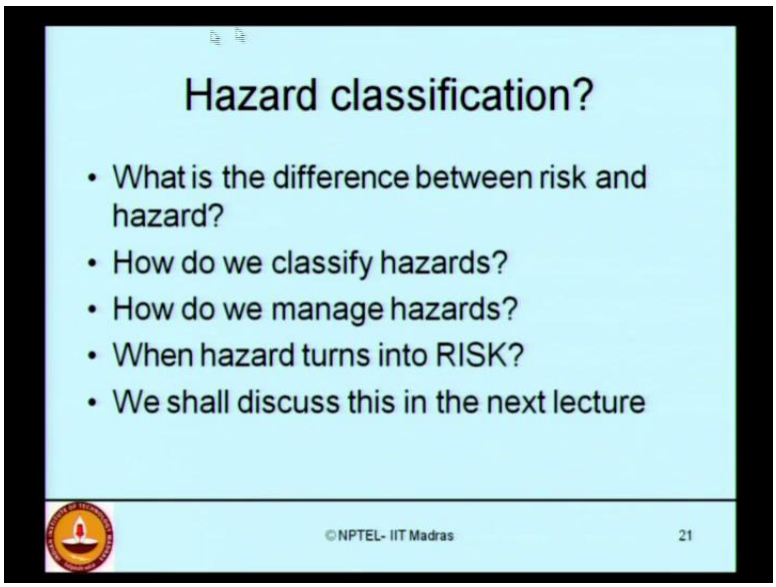


Now comes a question of hazard classification, what is a difference between risk and hazard? That is a very famous and common question which you would like to ask me. How do we classify hazards? How do we manage hazards? When a hazard can turn to a risk and what is actually the difference between a risk and a hazard? All these questions we will try to discuss in the next lecture.

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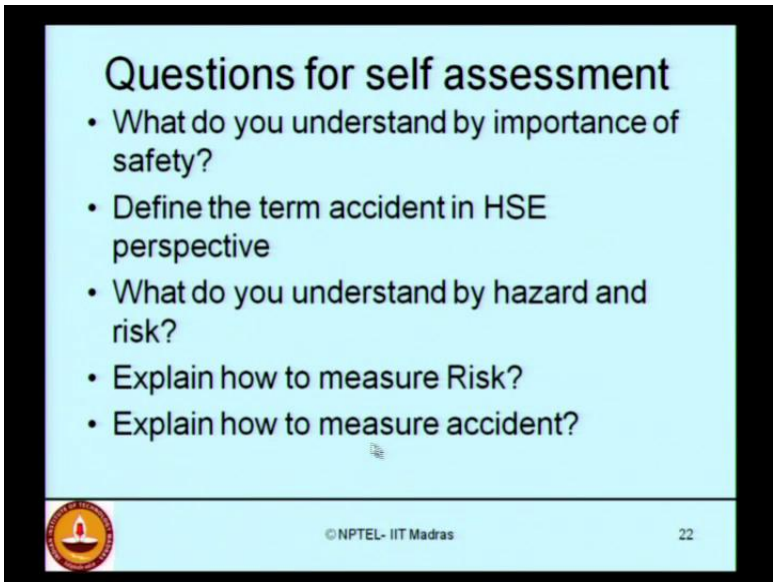


Before we move on to the next lecture of the same module, here I have few questions which I would like to ask you for your own self assessment. These questions are all taken from the presentation what I made in the previous slides. I hope you have followed them closely. If you have followed them closely, if you have an access to the literature which I referred in the previous lectures, let us try to answer the following questions as self assessment.

What do you understand by importance of safety? Why safety actually is considered to be important in HSE perspective? Can you define the term accident in HSE perspective? What do you understand by hazard and risk? Explain how to measure risk? Can we explain how to measure an accident?

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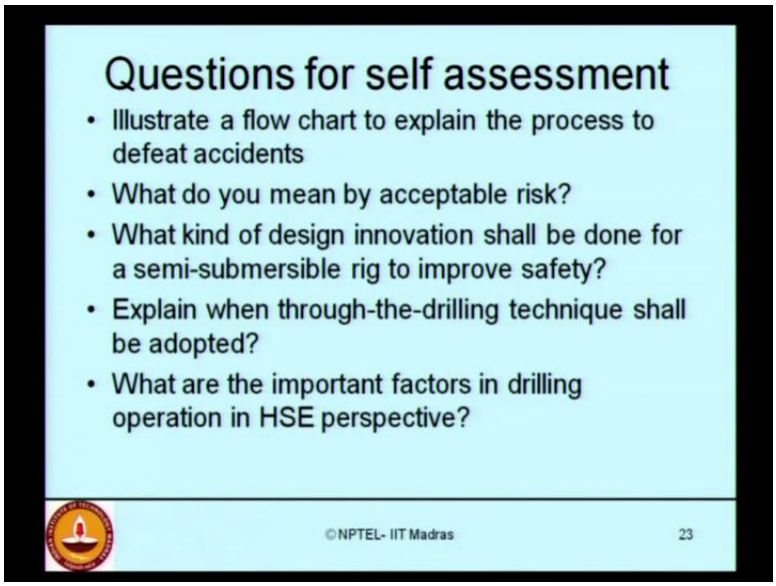


Can we illustrate a flow chart to explain the process to defeat accidents? What do you mean by acceptable risk? What kind of design innovation shall be done for a semi-submersible rig for example, to improve safety? Explain when through-the-drilling technique shall be adopted? All these questions have been frame from the previous presentations made to you, just to recapitulate, what and what best extent you have understood the presented lectures.

In the next class, we are going to discuss about the hazard methods and other issues related to hazard management. Let us also try to understand, what are the important factors in drilling operation in HSE perspective? So, ladies and gentlemen, kindly try to answer the previous questions, which I have asked for you as self assessment before we move on to the next presentation.

So, we have discussed about organizing for safety in this lecture. We discussed about understanding safety; we discussed about lessons from major accidents; we discussed about the hazard groups, then we discussed few case studies which we will again elaborate in module 3. For you to recollect, what are the factors which could lead to such kind of accidents, because risk analysis and management essentially based on such data base.

As I end, we also understand, what do we learn from such incidents. Therefore, how do we define risk, what is a classed definition given by Rowe for risk, and what do we

understand mathematically risk means, how ISO defines risk, what do you understand by loss control, what do we understand by risk in oil and gas sector, how do we classify hazard, what do you understand by the difference between the risk and hazard? All these things, we will discuss in the next lecture.

Thank you.