NPTEL

NPTEL ONLINE CERTIFICATION COURSE

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

Summary

Friends we are now discussing the last summary lecture on health safety and environmental management in offshore and petroleum engineering which is an online course at IIT Madras under the braces of NPTEL in this lecture we are going to look at.

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The summary of what we are stow far studied in the entire course of the entire semester the objectives of the set course which has been set in the beginning let us quickly revisit them and see have you fulfilled all the objectives what we committed to start when we started the first lecture of this course.

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We wanted to understand overview of safety and various environmental issues that are related exclusively to offshore and petroleum industries in particular and in general any process industry I think in module 1 and module 3 and of course module 4 we discussed about various environmental issues which are related to let say safety concerns in any production industry or process industry we have taken classical examples and made you to understand.

How safety can be easily implemented at the design stage maintenance stage planning execution decommissioning etcetera in offshore and petroleum industries. We had certainly attempted to give you have a fine overview of safety implementation and various issues that are on environmental management related to safety especially on aging installations in offshore and petroleum industries.

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The second objective what we wanted to emphasize through this course is to provide a detailed understanding of mathematical methods of safety assessment and assurance we discussed two methods in detail qualitative risk analysis methods and quantitative risk analysis methods I can give a very classical example of one of them qualitative we discussed about hazop studies and hazid studies we applied them to couple of good examples we also showed how an hazop report can be prepared for an existing petroleum industry in terms of LPG filling station.

We also demonstrated this using a very classical example through software so we had given a very good overview on qualitative risk assessment methods in detail, we have also discussed about quantitative risk assessments financing risk etc probability estimates classical example solve in process industries. We had discussed with different methods and implementation schemes of safety implementation program and safety assurance methods that can be practiced in oil and gas industries in particular.

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The third objective what we wanted to understand in detail more vertical is to assess hazards in any stage of operation we classified as ours in different stages of operation in oil and gas industries we gave you different overview of different kinds of hazards that are overseen in kind of any production industry nevertheless applicable to oil and gas industry the last objective what we wanted is to quantify and manage hazards in terms of hazop management.

We discussed about mechanical estimates like FMEA FMECA also in detail with classical examples applied to oil and gas industries we discussed one interesting example of FMEA applied to a newly developed production platform at IATM which is patented to IIT Madras where we talked about offshore Triceratops etcetera.

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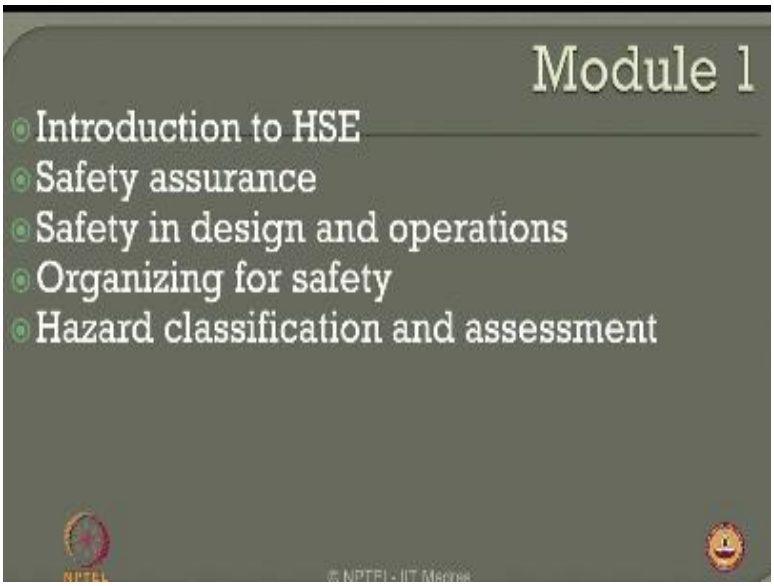

If you look at the characterization of objectives indifferent modules of this course we all agree that this course was separated and divided in four modules in module one we discussed about introduction to HSE safety assurance schemes and methods safety in design and operation at various stages applicable to offshore and petroleum industries we also talked about in detail how to organize for safety very interestingly in this module.

We spoke about hazard classification and assessment hazop worksheet we also prepared a process Instrumentation diagram applied to oil and gas industry problem as an LPG station we made you to write an hazop report and we also showed you how hazop report recommendations can implement very easily the financial assessments or financial status of a given situation we also highlighted how loss is connected to safety in oil and gas industries.

What is the economic concerns of implementing safety and of course in the number al of alarm how are they embrace din and what are different rules and regulations which are to be mandatorily followed in process industries and in oil industries in particular there we said classical example of us are classification we also explained you how to prepare hazards report.

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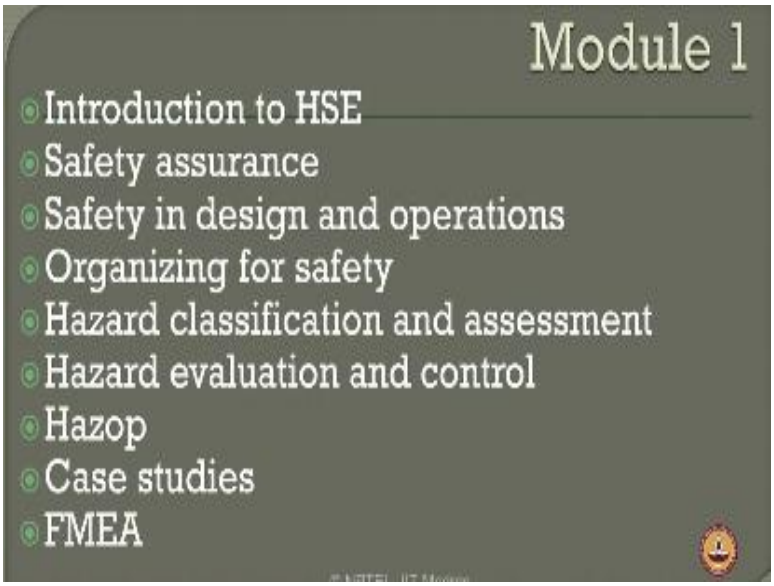

So we also explained and presented various hazard evaluation methods and how to control them in the design stage in the planning stage itself and of course very much during operation and maintenance stages as well hazop is one important backbone of process industry to maintain or implement or ensure safety during its operation hazop reports are valued for third-party audit and hazop reports become a legal document for safety reviewing techniques and method implemented in Aleph industries it is a mandate by in many international coddle regulations as far as oil gas industries are concern.

We also described and explained you couple of case studies how we can implement risk and Hazop evaluation methods and control techniques in during case studies and of course we had explained dedicated lectures on FMEA failure mode and effects analysis where we had shown you what are the different failure modes which are very difficult to identify but however by data inspection and experimental modeling methods in external investigations how they can be easily ascertained.

We also told you only assisted you how to prepare a risk priority number which is helpful in assessing risk in an envisage new kind of problem which can also be helpful in ranking risk quantitatively in a given system. So we helped you through some case studies.

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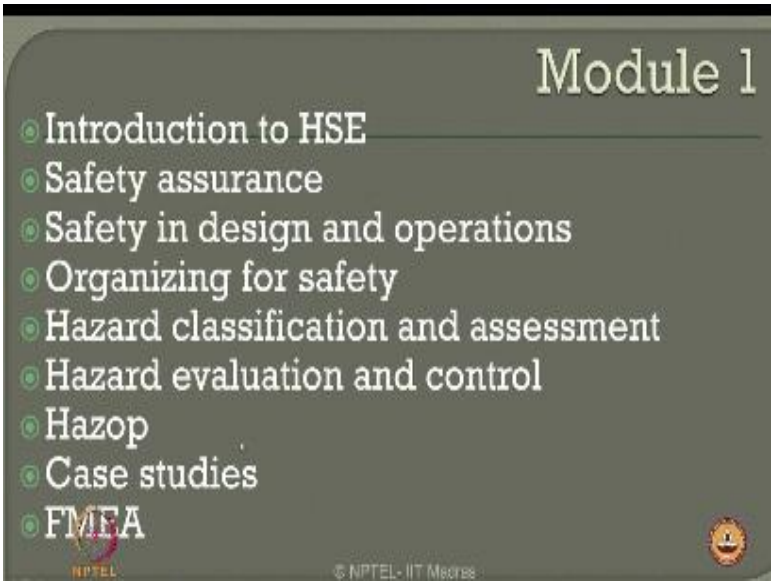

How FMEA can be computed we also showed you how FMEA can be done for a newly developed design platform like offshore Triceratops from stage by stage till experimental evaluation.

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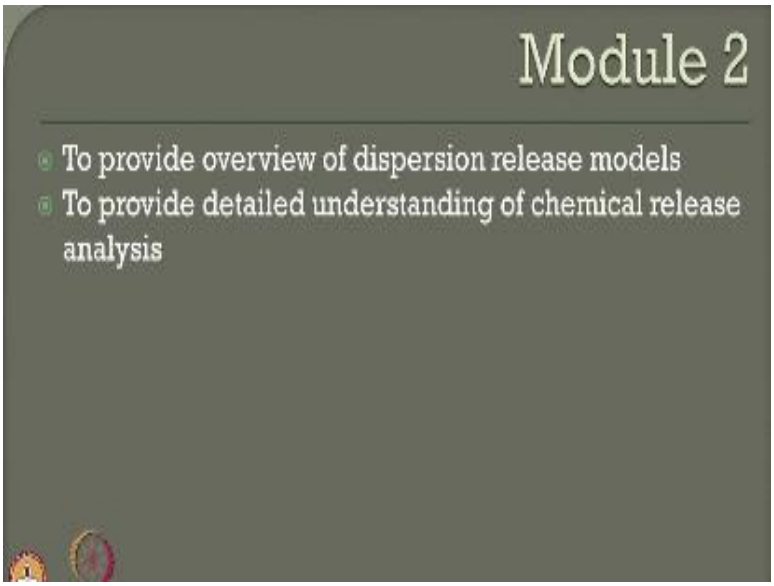

Of course in module two we talked about over view of dispersion release models we talked about atmospheric pollution we talked about chemical releases toxic chemical releases in environment we had provided you detailed understanding of chemical risk analysis a release analysis where we said we can prepare what is called chemical exposure index ultimately when chemical is being released in atmosphere we have to work out what is called the minimum hazards distance beyond which the public should be placed for implementing or ensuring societal safety.

We also said what are those emergency response planning guidelines whereas ERPG levels of different chemical I hope you have understood this chemical release models very clearly using the classical dough CI method as explained in the problem, we have solved couple of examples and exercises various tutorials were modulated on this segment for you to promote detail understanding on chemical release analysis and risk models.

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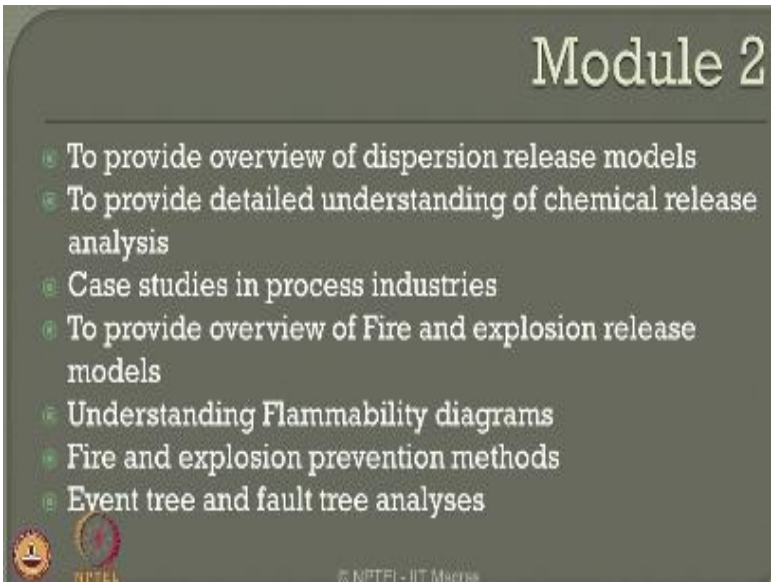

We also showed you chemical release analysis as a case studies in process industry especially in LPG gas industry to provide overview of fire and explosion release model was one of the main objective of this module we discussed about the fire and explosion release models we explain you how to prepare a flammability diagram how to use Flame the diagram for fire control hazards.

We have also said for different chemicals of hydrocarbons how can you draw a flammability diagram we also said what are the different methods available in controlling fire and explosion in oil gas industries essentially using flammability diagram and other techniques parallel available we have explained you how to draw a flammability diagram step by step we have also experienced certain examples in for example methane was drawn in the class here as a flammability diagram we have understood this.

We have also discussed in detail various methods of calculating the fire and explosion and we have also discussed how fire and explosion can be prevented at the design stage itself we have also clearly explained you a classical example of a nuclear reactor failure which has happened one of the countries in the world where design operation safety maintenance and education on

safety has protected the plant and the country as a priority in terms of HSE applicable to nuclear industries.

We are given classical examples on how to prepare even tree analysis and fault tree analysis how probability risk can be calculated for a given system using FTA and ETA we have solved classical examples you also showed you an applied example of this on Triceratops as an exercise problem in the given lecture.

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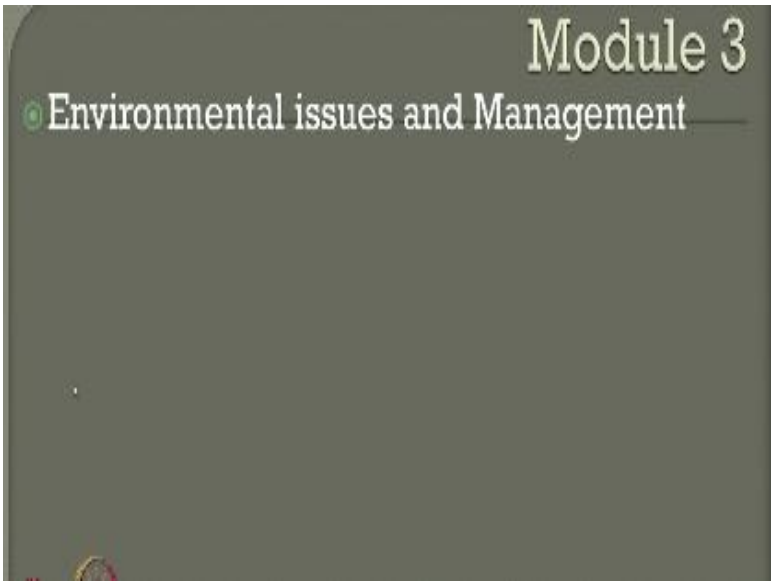

In module 3 we focused on environmental issues and management we discussed various issues which are very precarious as far as environmental concerns are raised by oil and gas exploration we have also seen how the continental shelf is being completely drifted because of the exploration happening recent times even in the shale gas exploration in the arctic areas we have also seen what are those anomaly issues related to oil spill how they can be modeled how you can protect or prevent oil spill spread in an open sea environment.

What are those various resolution issues which are related to normal management how they can be implemented what are the risks and difficulties in implementing environmental management

policies and guidelines how these policies can be adapted what is called international regulation where are the international versions available who will frame this simulations and how oil and gas industries get adapted to this kind of international understanding.

What are problems related to territorial boundaries of oil exploration how one can men over them what are the difficulties in your management issues as modeling as well as finance management in terms of oil gas industries.

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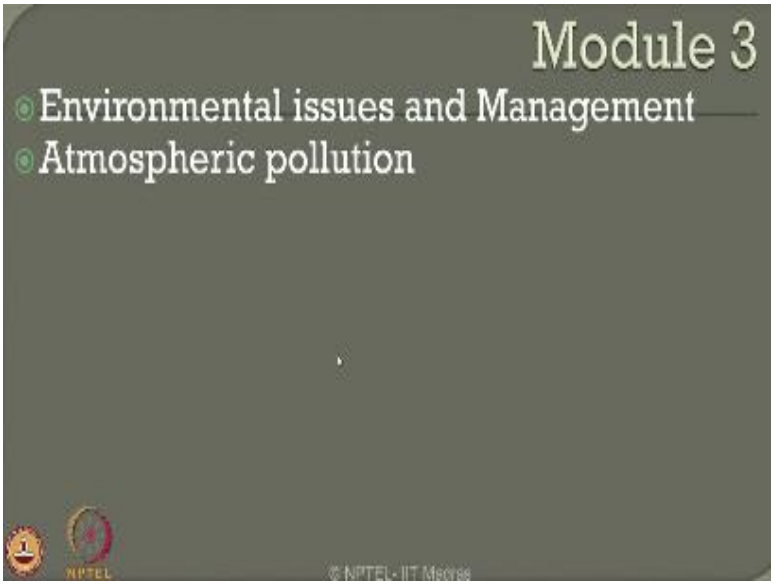

Then subsequently in this module we discussed about instantaneous release and continuous release models which are Klum and puff release models we had shown you different kinds of mathematical arguments and expressions and empirical relationships which are helpful in estimating them in this we also expressed you what are the different stability class like Pasqual stability class how they can be used and what is advantage of combining the stability class of day and night weather with that wind velocity in humidity and temperature.

What are those factors influencing the spread of atmospheric pollution as a result of chemical release or toxic release in environment by a process industry in general and in particular and oil gas industry or any process industry. We have shown new different atmospheric pollution model.

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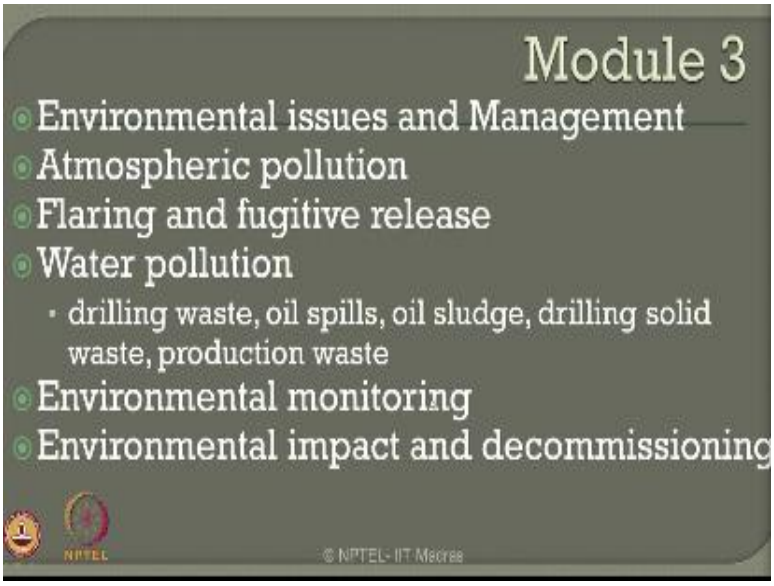

Then we also talked about flaring and fugitive release models in detail in this module we also talked about what are those various factors which causes water pollution because of those arising from drilling waste, oil spill, oil sludge, drilling solid waste, and production of produced waters what are those problems arising from them what are thus chemical contaminants present in these drilling waste.

How they can be harmful the marine biota how they can be controlled in terms of spreading further and how they can be in the first place prevented by having intelligent design systems in terms of water based drilling mud etc in terms of avoiding or reducing water pollution that arise exclusively from drilling operations.

We also talked about schemes that are very popular internationally talk about environmental monitoring issues how environmental monitoring is indirectly done by controlling or by

measuring the response of algae in species on polluted waters how they can be used to control or implement legislate lee rules on oil and gas companies how environmental monitoring can be a very successful method to improvise and practice and improve safety techniques during drilling and production facilities.

More importantly friends we talked about what are those impacts on the environment caused by oil gas industry though it is a bothering issue but however they are very important especially when the aging platforms are getting decommission what will be those special issues which can arise from aging platforms how a nominal impact can be managed first of all they can be modeled how they can be managed.

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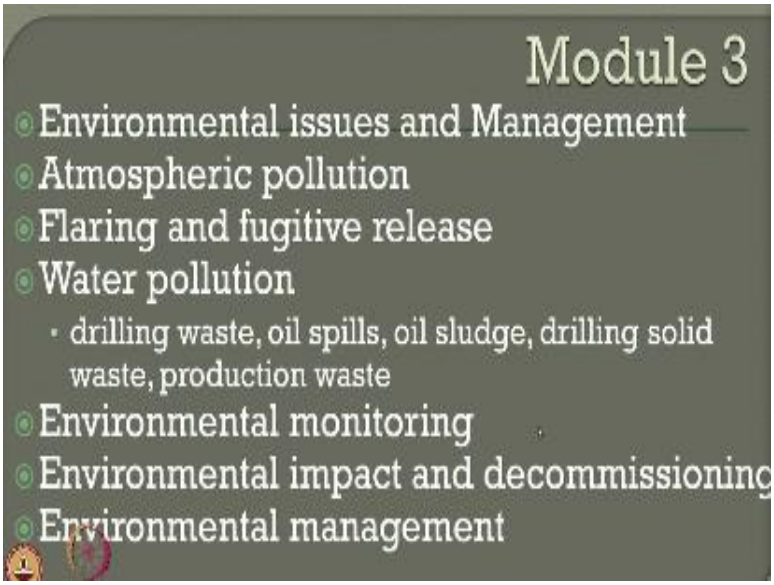

Therefore issues related to environmental monitoring and management are completely studied and explained and understood in module three.

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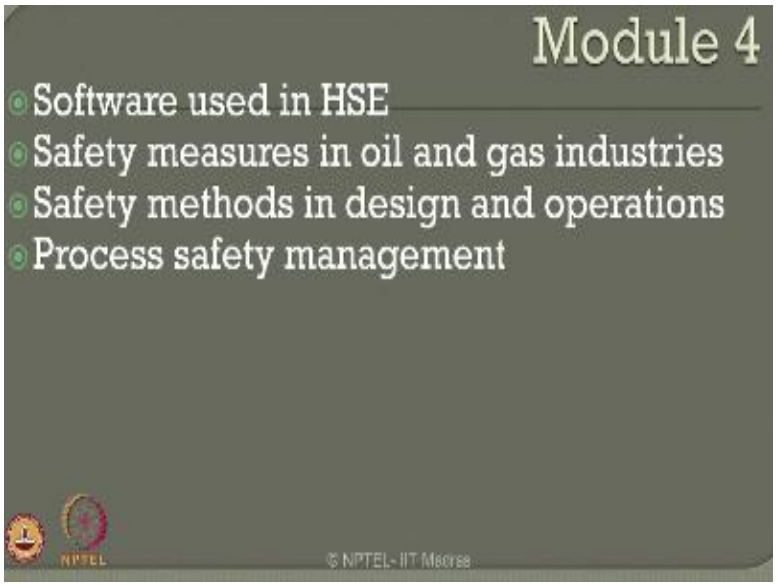

In the last module in module 4 where we are currently working at we talked about exclusive list of software used in HSE I am glad to give you a hands-on operation on one of the interesting software step by step which is being used in one of my laboratories for conducting research in safety. So this is the fastest software developed by D&B I made you comfortable to follow different modules available in the software.

And I showed a very live example on how this can be used to do risk analysis in a given problem very interestingly there are various varieties of software where you can use for applications in different sectors in oil gas industries we have discussed them in detail we have also talked about various safety measures in oil gas industries which are very important indifferent stages we have classified the safety measures in different levels.

We have understood them we talked about different safety methods that can be implemented and practiced in design stage itself and of course in operation stages for both structurally and mechanically for different equipments plans and layout we talked about in detail process safety management what are those factors issued what is hot work permit how you can inculcate safety culture in a process industry.

What are those issues related to violation of safety culture why safety cannot be imparted except it can be only trained and practiced how safety can be made to understand and realize that it is a good way of successful business in terms of oil gas industries production we have talked about them.

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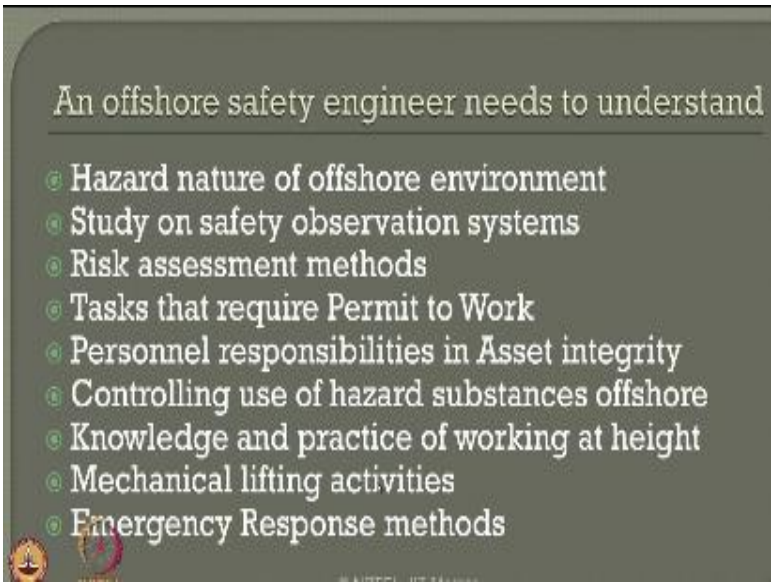

Now we will quickly see interesting questions as a summary lecture for this entire course the fundamental question which I want to reiterate is what would a safety engineer need to understand if he is working in offshore industry a safety engineer need to understand various hazardous nature of offshore environment in general which has been highlighted in this course, he must undergo a detailed study on safety observation systems.

If they are how are they been implemented what are the various limitations of variety of safety observation systems present in the design stage how to periodically maintain them how to update them how to record them as in the hazop reports etc, what are various discusses methods qualitatively and quantitatively which a safety engineer must understand if he has got to practice in offshore safety systems.

May have also talked about what are various tasks that require to be performed before issue permit to work especially hot permits etcetera, personal responsibilities in terms of asset integrity is one of the key factor which ensures asset integrity management as well as safety therefore the economical interest of the platform is completely protected and safety is implemented and practice most successfully in oil gas industries.

One need to also understand what are the various methods which you can control hazard substances of show by way of inventory control you should have a very good knowledge and practice working at heights because offshore accidents in terms of collision drop of objects or very serious concerns in terms of platform safety violations in offshore production systems, mechanical lifting devices always pose challenges and problems.

When they work out in hostile environment one need to understand them most importantly emergency response guidelines need to be understood and followed and various methods need to be devised to practice ARPG as well as option industries are concerned.

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Ladies and gentlemen this curve has been already discussed and we want to reiterate how to manage HSE performance please understand this curve shows me very interestingly if you are not focusing on safety then the prevention cost in terms of safety implementation will be very minimum in the beginning however it will keep on exponentially rising as the structures get aged off.

Essentially if you look at the failure cost initially the failure cost can be very high and can be brought very low when you keep on implementing unnecessarily safety issues because of even primitive issues, so the total cost what is spent in a given system usually should be some of these two so one can be always effectively saying that the total cost can be sustained at a specific minimum level at for example in this case.

The point be provided you pay attention to preventive maintenance and of course avoid catastrophic failures if you really wanted to maintain without increasing the total cost as the aging structures go away from x_2 to x_3 one should be able to control at the point B the total cost can be controlled and it is NBCA in literature that it can be controlled within a brace of plus minus fifty percent of the total budget.

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These photographs show various incidences accidents happen in process industries which is caused devastation they came seen a fire explosion release models they have seen figurative releases they can be always seen as plump and plume and puff release model experimental etc.

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So what we learn from these incidents and accidents are.

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They should not reoccur they give us very interesting lessons.

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We will be able to understand how they can be avoided.

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And why they should be avoided.

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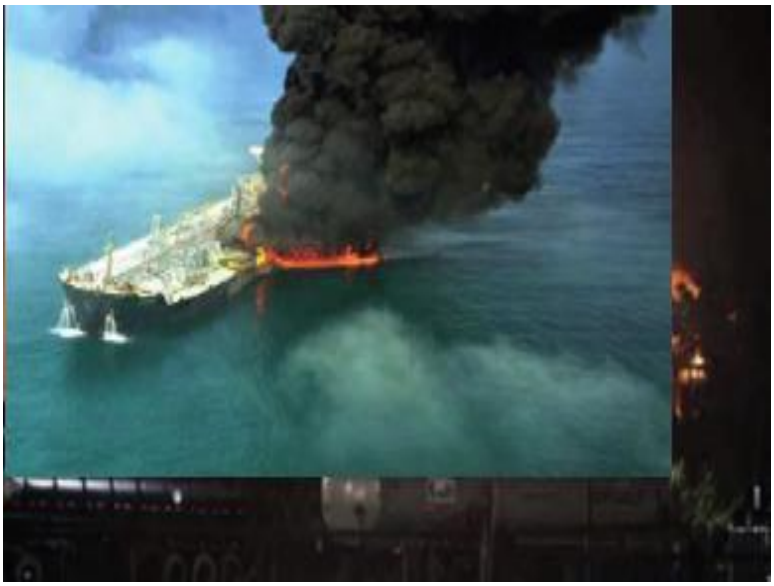

Because it is interesting.

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That successful management will understand that profit is nothing but the revenue minus cost implementation towards safety correction measures.

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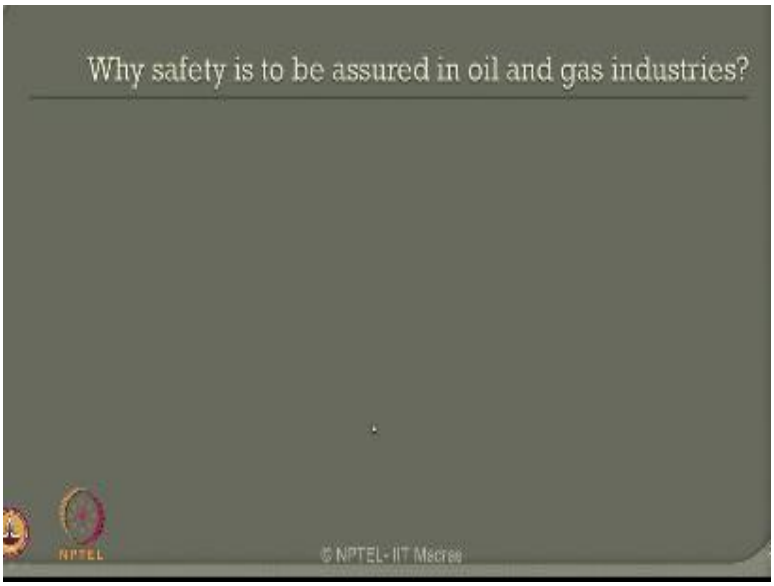

Therefore let us again ask a question and leave a file in final note to the audience why safety is to be assured in oil and gas industries it is a very interesting question why at all safety more important in oil gas industries.

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Friends let us reiterate oil and gas industries make continuous technological progress we should be proud about it this is one of the industry which makes a continuous technological update because of the demand from the production industries and more importantly and more proudly the growth what is industry makes is very, very rapid. So that leaves a very important note when you are looking for continuous technological update and progress.

Obviously there can be several varieties of complexities which come at different stages at exploration stage itself a transportation stage processing and of course these complexities arising from different stages or entirely different what has got to understand them in a different manner. All of them therefore lead to a constant change in manpower requirements and the skill levels, so there is a demand for constant update of training to the skilled manpower which is of course available very rare in oil gas industry.

And therefore the manpower requirements and the skill level of these manpower is kept on the increasing demand and that is one of the important challenge where safety training becomes important in oil gas industries most important difference job satisfaction generally are found to

be relatively low with offshore personal one can ask me a question what could be the reasons for this it is mainly due to the risks involved in performing the exploration of production facilities.

Of course psychological behavioral and physical manifestations have exposure to the stresses are also important reason why people have low relatively lower satisfaction of jobs in offshore industry so they need to be motivated therefore the common practice to improvise this is to consider economic objectives because there is another catch why people address safety in economic perspective in oil and gas industries.

And this may need to de-skilling of jobs that is very important area most important is to improve conditions of work safety becomes more important and rather most important because safety costs nothing safety violation cause hmmm.

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What are the major concerns which we must understand and remember which are applicable to oil and gas industries oil and gas industry is involved very high hazardous nature of work the risk of accidents occurrence is relatively high though the consequences are relatively very, very high

you may work about the frequency of occurrences but we understand risk is a product of these two.

The risk of accidents in offshore industry is very high accident prevention therefore makes more sense it should be preventive more not and never a corrective mode an accident prevention should be understood both in two domains one is financial domain other is humanistic domain pro-active measures are very important rather than reactive approach industry deals with high media image therefore accidents occur will cause depreciated in the media image of the industry.

Oil industries of course have a self reputation therefore they have a self regulation to be followed there is no doubt about it therefore this safety is one of the major concern oil industry because they have their own regulatory measures to be followed for practicing safety more important difference recently many unmanned platforms have been started commissioned in North sea therefore unmanned means people visit these platforms once in a month only for periodic inspection.

So safety of plants and equipments at unmanned platforms become more concern for us because we should have that kind of technological updates to really protect these equipments even when nobody physically there to even notice or may remain safety as a proactive measure.

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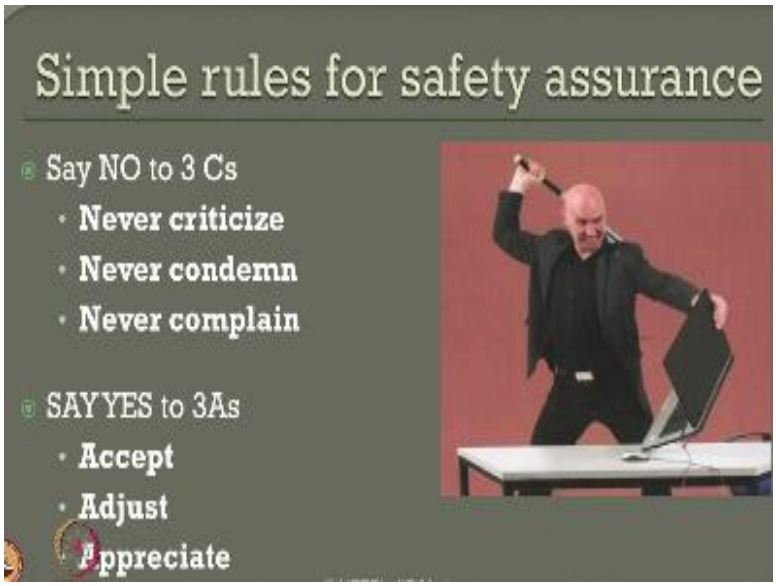

Simple rules for safety assurance say no to 3C's never criticize condemn and complain say yes to 3As except adjust unappreciated.

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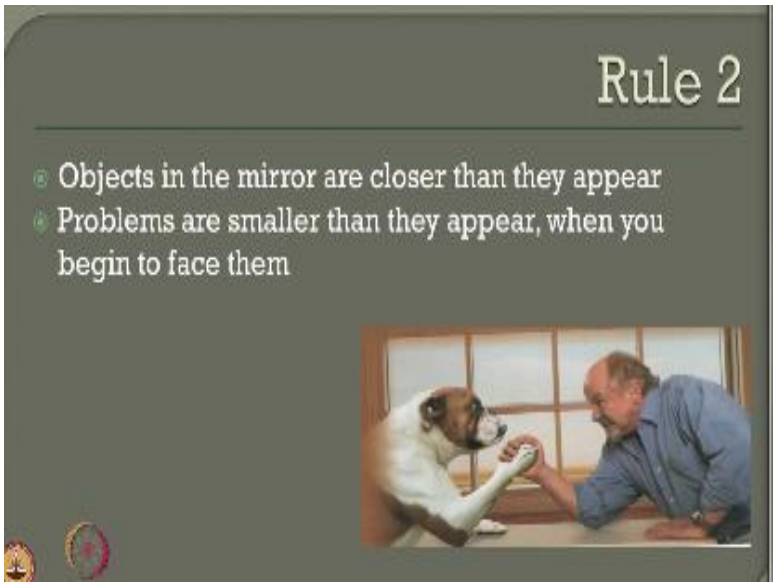

Rule 2 objects in the mirror are closer than they appear as applicable to oil and gas industry problems are smaller than they appear when you begin to face them so face the problem try to resolve them amicably and be proactive.

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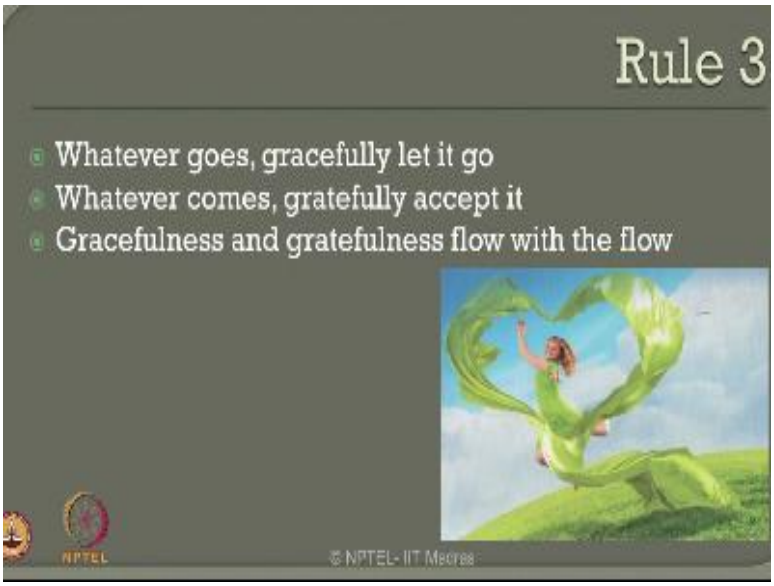

Rule 3 whatever goes gracefully let it go whatever comes gratefully accepted gracefulness and gratefulness should flow with the flow of oil and gas.

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Rule number 4 nobody is useless you are just used less that is the fact therefore involve participate and discuss in safety improvisations in industry either use yourself or at least find someone who knows how to use you.

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Rule 5 interesting always hold yourself to the standards higher than the expectations of the management please do not feel safety is procreative the management safety comes from you, you have to practice safety management is a part of you, therefore in everything go extra mile that is important.

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Rule 6 take a diversion statement does not stop your journey in the similar manner temporary setbacks like accidents should never alter your focus in improving a design and being innovative in bringing your new platforms for the future exploration stages keep going and simply keep on going in their advance direction for innovations in oil gas industries.

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Rule 7some huge a judgment to find fault in everything interestingly uses a judgment to appreciate everything that can improve excellently your production as well as improve safety satisfaction for the people on board.

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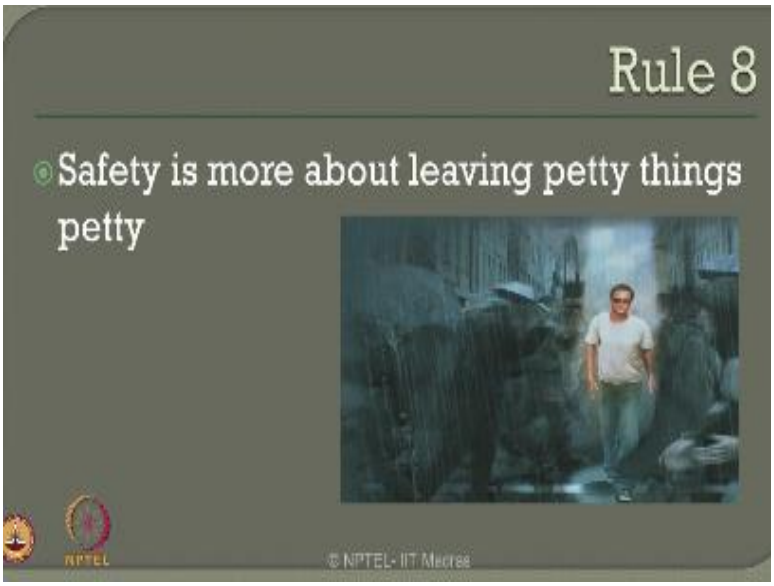

A rule 8 safety is more about leaving petty things petty.

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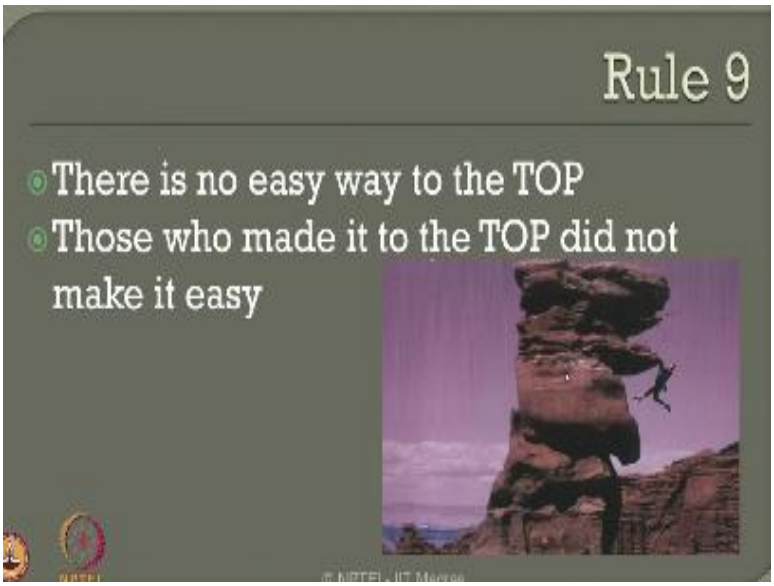

Rule 9 please understand there is never easy way to reach the top whoever raised has been always swinging face greater difficulty before they are in the top therefore those who made it to the top did not make it easy please understand you have to struggle innovate be patient be steady and of course follow rules and regulations to make safety is the first agenda in my life.

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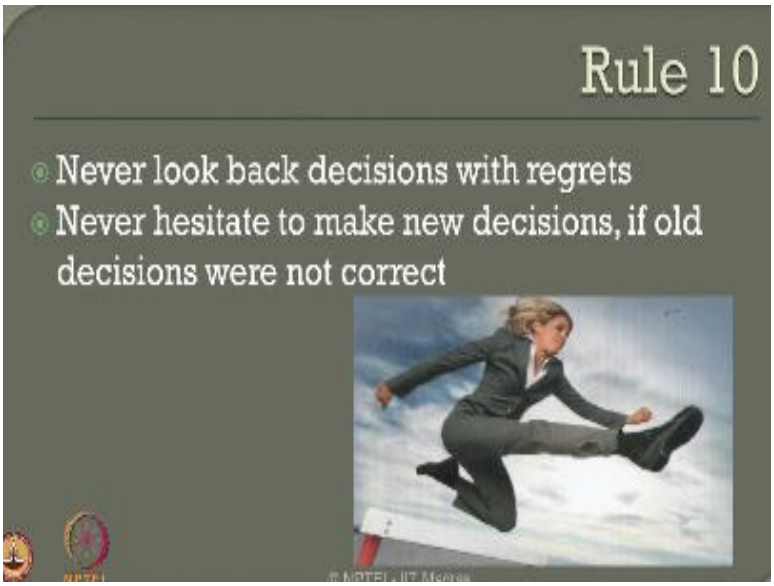

Rule 10 never look back decisions with regrets accidents do occur but always never hesitate to make new decisions even your bold decisions were not correct.

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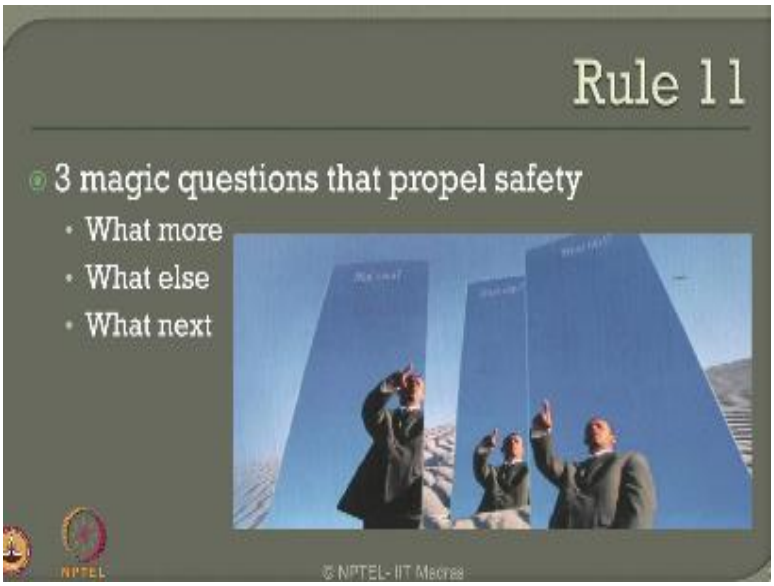

Rule 11 more importantly three magic questions which can propel safety what more what else and what next.

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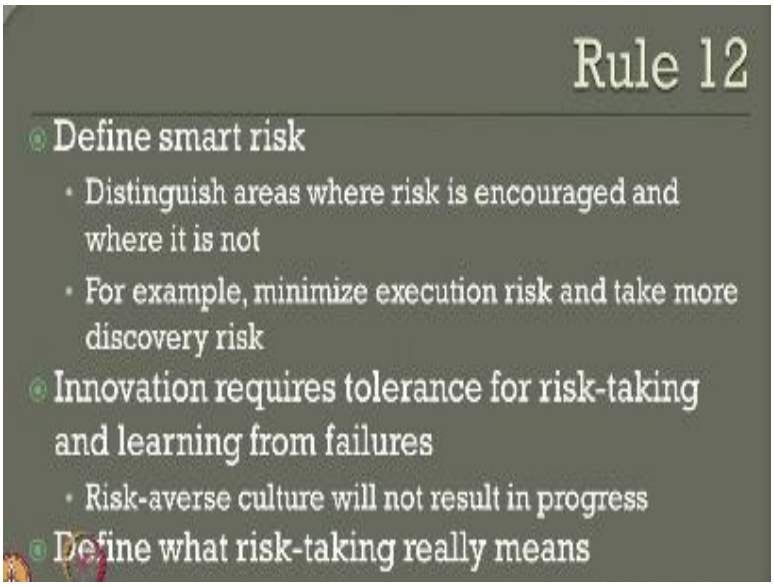

The last rule, rule 12 defined smart risk distinguish areas where risk is encouraged and where it is not for example minimize execution risk and take more on discovery risk innovation requires tolerance for risk taking and learning from failures risk-averse culture will not result in progress please understand this particular point define what risk-taking really means therefore you tell people to take risk but not in the wrong man.

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Finally friends health safety involved management generally comes in cans I can you can jointly we can I think this course has given enough idea about the whole concepts of safety HSE practices environmental issues and management I hope you have enjoyed online course at IIT Madras at NPTEL, thank you very much, bye.

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