Health, Safety and Environmental Management in Offshore and Petroleum Engineering

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Module – 02
Operational Safety
Lecture – 05
HSE Lessons

Welcome to the online course on HSE. We are now discussing lectures on module 2. Here we are focusing on operational safety.

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In the last lecture, we discussed about some of the lessons learnt from few accidents we will continue with the same with lecture 5, where we say lessons learnt from HSE practices. Today we will discuss about couple of more accidents and incidents happened in offshore industry and try to gather information as per as safety assurance are considered, or what are those conditions which has been violated I mean unwarrantedly or unknowingly which lead to these incidents or accidents.

Let us say West Vanguard Gas Blowout, it is a very important incident happened on sixth October 1995. Actually this was an accident occurred on semi submersible drilling unit. The name West Vanguard the accident happened, when they were conducting exploratory drilling, luckily it was not a production drilling because semi submersible generally used

for exploratory drilling in the initial happened in Halten Banken area, Norway. Let us quickly see a summary of what had happened, which lead to the accident of West Vanguard.

During drilling interestingly, The drill bit actually entered a thin gas layer which was located about 236 meter below the sea bottom. So, the moment the gas the drill bit entered the gas layer this resulted in causing the influx of gas, this entered into the well boat this is followed by a second influx subsequently, may be after about 30 hours the second influx happened.

The third influx, which subsequently happened, resulted in a gas blow out. So, even you can see the chronology, before a catastrophic instance occurs there are sufficient warning stages which are generated with sufficient time intervals. So, if one can take a preventive measure in the design or by emergency existence methods one could prevent catastrophic damages which could cause such gas blow outs that can be one of the interesting lessons what we can learn, from this accident can be re look the design. So, that when an warning is being generated by the system, what are our secondary plans to either shut down the systems or exit from the system or safeguard the remaining parts of the system.

The next point is very interesting it was analyzed subsequently later that drilling operation was carried out without a blow out preventer.

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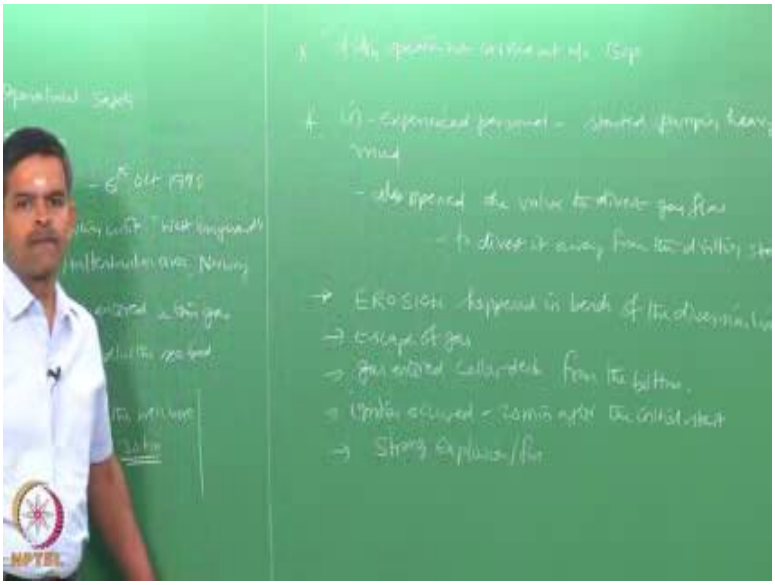

That is very very interesting to be noted in the blow out preventer which is one of the vital component of any drilling stack is not present or was not natively present in this exercise. So, this is a very vital point this requires for a design re visit, this requires for an operational negligence.

The next one is very, very crucial in experienced personnel, where start the pump started. Started pumping heavy mud to stop borrow, they subsequently also opened, the valve to divert the gas flow. The intention was to divert it away from the drill stack, but unfortunately erosion happened in the bends of the valve of that so, called diversion line this resulted in escape of gas. The gas entered the cellar deck from the bottom. Subsequently ignition occurred approximately 20 minutes after the initial start. This lead to a very strong explosion and fire now, to save the crew 2 life boats were launched.

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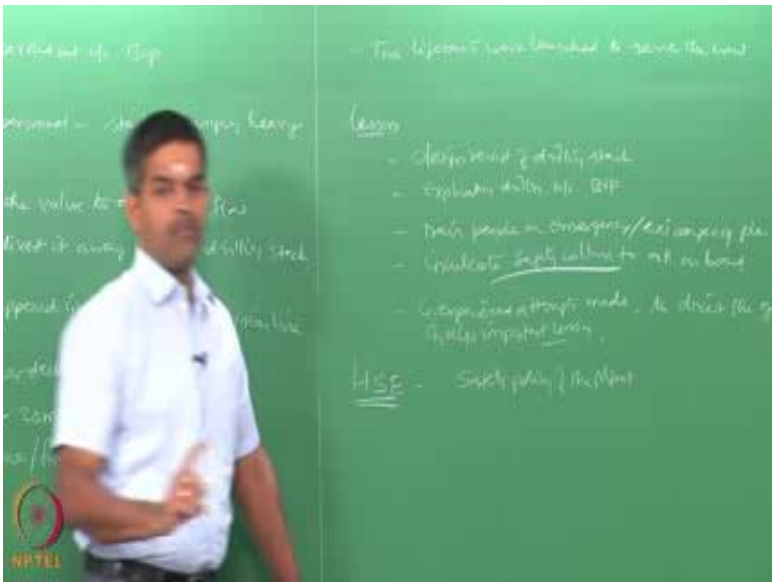

So, we can say some of the lessons, what we could learn by looking at the chronology of the events as we understand design revisit of drilling stack is an important lesson. Do not use even exploratory drilling even exploratory drilling without in important metal component of the drilling stack which is the load preventer, train people on emergency or exigency plan inculcate safety culture to all on board. So, HSE practice is very important not as a training, but as inculcating a culture if you really wanted to avoid accidents of this order which happen very rarely, but still the catastrophic damage or the consequences caused with accident is very severe.

Subsequently one can also say inexperienced attempts made, subsequently after the blow out to divert the gas flow from the drilling stack are also a very important lesson. So, one should look into the diversion lines well ahead in planning and therefore, HSE practices should be implicitly built in the safety policy of the company. So, HSE should not be looked as a diagnosing tool after an accident. HSE should be looked as a preventive and protective measure to avoid even hazards of this order not an accident, ladies and gentlemen if you look at the screen now.

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There is a capture shown on the screen which is giving a schematic view of the west vanguard semi submersible which actually encounters a gas blow out on sixth October 1995, which resulted in a very disastrous explosion on fire.

The next incident which we will discuss now is Ekofisk a riser rupture.

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The riser of a steel Jacket platform Ekofisk alpha rupture due to the fatigue failure on November 1, 1975, the riser of jacket platform rapture due to fatigue failure actually occur due to insufficient protection this splash zone. The riser was not well protected in the splash zone, which actually leads to a very serious corrosion. Actually the leak took place at once at the lower part of the living quarters the leak started at the lower part of the living quarters and then subsequently caused explosion and flame propagation.

So, resulted in explosion and of course, flame dispersion or flame propagation. The duration of the intense flame remain for a very short time very short time the duration was very short. Interestingly the gas flow was immediately shut down. So, lives are protected blast was completely eliminated. Because of the safety practices involved efficient fire fighting system was in place which could save this incident. So, the fire fighting approximately took for about 2 to 3 hours to bring down the event from a very basic level of acceptance.

So, as a result of which the activities taken up by people, only a modest damage was caused in the platform due to fire the most important lesson what we learned from this incident is, important to note that the location of riser, below the living quarters is a bad design.

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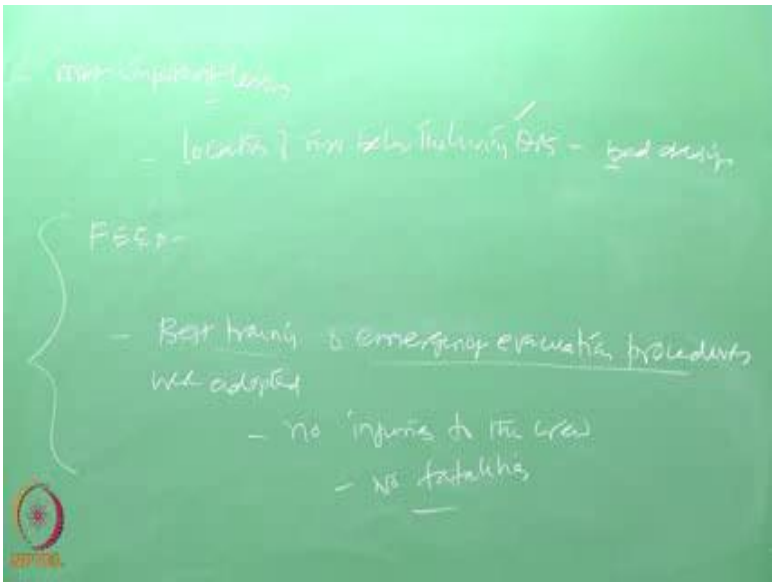

So, when you talk about the front end engineering designing layout of any offshore platforms, be careful that the production risers are not located in the close vicinity of the living quarters.

The second lesson what we could learn, best training and emergency evacuation procedures were an adopted which could save the platform from the blast. So, practically there were no injurious to the crew, there were no injurious to the crew and obsolete no fatalities. So, that is a very interesting lesson we learnt that how training and emergency evacuation planning could save even a catastrophic accident far from occurrence of that. The platform of course, only suffered a limited damage because of fire for a short duration of intensive fire loops.

So, let us ask a question comparing these 2 events, what do we understand and learn from these events.

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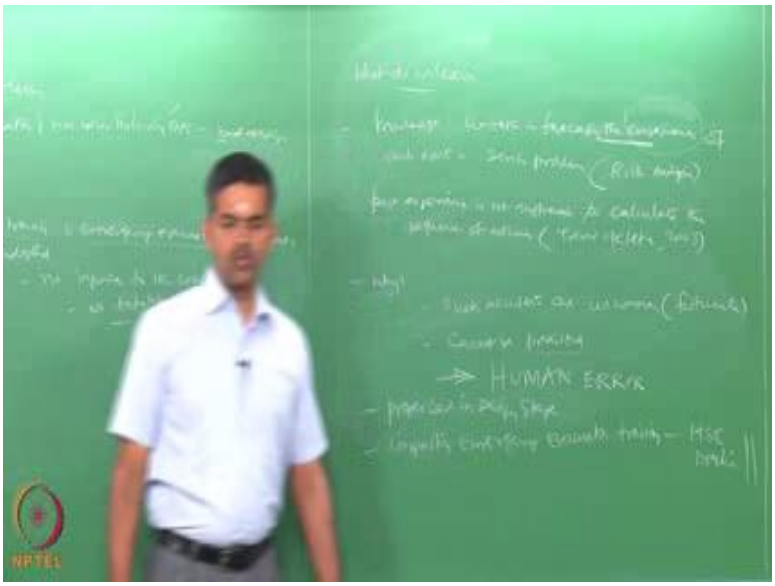

So, what do we learn? One; there is a limitation of knowledge and forecasting the consequence of such events, the knowledge limitation in forecasting the consequences of the event, not the events is a very serious problem. It means people did not and do not pay attention to do proper risk analysis, because risk analysis will always focus not only the frequency of occurrence of such events it also focus on the consequences of such events. The second interesting lesson even though we have got a very good past experience of understanding or diagnosing the reasons for such accidents, this alone is not sufficient to calculate the sequence of outcomes.

So, experience alone will not do very clearly said by Trevor Kletz 2003, the question is why experience alone is not sufficient? Because such accidents are uncommon, this is fortunate the most unfortunate is cannot be predicted. Why? Again the question is can not be why they cannot be predicted why they cannot be forecast because most of them initiate from human negligence or human error, the design error is also a part of human error you could see in many of the instance what we discussed in couple of lectures, none of them failed because of mechanical fault.

It is only because of the human cooperation or human coordination either in the design or in the maintenance or in the shift handovers or inexperience in handling emergency situations resulted in accidents. So, therefore, to avoid any accident of this order especially in oil and gas sector good HSE practice will always recommend very intensive

intelligent and capacity building with educational background to all people on board. So, those accidents can even be avoided at the initial stage itself.

However, the catastrophic consequences in most of the cases would have been avoided by proper care in the design stage itself. So, proper care in the design stage, that is a first important remedial measure which we have to adopt, The second could be imparting emergency evacuation training, which is very much part of the HSE practice should be imparted to all person on board as mandatory. It should not be imparted only once it should be periodically updated may be once in a year or very good practice could be at least once in about 6 months time, we have to continuously update people on emergency evacuation plan and procedures which is adopted which is to be followed in any one of the cases.

Now you could interestingly see any public buildings you go, any important locations you go, you will always see in the beginning of the building or the entrance of the building there will be emergency evacuation plan which will be posted or pasted on walls and painted and there will be a video running as a safety precaution measure that every public enter in the building should be informed well in advance before they enter the building that where are the emergency exit doors, where are the fire exits where are the lift locations where are the stairways in case of emergency what to do and what you should not do.

Similarly, when you go to hotels or stay in hotels, you will see when the back rear side of the door. Emergency evacuation plan will be pasted or painted on the back side of the door. So, every habitat of the door or just staying in the hotel will easily understand in case of emergency what he should do and what he should not do.

So, emergency evacuation is a kind of education which should be given to everybody of course, in oil and gas sector people working on board especially in drilling platforms it is become very mandatory and though it is being followed, but intensification of such trainings with educational support like a just HSE practice courses like this and hands on experience on training of certain emergency evacuation plan in fire fighting etcetera is very, very vital if you really wanted to prevent such accidents which has happened in one of the cases people intelligently diverted and prevented a catastrophic accident except for a minor damage to the platform. So, it all depends upon what level of training you

undergo and how you take it seriously. Therefore, friends please understand HSE practice is not an education it is actually a culture which need to be followed, after understanding this let us redefine slightly with more intelligent way what is risk.

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Now, let us redefine this after understanding. So, many instance lessons learned from the accidents etcetera after experiencing them, virtually let us see this, risk is actually defined as the fatality and damages caused to the human and material which results in a financial barrier or financial loss to the investor. So, friends please understand risk is now redefined in terms of economic terms.

So, please understand risk is not directly related to human life. It of course, encompasses of safety human on board with more focus towards saving or protecting plants and equipments machinery, environment, society which all could lead to a financial barrier to the investor. So, risk is a very large picture, risk is not only all about loss of human life. Therefore, risk involves avoidance of loss and undesirable consequences; risk also involves probability of failure and estimate of loss caused because of failure.

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Please understand failure will be always expressed in probabilistic terms, but the financial loss which you would estimate this based on this should not be a probabilistic term, it should be in definite terms you cannot say probably it will result in a loss of. So, many billion dollars no therefore, there is a very clear cut division between consequences and or the financial loss and the risk analysis.

So, the risk analysis leads to that of risk is actually a product of probability of occurrence or frequency of the event multiplied by the consequences, frequency of the event generally expressed in probability of failure, but the corresponding consequence which will be looked only in economic prospective should not be on probabilistic terms it should be in definite terms. One may ask me a question why we are looking risk associated only with financial or estimate of economic class? That is how risk is redefined we can see here though risk deals with fatality and damage cause to the human, but the focus is if that cause or that results in financial loss to the investor then the risk is very high.

So, therefore, risk is connected not directly to the human life or loss of human life, but it is connected directly only to the economic prospective of the whole system which of course, includes safety of the human being as well. Therefore, risk should always look into the consequences in terms of economic perspective not in terms of loss of machinery etcetera down time etcetera all will converted, should be rather converted in to an

economic prospective in the consequential form, but it should be in probabilistic terms it should be in definite terms. However, failure of events can be in probabilistic terms. So, risk involves probability of failure and of course, estimate a potential loss as well caused because of such failures.

Let us see how international agencies regulatory bodies defined risk? Let us take for example, definition of risk by various levels or agencies in international form.

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Let us say ISO 2002, let us say how ISO international standards organization defines risk. Risk is defined as combination of probability of an event, and it is out come. If you look at ISO 13 7O2 which is subsequently ISO 1999b, risk is defined as probability at which a specific hazard event will occur and the harshness of the event, mathematically risk can be expressed as algebraic sum of I probability of an event and consequence of an event, where I is actually the number of events counted. So, p is a probability of occurrence of accident c is a consequence of course, a number count I depends upon how many events you are considering for estimating the overall risk of the whole plant.

So, there is a very critical observation about this particular expression. Let us call this equation as one equation one has a very critical observation equation one defines risk.

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In a statistical look because probability is involved there, which means the value in practice shall never be discovered, because it looks only in the mathematical manner or the statistical manner, the whole problem but what we are interested in not the statistical look of risk we have to look the value of risk that is why we say HSE practices.

So, we are not bothered about what is the risk of this specific event though we are interested in knowing and we already know the probability of such events and the consequence done the financial loss we are interested in knowing what is the overall value depreciating the property worth or the business worth of oil and gas sector industry as a whole because, we are associating economic index to any such statistical computation, which is a innovative way of looking risk is applicable every stringently to offshore oil and gas industries because friends we all know this is one of the important back bone of economic build up of the nation.

So, we are not very curious to know what is the statistical outcome of any risk of an event we are ultimately interested to know the value. So, I must convert risk some way or the other in a financial form for example, if you say in an accident one fifty people died though it is it is undesirable it is unwarranted it is not good to know that, so many people in a crew expired because of some accident, but ultimately as an investor as an offshore engineer as a risk analyst, we must be also able to convert the so called death of one fifty people in a crew to an equivalent financial loss because it is all about the

investment of the whole business.

We have already said why offshore business is unique in the world because of it is high nature of investment, because of complexity in the design, because of it is uniqueness, in the whole exercise no such parallel industry can compete with offshore oil and gas sector because of a simple reason; whatever steps you follow right from analysis, planning, construction design and execution explosion decommissioning, all are completely innovative case specific, site specific and known to an experienced only to a small sector people in the world as an experience professional in oil and gas sector.

So, we the group of oil and gas sector should be more concerned, more concerned I am I am underlining the statement to be more concerned towards the economic index of risk. So, my risk analysis should ultimately lead to me towards the economic perspective of risk estimates. Though I will do QRA though I will do hazard, I will be able to extract I should be able to present to my management to my public to my stakeholders. What is the economic perspective of the whole risk involved in the industry? So, financing risk is a very interesting term which now integrates oil business with that of risk. So, one may be interesting in asking me a curious question; how one can finance risk? If he know there is risk involved who, will finance it every insurance company in generally does this you having a car you hold the license, you are heal and healthy, but still you insure because there could an accident and therefore, your risk is financed in terms of insurance, where you pay premium every year this is common in every country in the world.

Similarly, you are hear and healthy for about 40-45 years, you retire at the age of 60-65, you earn salary you are having every efficiency to build up your life style in a comfortable manner and no human being wishes to desire; I mean die as early as possible therefore, you are hear and healthy you take care of your health, but still you do health insurance, because there is always a risk because of the external atmospheric conditions or the environmental conditions, which may lead you to a catastrophic and fatal end therefore, insure your life.

So, that your followers your dependents will get benefit of the finance. Therefore, in common day to day life also, like driving a car or living, breathing, working, etcetera. Everywhere you see risk is directly connected to financial perspective. So, why not to in

oil and gas industry because, oil and gas industry business is a very huge investment block, one should always convert one should have an attempt to convert at least the risk involved in this industry to equivalent financial terms.

So, financing risk is a thought process happened in early eighties; where we looked into the mathematical model in a next how it can be easily done and how interestingly one can really find out what is the extent of risk involved in terms of economic perspective in a process industry by taking an example, we will do that and we will have a conversion of mathematical model which helps me to understand risk in economic perspective.

Though this equation gives me risk only in statistical perspective, the one is interested mathematically, but as an offshore engineer as an oil and gas sector professional, I do not stop here I want to go one step ahead and try to see what is the economic influence, if risk is involved in my industry because I have to I am answerable to my stakeholder, I am answerable to my investors, I am answerable to my management, above all I am answerable to my own profession am I doing it risk safe business. Why because oil exploration is a natural invention in the process, when intervening with the nature you must ensure safety, otherwise nature will become furious and show an after effect on the intervention.

So, ladies gentleman in this lecture we tried to understand some of the important lessons of accidents, we converted the whole observation in terms of mathematical findings and physical observations, we understood the chronological events we looked into the plus and minus of these incidents and we ultimately redefined risk based on our understanding so far and we connected, we bridged risk to an economic perspective as we just now saw from the equation 1.

Thank you very much.