NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Health, Safety & Environmental Management in Offshore and Petroleum engineering (HSE)

Module 1
Safety assurance and assessment
Lecture 1
Introduction to Safety

Welcome ladies and gentleman this is an online course on health, safety and environmental management in offshore and petroleum engineering very briefly called as HSE this is one of the core course which generally every safety engineer make to pursue under the braise of NPTEL IIT Madras this course offered free of cost to all the viewers. So you take the benefit of understanding the safety engineering in terms of its original perspective.

I am Prof. Srinivasan Chandrasekaran from IIT Madras who will be offering this course for you for the whole semester. This course actually runs in 4 modules you must have seen it in the website of NPTEL IIT Madras, we are now discussing the module 1 lectures. Module 1 is about safety assurance and assessment; we talk about lecture 1 where we focus about introduction to safety.

The fundamental question asked by every safety engineer is what do you mean by safety, generally the term safety refers to personal safety or safety of a human being whereas in oil and gas industries safety is a term not only related to personal safety, but also the safety of the equipments, plans and machineries, safety to investment of money, returns, finance there are many aspects of safety which is addressed in oil and gas industries.

The main reason being all of these segments as it was now said are important. So safety is not only personal safety but there are many facets to safety. Let us try to understand what safety means with perspective to oil and gas industries, let us quickly see what are the objectives of this course.

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The objective essentially is to provide an overview of safety and environmental issues in offshore and petroleum industries. We also talk about detail understanding of methods for safety assessment and assurance, we will also speak about how to identify and assess hazards in any stages of operation in a process industry like oil and gas industries. One must easily understand how to quantify and manage hazards as applicable to oil and gas industries it is very important that one should know how to quantify qualitative issues like hazard management.

I will come to that in detail in the next class, because when you talk about safety you are always contemplating what is called risk. So there are quantitative and qualitative assessments of risk, so when you talk about hazards, you know it is a qualitative measurement, but we must know how to quantify the qualitative measurements of risk involved in oil and gas industries.

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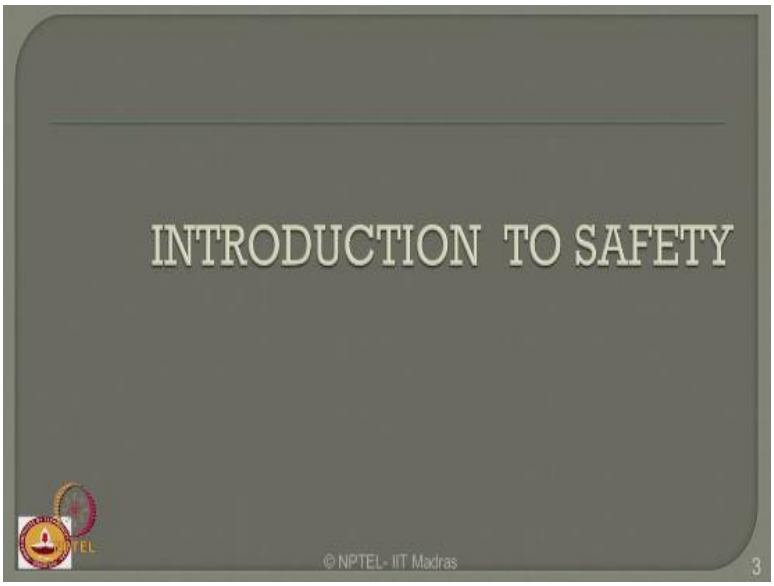

Let us ladies and gentleman now introduce safety as a fundamental perspective applied to oil and gas industries.

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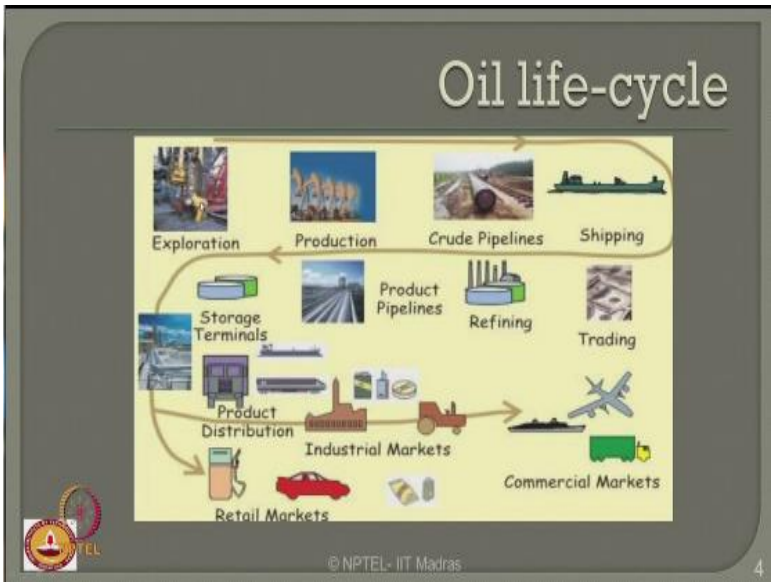

This is a very interesting oil and life cycle what you see here, the oil life cycle starts essentially from exploration, it goes to production because once you identify the wells where there is potential of oil to be explore then you start producing oil. After you produce oil you have obviously transport this oil from the drilling well site to that of the place where this oil can be processed.

So obviously one will look at some crude oil pipelines, the moment I say crude oil you should be able to understand that whatever oil we reproduce here in the well in offshore is not or cannot be directly used without processing. So this oil request to be processed, on the other hand ladies and gentleman once it processes oil a majority of the explored oil becomes a waste which is disposed of back to the sea which causes lot of environmental problems which we will discuss in a separate module.

So crude oil pipelines are to be laid which will transport the crude from the explode site or the produced site to that of the process plans. To do this either you can deploy pipelines or you can transport the crude oil in barrels from the produced site to that of the process site using ships,

you can also create alternatively a large storage terminals where the explode crude oil can be stored and subsequently transported.

Once the crude oil is treated onshore or offshore in general then these crude oil should be disposed up to various places what we call as product pipelines, these pipelines carries material from the processing plans to refining plans, from the refinery plans it goes for public trading, what we call as product distribution, it goes to different sectors like shipping, railway, highway, cars, public and passenger and private vehicles, industrial markets etc, including civil aviation fuel and for shipping industry.

So there are commercial markets, there are retail markets, so the entire history of safety starts from the exploration site to that of the disbursal or useable market. Of course, in oil and gas industries all segments indicated here are related to the industry where we talk about safety, you can always speak about safety during exploration during the production stage what we call process safety management.

We can also talk about safety in terms of design where we talk about pipelines design, you can talk about safety in transport, maybe in shipping, maybe in commercial markets, maybe in passenger vehicles, maybe in road, bullets etc. So safety or health safety can be addressed in different segments of this oil cycle which is very important for all of us to understand. So in this lecture or in this entire course we will talk about HSE perspective in different segments of these, what we discussed here in this slide.

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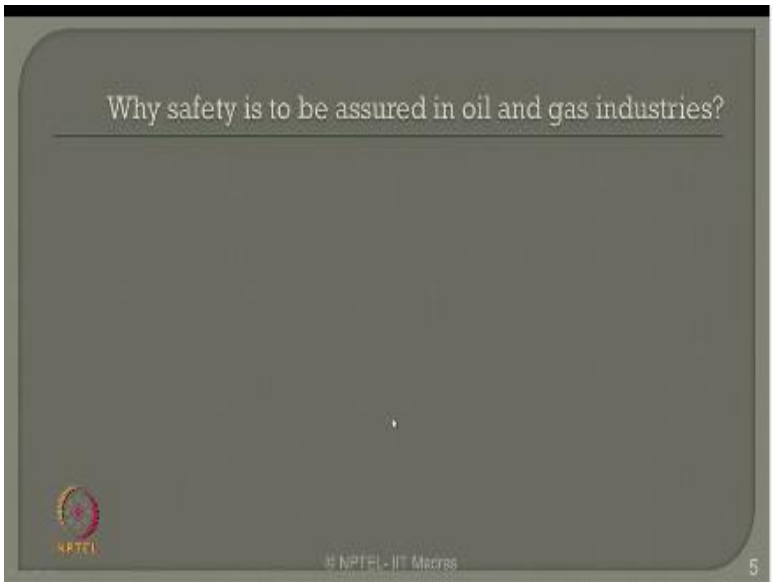

Now one can ask a fundamental question why safety is to be assured in oil and gas industries? Now every segment of a process industry are manufacturing industry demands and emphasizes safety, to our safety as become an inherent law of any manufacturing unit where human or personal safety is to be as a time. Now let us ask this question once again, why safety is important, why it is to be assured in oil and gas industries?

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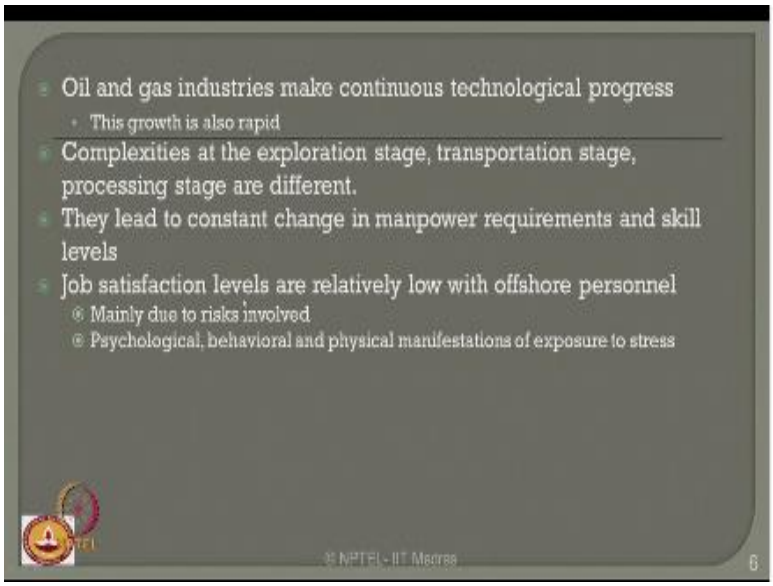

Oil and gas industries make continuous technological progress, we all know this because of a fundamental reason oil was available at shallow depths about 100 years back now oil and gas are available at ultra deep and deep water depths. Obviously the technology used for extracting or exploring oil and gas from the shallow water is completely different from the tuff being used for deep and ultra deep waters.

So there is a continuous technological process or the progress made by these industries and obviously the growth of this industry to be proud to say so is very rapid. It means this industry is foreseeing a very rapid state of growth in every year to come. How does this affects safety? As I said just now there are different complexities involved at the exploration stage, transportation stage, and also the processing stage in a given oil sector.

Interestingly, the complexity is involved in these stages or entirely different. The safety as applied to exploration stage can be a different perspective compared the tough transportation and compared the tough processing stage as well. Oil and gas industries of course lead to a constant change in manpower requirements because the plants and equipments mixture is used for drilling in the present scenario or different from the tuff, the concepts used about 50 years back.

So there has been a constant technological progress being made with this industry which demands a constant change in manpower requirement and of course, the corresponding skill level of this manpower is also constantly updated. More interestingly since the skilled manpower available in the sector is highly limited, this skilled manpower should ultimately have what is called a job satisfaction.

Either job satisfaction is not maintained for this skill man level or skill levels then, obviously this will affect the production rate of oil and gas industries. So job satisfaction levels are relatively low unfortunately with of a personal, there are many reasons for this let us quickly see what are those two reasons which are very important, which draws down the satisfaction level in particular with offshore safety personal.

Mainly it is due to the risks involved, if the person working and in offshore platform is not assured that the platform is safe enough for his life, obviously he will not be giving a good produced as an outcome of his efficient duty. There are other psychological behavioral and physical manifestations.

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Which this man or this person undergoes which results in lot of stress growth in his mind set. So safety has to be addressed as a predominant factor in oil and gas industries, if you really wanted to maintain a good technological progress of this industry which is unfortunately are fortunately at a very rapid rate. The common factor is only to consider economic objectives that is generally what every oil and gas industry look at.

Though it is unfortunate but most of the cases it is a fact, you look only safety when it is challenged, on the other hand you look at safety of a personal only when he dies. So common practice is generally to consider safety only under economic objectives.

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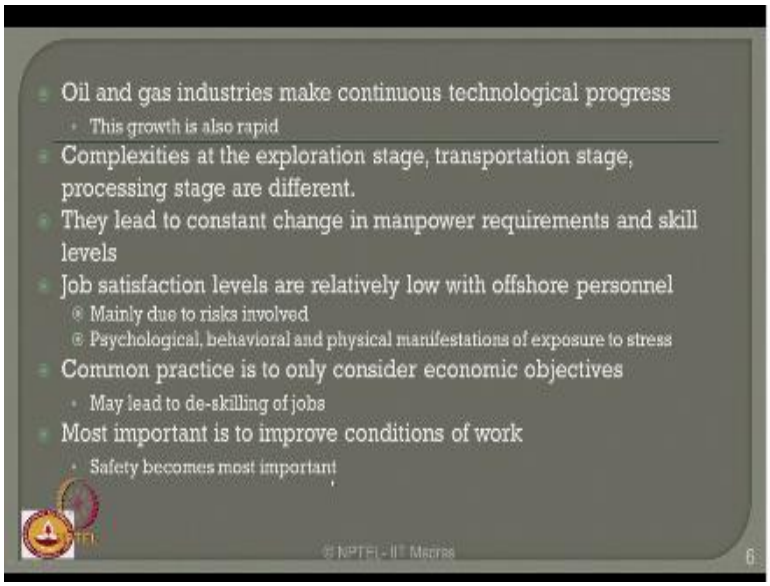

But if you start focusing only on this friend then it is unfortunate to know it may lead to de-skilling of jobs, you will not find a skilled manpower available continuously for a offshore production. The most important factor is now to improve the conditions of work at making it comfortable. So therefore, considering all the above factors one can realize that safety becomes most important in oil and gas industries.

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It is very interesting for us to know that Ayn Rand said a creative man is motivated by desire to achieve not by the desire to beat others. There is an Irish poet Butler Yeats, William Butler Yeats says "Do not wait to strike till the iron is hot; but make it hot by striking." So it is very interesting that oil and gas industries do not wait for an infinite period of exploration, exploration rate has to be on the higher demand.

Therefore, the technological update of the progress has got to be continuously maintained, but this will lead to unfortunately lot of physical hazards and new unperfected technologies because you are trying new technologies to rapidly expand your production which may not be completely perfect for a given scenario those technological updates which are continuously and not completely tested may lead to lot of physical hazards which will lead to a fear of compromising safety that is very important.

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Generally when you start developing a new technology safety should be an inherent part of this development with a general practice, but unfortunately in oil and gas industries you do not have enough time to test these kind of unperfected technologies before they are tested for safety, because there are very many involved reasons why these technologies actually fake. Therefore, health in HSE not only refers to personal but occupational health, improved living conditions, psycho-social factors, and hygiene all of them put together is what we call as health in HSE.

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One can ask me a question why oil and gas industry is so much bothering about personal safety. Why one has to bother so much about safety? The record of accidents in oil and gas industries are only few that is very advantages, it is meritorious, one is glad to know this.

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Because the reasons are either they are not reported, because they are a near-miss event or unfortunately and intestinally they are not documented. Ladies and gentlemen please understand the oil and gas industries are one of the industries where risk is constantly involved in every production stage. But the record of accidents may not be there because of these two reasons, it does not mean that access do not occur in oil and gas industries.

Therefore, one cannot say I will not bother about safety so much, now one can ask me another question indirectly when the accidents are not reported.

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Or not happened very frequently this result to a simple phenomenon called lower frequency of occurrence. Though these accidents are of a very low frequency of occurrence, on the other hand they do not occur very frequently may be once in a year, may be once in two years. But that does not save you from worries, because even though they occur once in two years.

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The consequences caused by these accidents are phenomenally high. Now one can ask me a question, how the consequence and the frequency are linked? Now the product of these two ladies and gentlemen is what we call as risk. Now one can have a doubt in the mind how risk and safety are connected? We are talking about safety why risk is addressed here, ladies and gentlemen it is very important to know risk and safety are contemporary.

Safety is a qualitative statement, risk can be quantified, so any subjected statement like safety cannot be mathematically model. But any quantitative statement like risk can be mathematically model say if we can risk model I can always address safety indirectly.

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Therefore, risk assessment becomes now important because risk is nothing but the product of frequency of occurrence multiplied by the consequences of these occurrences. So though the frequency can be very low, but the consequences are phenomenally high therefore the risk level involved in offshore industry is phenomenally high. Since the risk involvement is very high one must bother about safety in oil and gas industries.

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Interestingly let us talk about the parallel problem like road accidents because of not wearing a car belt. Now you must know many countries, many legislations have made wearing up seat belt compulsory. Look at the design it can always be another new pattern of design where do not allow your counterpart to talk.

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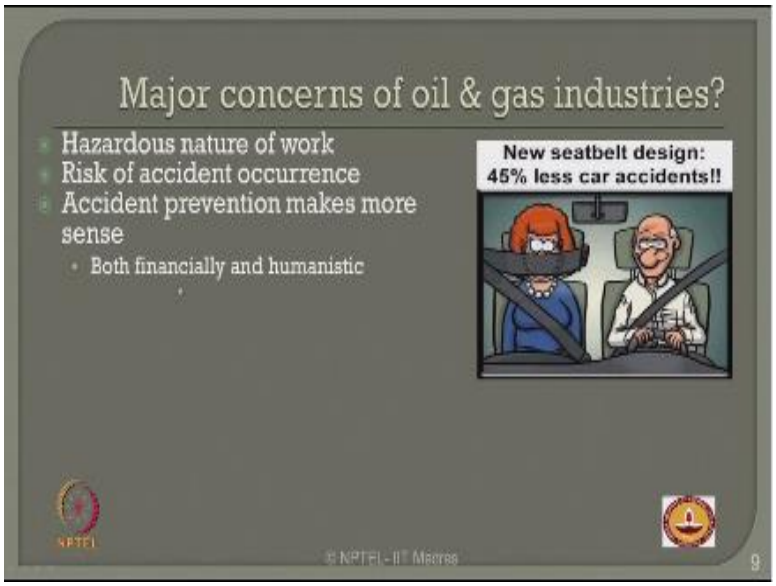

Therefore, you can drive safely, but is it a good design of car belt. The question is what are the major concerns of oil and gas industries, where I can come with a new design which can be safe. Now we all understand the nature of work involved in exploration, in transportation etc, is hazardous in nature. There are risk involved in every stage of this production the risk of accident occurrence is always high.

The accident prevention makes more sense, therefore instead of addressing accident not to occur let us try to see what are those reasons or what are those factors which can cause accidents which can be prevented. So once we talk about factors we must always understand these factors can be both financial and humanistic. So I am not talking about only personal safety I am also talking about the investment, the economic safety as well of the industry. So one must take proactive measures which are very important.

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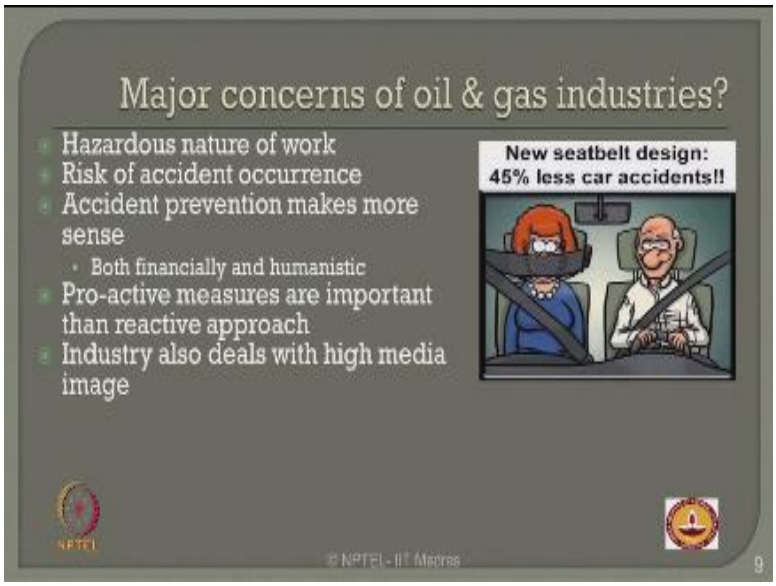

Compared to the reactive approach, generally safety in other process industries is considered as an emergent out from the past accident scenarios, this is addressed as a reactive approach, whereas an oil and gas industry safety should be your pro-active approach. You must also understand that every oil and gas industry deals with a very high media image, either important that the company maintains its image in the public domain.

To maintain the image in the public domain the company asked to also say that there are very few accidents or there are no fatal accidents happened successfully in the last consecutive years was a image of the industry in the public media because very important. There are two reasons for this one the company can market the product well, number two the company can attract highly skilled professionals for improving their production rapidly.

Oil and gas industries also have a reputation of self regulation is very important interesting to understand compared to all other process industries oil and gas industries have a very stringent self regulation on safety perspectives. Recently many unmanned platforms for smaller oil fields are being developed in North Sea therefore, safety should become inherent product of the design

and development. So that accidents do not occur even if they occur the consequence of these accidents are as minimum as possible.

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Let us ask a question now, if oil and gas industry view safety program very seriously. Let us quickly say what do we understand by review of safety. There are two basic regimes available when you want to review safety one is what we call as goal setting regime.

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The other one is what we call as rule based regimes. Now let us quickly understand what is the difference between a goal setting regime and rule based regime. Goal setting regime makes the duty holder responsible and he will assess the risk. Management will not intervene directly. The duty holder needs to demonstrate the understanding of the risk himself he has to be careful, so it is the owns is not individual.

It keeps space to the new knowledge and development because the trainer or the skilled professional will be updated about all risk factors involved in the equipments and plants.

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Therefore, there is a constant new knowledge being fed to this personal and that makes it a goal setting regime. This gives lot of opportunity for the work force to engage in the larger sector, whereas consider the rule based regime where the management takes all the responsibility and imposes safety regulations on it is employees. So they set rule or set of rules to be framed and they need to be followed meticulously. The focus is only on the compliance not on the outcome that is very unfortunate that is a fact.

So you form a set of rules and made the employees to follow the rules so that they are strictly in compared the rules but you do not bother what to do outcome of a wrong implementation of these rules. It is very interesting to also know that the responds to this kind of rule based regime is much slower comparison to the goal setting regime because here the owns is on the individual whereas here the owns is on the management. Therefore, there is no emphasis on continuous improvement.

Once a set of rules are formed you do not change the rules very often you keep on applying it and keep on following it. Therefore it does not come out more workforce involvement whereas here the workforce engagement is much larger. So they are converging at one point and they

diverge by enlarge in the latest stages. For example, this has no continuous improvement chance whereas this has a constant update of the knowledge.

So one can now understand which program will be selective and applicable to your industry, the industry has a meticulous practice of imposing regulations continuously, then one can use rule based regimes. If the industry promotes the personal skill and personal safety culture in the work environment then the industry can focus on goal setting regimes. So the choice of these two regimes is with the industry whereas the success of the two regimes depends on both the industry or the management and the personal involved in the management.

So the success of safety program is very important if the management only follows it cannot be successful.

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It is got to be realized by the workforce to make it successful, so personal safety also involves educating a person about safety is not only educating the management to follow safety that is why HSE course becomes very important for all safety personal to understand what safety means. There are very simple steps to understand safety better.

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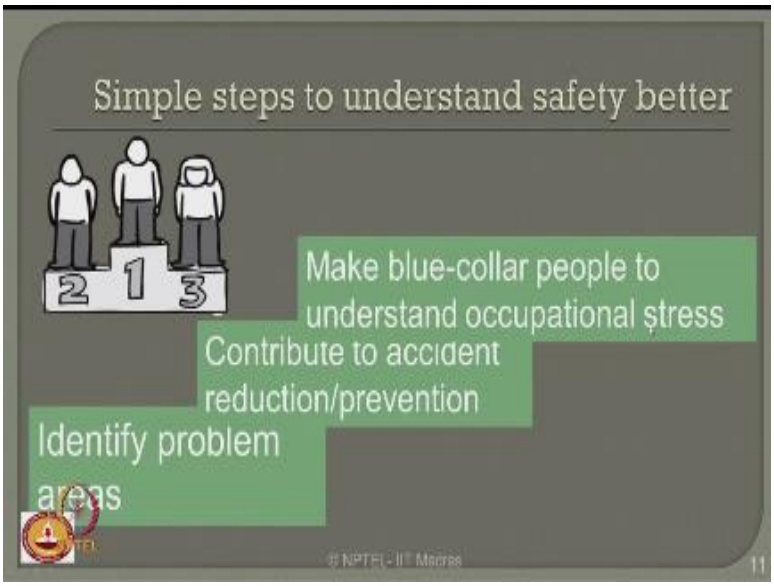

Let us say first identify the problem areas, then contribute to the accident which can result in either reduction or complete prevention, more importantly make the blue-collar people to understand the occupational stress. So do not try to isolate the management from the workforce, make the management to understand what is occupational stress the workforce undergoes.

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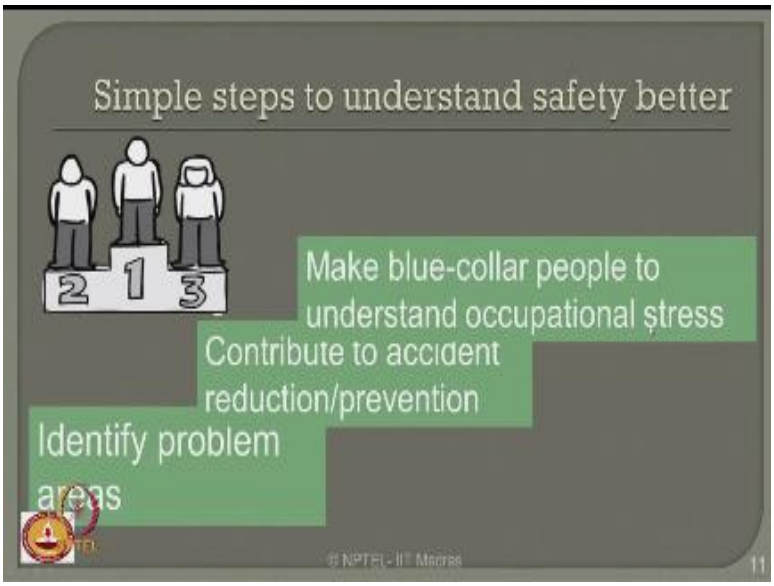

On the platform, so the safety is personally felt and experienced not only the person onboard but also the person on the management. So it is a three tire or three step for success of our process.

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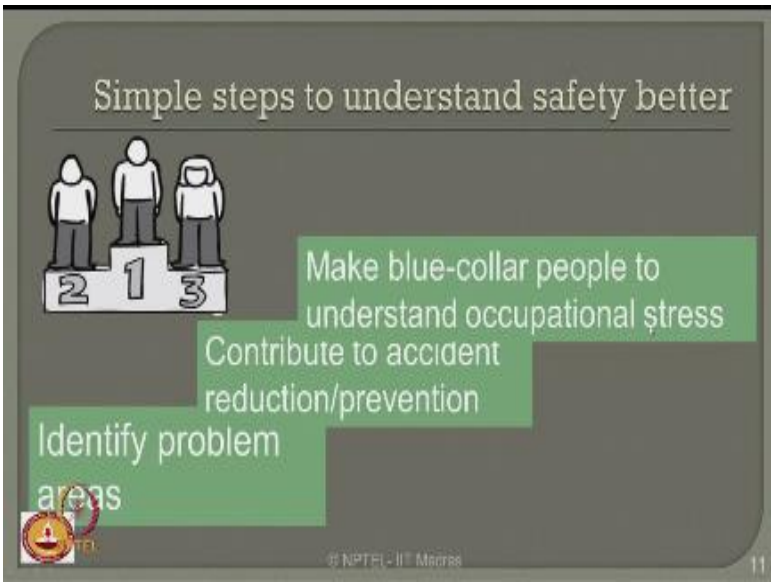

There are simple steps to understand safety better.

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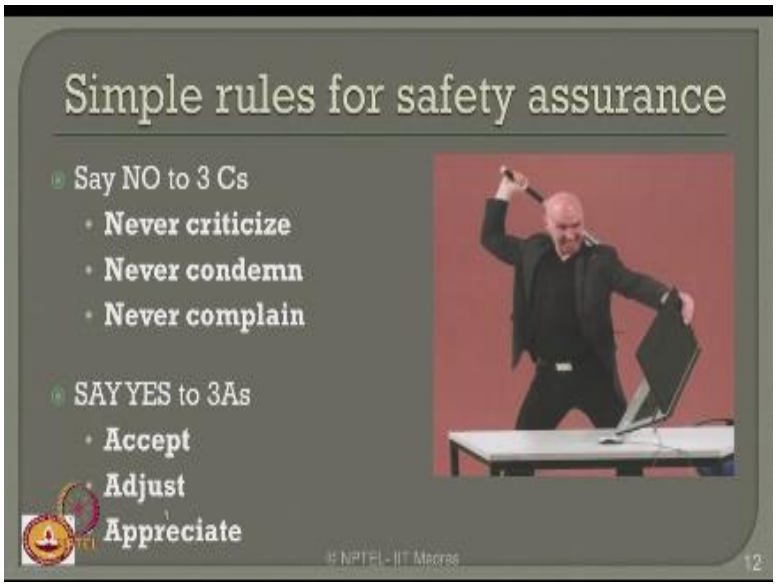

Let us frame some basic rules for safety assurance, there are simple rules say NO to 3 Cs never criticize, never condemn, and never complain. Say YES to 3As always accept, always adjust, and always appreciate.

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Rule 2, objects in the mirror are closer than they appear it is a constant statement what you see in every mirror autumn optimal vehicle whereas let us re-modify the statement going as industry, problems are smaller than they appear, when you begin to face them actually.

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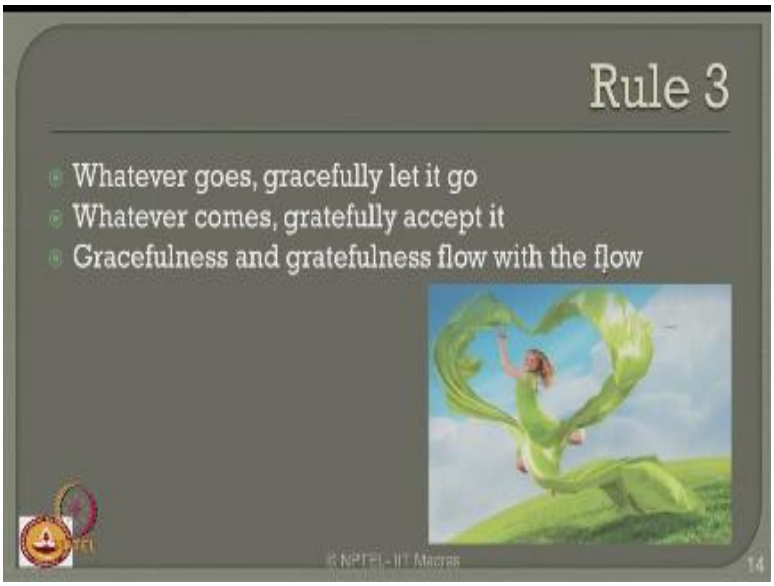

Rule 3, whatever goes, gracefully let it go, whatever comes, gratefully accept it, gracefulness and gratefulness floe with the flow, do not take intervene.

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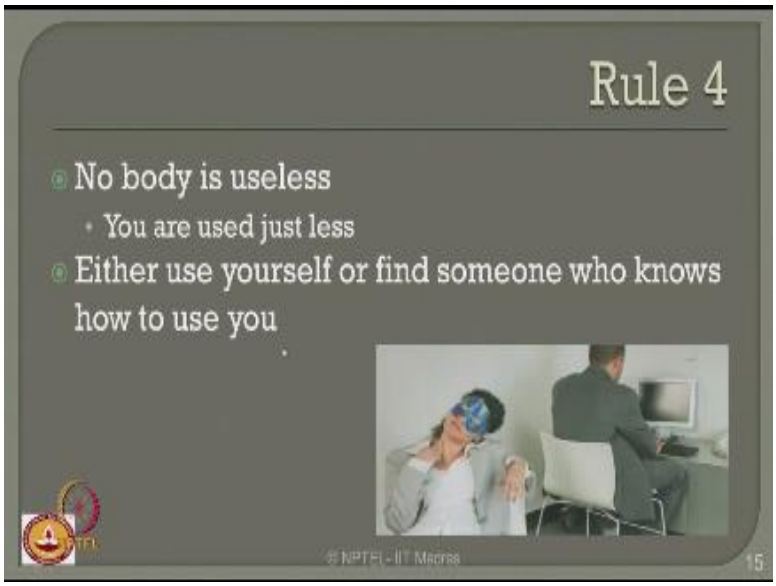

Rule 4, nobody is useless, my dear ladies and gentleman you are used just less so make it in mind and try to contribute, either use yourself or find someone who knows how to use you properly.

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Rule 5, always hold yourself to standards higher than the expectations, in everything, take an extra mile, write the contribute individual even it maybe a percentile of the progress of the industry.

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Rule 6, take a diversion cannot stop a journey, the statement always enables to continue the journey but the journey does not stop with the statement, same way temporary setbacks in oil and gas production should never alter your focus, so be encouraged keep going, and keep on going.

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Rule 7, some use a judgment to find fault in everything that is not correct, but use a judgment appreciate everything, this will always encourage people working onboard. Rule 8, safety is more about leaving petty things petty do not try to magnify the mistakes.

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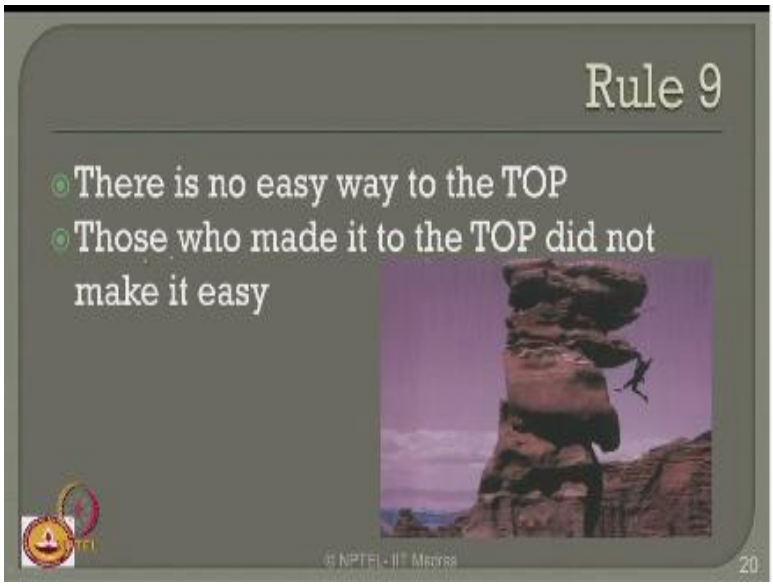

Rule 9, there is no easy way to the top, everybody is struggle to reach the top, please keep in mind the industry has to grow through a struggled to path only. Therefore, please understand those who made it to the top did not make it easy.

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Most important Rule number 10, never look back decisions with regrets, never hesitate to make new decisions, if old ones were not correctly made. So always intervene in the rule based regime of safety regulations in the industry keep on updating, keep on correcting them.

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So that the best target is achieved as early as possible in 100% success.

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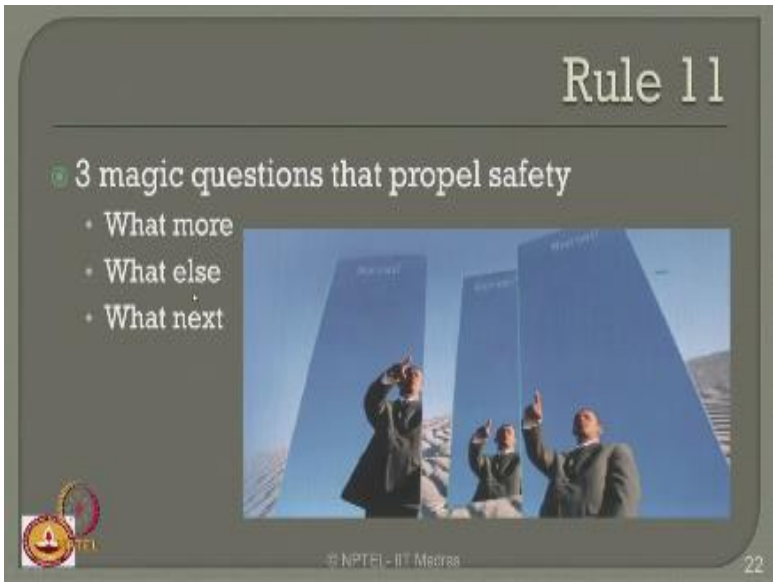

Rule 11, three magic questions that always propel safety what more, what else, and what next. So we have to keep in mind keep on asking this questions so every time safety is always updated on the working platform.

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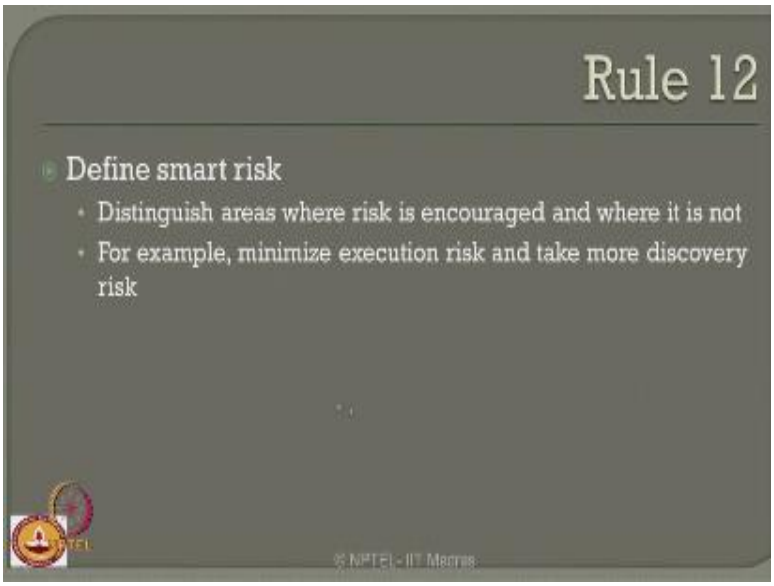

Rule 12, define smart risk, try to distinguish areas where risk is encouraged and where it is not. For example, minimize execution risk take more discovery risk. So one can always encourage risk also to make more discovery risk but execute with them, execute them with a great care.

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Innovation of course requires lot of tolerance for risk taking and learning from failure. So risk-averse culture will not result in progress, ladies and gentlemen if you do not take risk there is no success, but risk is contemplate to safety. So I am saying otherwise take safety as a challenge and implement it successfully that is important because oil and gas industry requires the faces risk every day of the production.

I am proud to say to be assure with this industry this is the only industry in the world which takes risk as bread and butter of everyday job that is very important with all that the number of accidents on the declining side with this industry, so this industry look safety as a very important target, there is no doubt about it. So my contribution to this lectures are only to these people in these lecture that safety is inculcate to them not as a literature, not as a language, not as a subject. But it is a practice you have to adore this, feel this and implemented as far as possible, you should always try to define.

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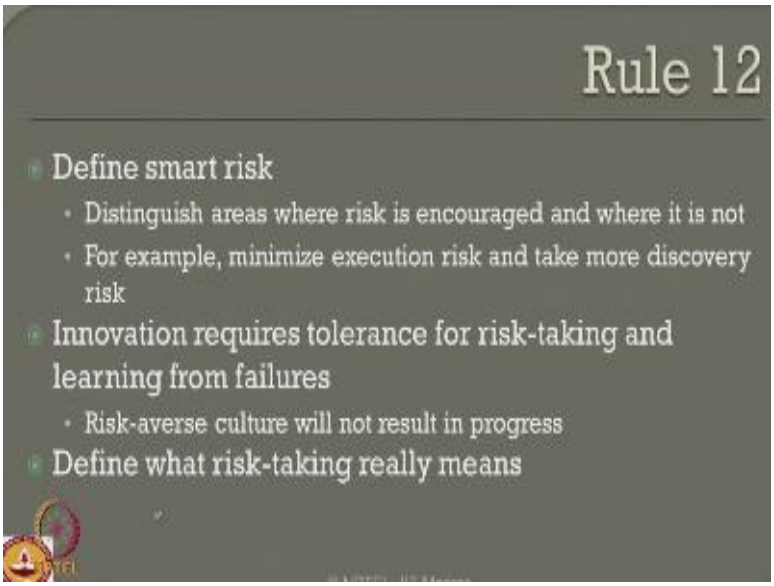

What risk taking really means, you cannot always attempt risk in expletory stage and cost safety challenge to the company.

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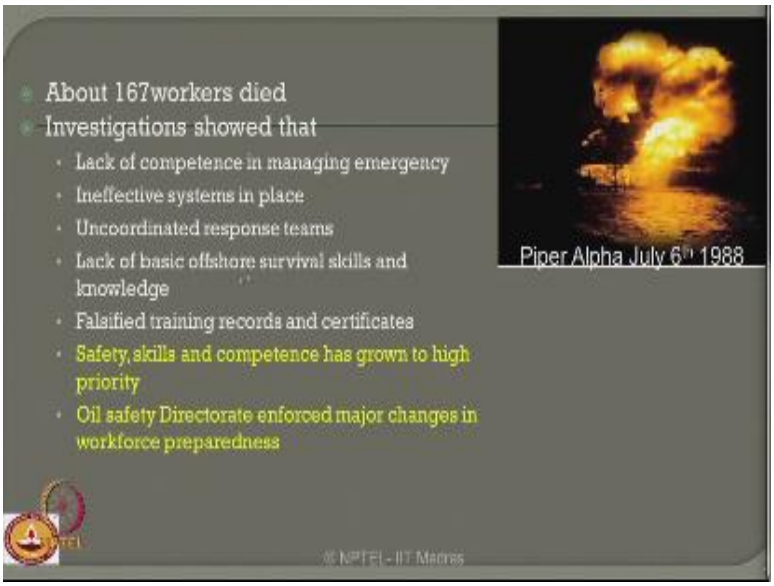

When you ask a question of define accidents occur in oil and gas industry one generally remembers piper Alpha incident occurred in July 6th, 1988 interesting with the stat shows that about 167 workers died in this accident. The investigations report show very clearly that lack of competence in managing emergency, ineffective systems were in place, uncoordinated response team were deployed, there has been lack of basic offshore survival skills and knowledge with the people working on board.

Falsified training records are produced and certificates are issued, safety, skills, and competence has grown to high priority as a result of this accident. Oil safety directorate has started enforcing major changes in the workforce preparedness after this incident occurred. So there are good lessons learn from this incident there are bad lessons learn from incident, so lack of competent and managing emergency and uncoordinated response can be considered as one of the two most important reasons why this accident resulted in fettle end of 167 people.

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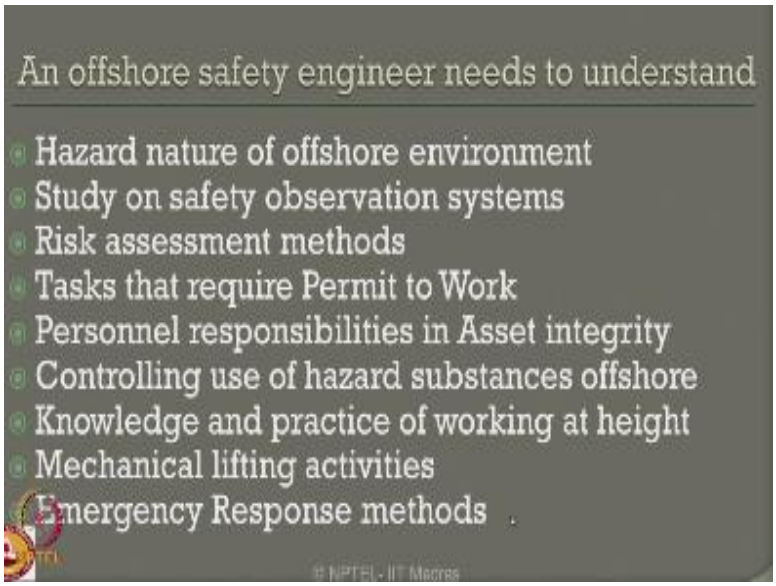

Therefore, an offshore safety engineer needs to understand the following. Hazard nature of offshore environment should be understood thoroughly, he has to understand the safety observation systems, he must do a detail studies on safety observations systems, he must undergo thoroughly the mathematical methods available for risk assessment, he must take the tasks that require permit to work only personal responsibilities in asset integrity should be understood thoroughly by the working personal.

He must considered in full as one of the important item of controlling use of hazard substances offshore because hazard substances used offshore can cause catastrophic accidents which has been reported in the literature, knowledge and practice of working at height is very important, mechanical lifting devises, their understanding, the limitations, and the serviceability requirements are to be thoroughly understood.

Emergency response methods should be clearly understood and should be practiced in reality by the person working onboard.

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There are many benefits derived by these kind of safety standards implemented. What are the employers benefits, there is an improved safety, there is an improve competency, there is improved efficiency in production, and there is a overall production to environment, what the employer gives. Employees benefits are he gets good and health environment, his personal safety is assured, good payback incentives because the company is making good profit out of him there is a good production.

Improved work culture because it is safe and assure and therefore he then develops a good coordination because he is overall and by enlarge happy.

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So this lecture has summarized importantly why safety is necessary, what are the different rules of safety, how safety can be practiced, what are golden rules to practice safety in oil and gas industries, and more interestingly what do the benefits derived with the practice safety from the employers perspective and from the employees perspective. I hope you have followed the lecture nicely whatever questions you have please post them in NPTEL studio so that we will try to answer them offline, thank you very much and bye.

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