Risk and Reliability of Offshore Structure
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Module - 03
Risk assessment and Reliability applications
Lecture - 18
Risk Management

Friends, let us talk about 18th lecture in module-3, where we will briefly summarize all the possible points what we so far studied on Risk Management.

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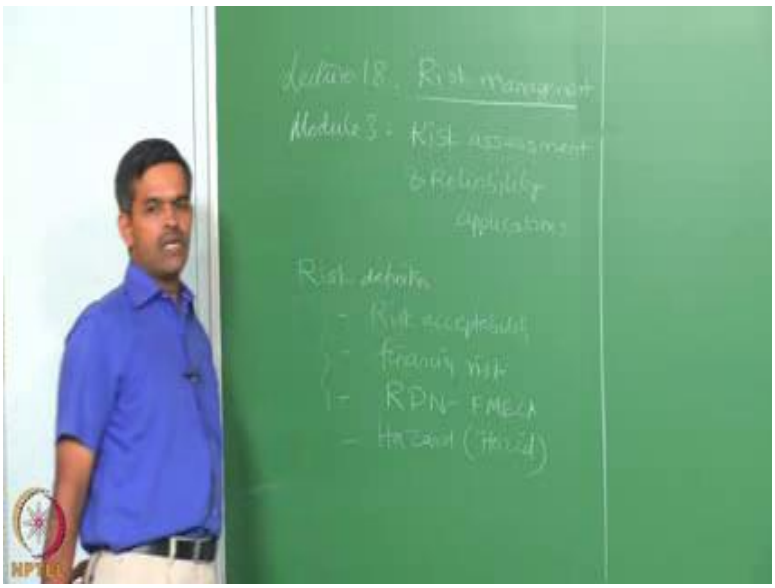

So, if we recollect back about the risk assessment in total we started defining risk, we also define what is the risk acceptability and also showed how risk can be easily said in financial terms what we call financing risk. How risk assessment can be used in identifying the priority of failure using risk priority number in FMECA studies and ultimately we said that one is interested in identifying not the risk a prior to that; that is identifying the hazards present in the system, hazard studies. So, from the hazard study one can easily find out the failure scenarios.

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From the failure scenario one can easily identify what is the possible damage scenarios, the factors could be the intensity of exposure of any specific damage, may be over pressure, may be a blast wave, and may be heat radiation. The second factor could be time or duration of exposure. Ultimately we said risk should lead towards identifying either lost one individual or lost the group of people live in the society which we called individual risk or societal risk. So, ultimately risk should converse to estimate of losses. So, the losses can be loss of human life, loss of asset, loss of public property etcetera whatever may be, but ultimately this quantifying the loss actually.

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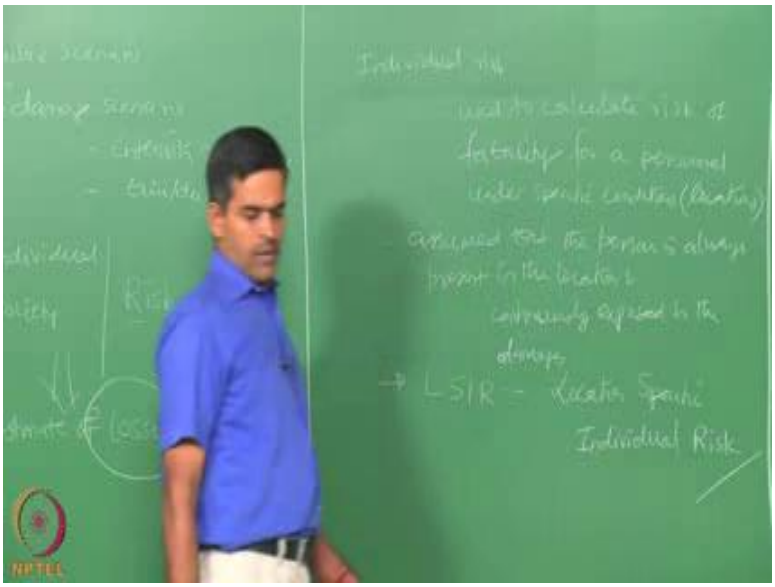

So, in that contest we discussed about individual risk in the last lecture. We will just windup back and say the term individual risk is used to calculate risk of fatality, risk of fatality for personnel under specific conditions, to be very clear we can say specific locations. During this estimate, it is assumed that the person is always present in the location, so it is assumed that person is always present in the location and continuously exposed to the damage that has an assumption, we already said the list of assumption.

Sometime this is called also by a different name what they call as LSIR - Location Specific Individual Risk. So, it is very important to distinguish from person specific individual risk. So, it is very important.

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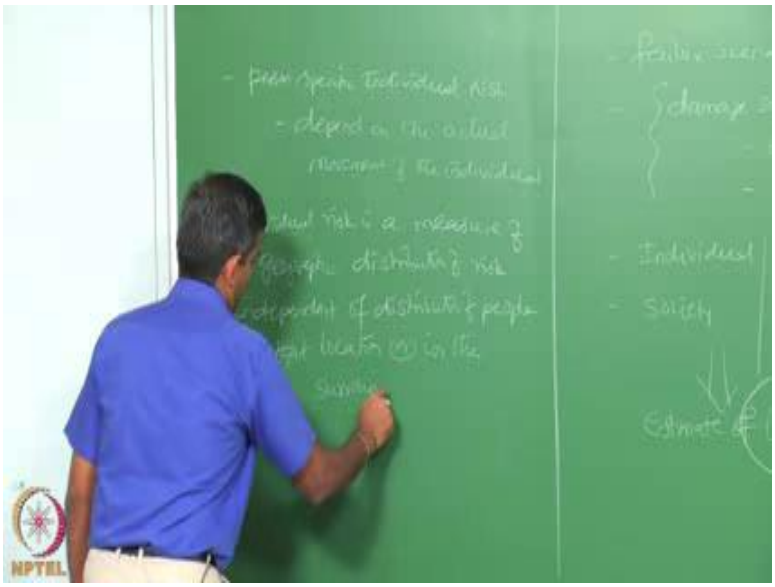

So, person specific individual risk will depend on the actual movement of the individual. During the process there is a always a probability that the person may move out of the risk zone, whereas in location specific individual risk estimates this assumed that the person is always present in that location and he is continuously exposed to the damage that is very important.

Therefore, one can say that it is a measure of geographic distribution. So, individual risk is a measure of geographic distribution of risk and is independent of the distribution of people at that location or in the surrounding area.

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Now the individual risk, which is given by IR that is individual risk of M xy given w, for a location X Y; for weather condition w is given by, IR M xy w is Fm theta 1 to 2, P theta given w, P d given w, d theta a - equation 1.

So, x and y are actually location parameters, location of the given space w is the weather combination which can be given based upon wind speed atmospheric stability given by Pasqual's stability class.

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Fm is the even frequency of the scenario for the chosen failure damage scenario, theta is the direction of release, theta 1 impacts the lower value of the location and theta 2 has the upper value of the location in terms of its impact. So, therefore, xy theta 2 is the upper value of the impact of location. Now, xy P given w or P theta given w is the probability of release occurring in the direction.

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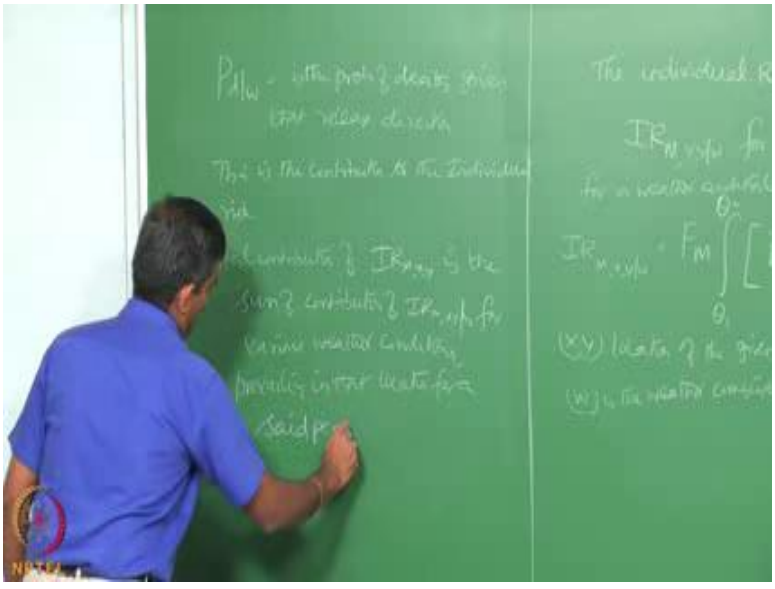

Pd given w is the probability of death given that release direction. T of course, is the contribution to the individual risk. So, this is going to be contribution to the individual risk at that location for the given weather condition.

Now, the total contribution of let us say IR M xy was given w is the specific bend and weather condition. Whereas the total contribution is going to be a sum of contributions of of IR M xy for various weather conditions prevailing in that location for a set period.

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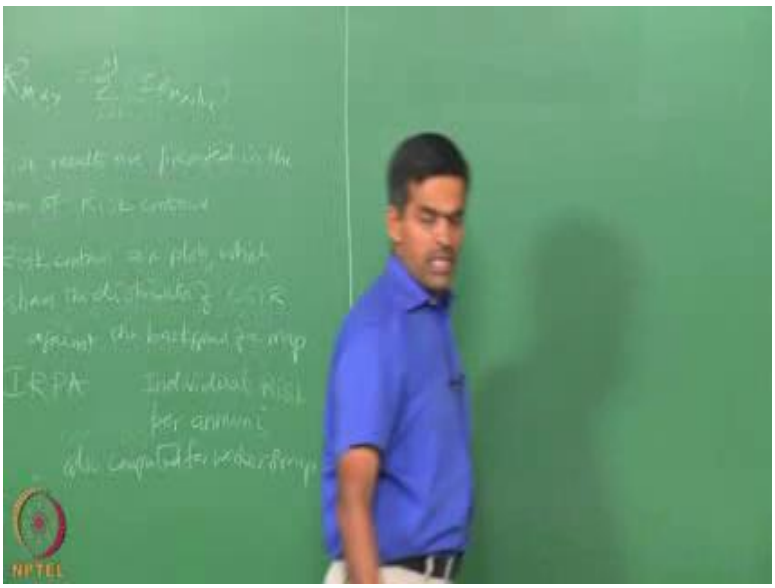

Therefore I should say IR M xy is the sum of IR M xy w for different scenario, for different weather conditions I varies from 1 to n where you are considering n weather conditions for a specific set period. Therefore, risk results are present in the form of risk contour, risk contours are nothing but plot we show the distribution LSIR risk; contours or plots which shows the distribution of LSIR location is specific individual risk against the background map against the background of a map.

In addition individual risk per annum is also computed for each worker group. So, in such cases, W i which is the weather condition will be considered for the full year.

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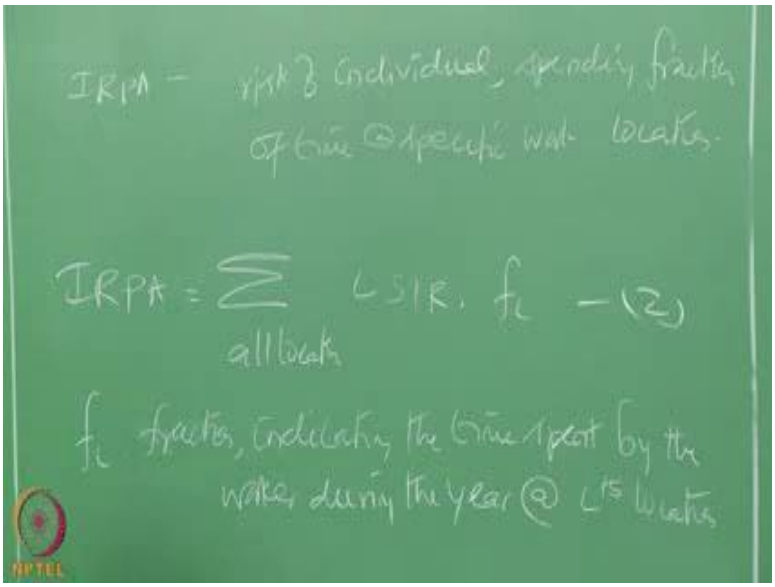

So, IRPA actually reflects the risk of an individual spending certain fraction of time at specific locations. If I know IRPA I will always know what is the risk of an individual spending fraction of time at specific work location. The fraction of time where a particular individual spends as specific particular location is combined with LSIR at a particular location to derive IRPA. Therefore, IRPA is given by sum of let say all locations of LSIR into let us say f L where, f L is the fraction indicating the time during a year; fraction indicating the time spent by the worker during a year at Lth location.

So, now I have to understanding individual risk. Now let us talk about extension of risk management for societal risks.

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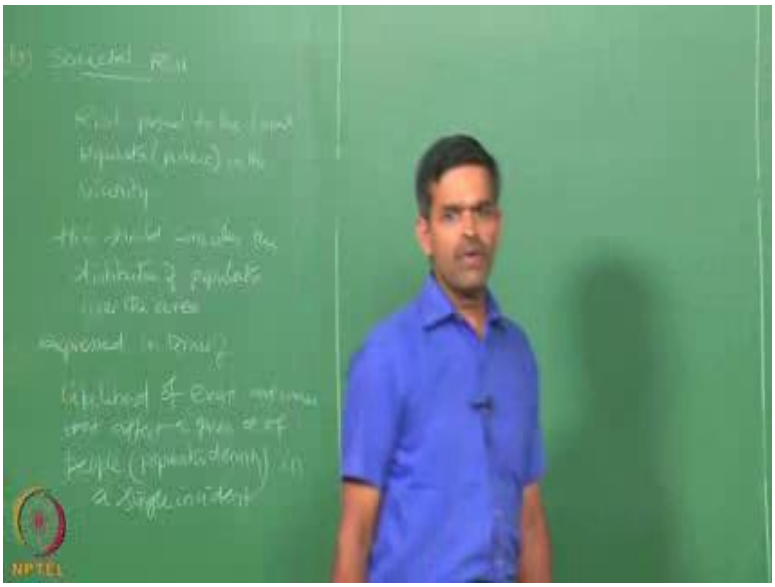

Societal risk is the measure of risk that the event posts the local population, so nothing but risk post to the total population or the public in the vicinity. This takes into account the distribution of population, so this should consider the distribution of population over the area what we call population density. The societal risk is expressed in terms of likelihood of event, outcomes the defect for a given number of people in a single incident.

So, societal risk is expressed in terms of likelihood of event that outcomes, that affect a given number of people what we call as population density in a single incident.

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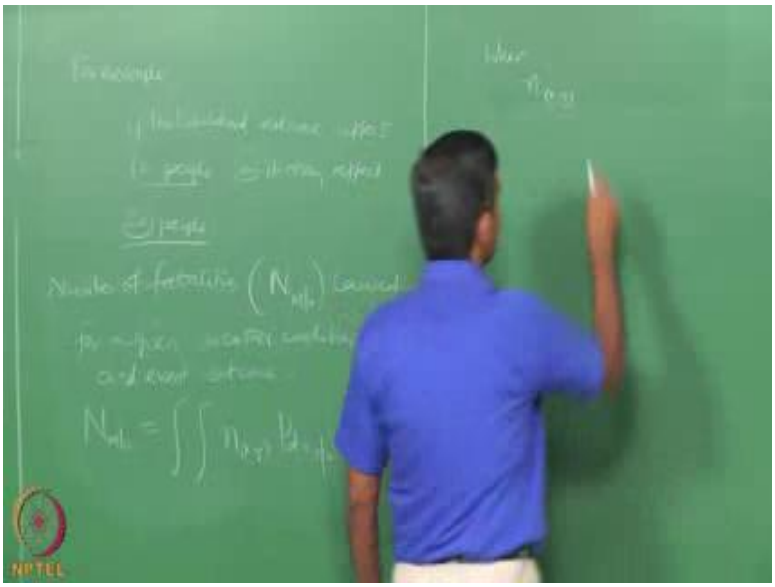

For example, if the likelihood outcomes that affect in people in a given locality or the likelihood even may affect 20 people or it may affect 20 people in the given locality. So, it is amount of understanding what is the extent of population which will affected by the likelihood of this event if it occurs, that is the societal risk. So, number of fatalities which is given by N M given o caused for a given combination of weather condition, direction and event outcome is given by n xy P d xy given o dx dy.

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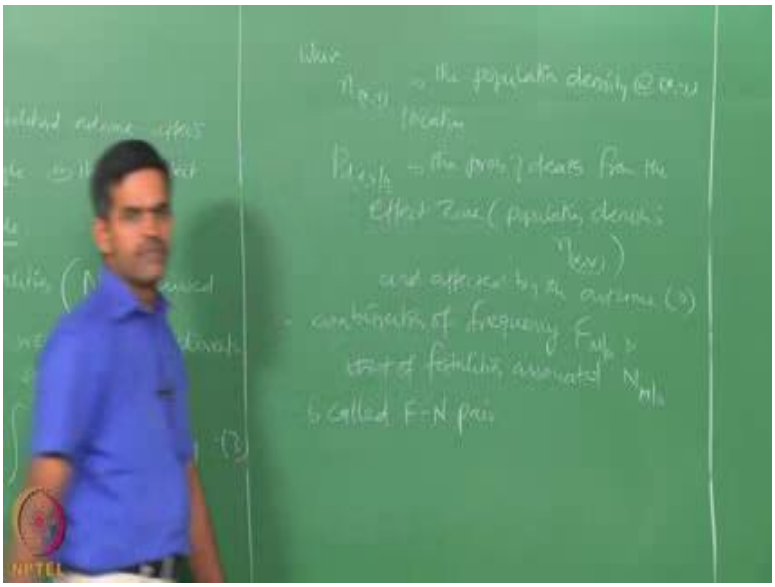

Where, n xy is the population density at xy location P d xy given o is the probability of death from the effects zone whose population density is n xy which is affected by the outcome, so here the o is outcome. The outcome can be radiation, can be blast wave, it can be shock waves etcetera.

The combination of frequency F M o, the combination of frequencies because it can occur in different frequency for the location and outcome and the number of associate fatalities is known as the Fm pair; combination of frequency F M o and that of fatalities associated which we call as N M o because that is if fatalities associated is called F-N pair.

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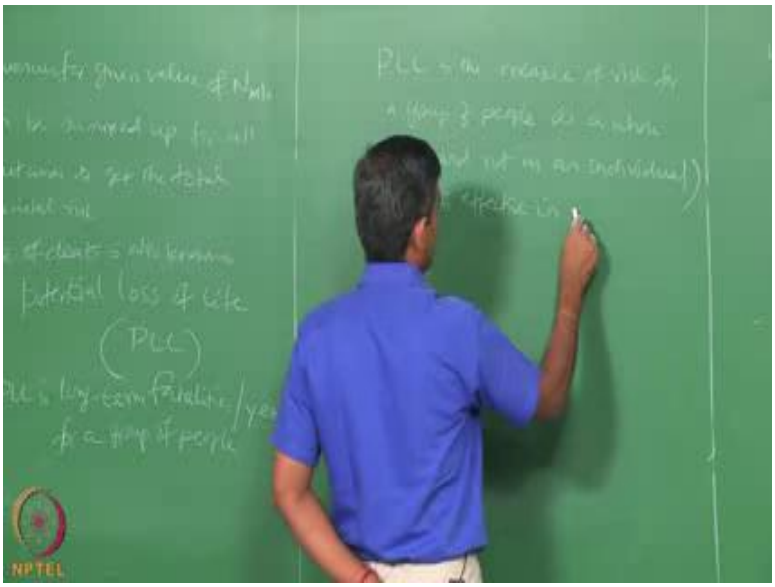

So, frequency for the given values of M it can be summed up. It can be summed up to get the total societal risk for all outcomes, rate of death is also commonly known as potential loss of life which is indicated as PLL, which is actually a long term average number of fatalities per year for a group of people. So, PLL is long term fatalities per year for a group of people.

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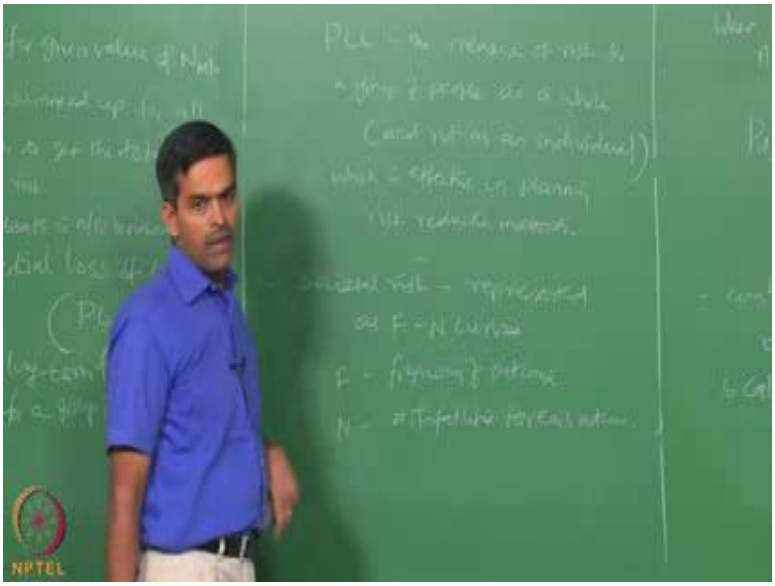

PLL therefore is the measure of risk for a group of people as a whole and not as an individual that is very important. Now, we are talking about a group failure which is effective in planning risk, reduction, measures or methods, was I while planning risk reduction methods people do not look at individual risk data, they will look at PLL. So, generally societal risk as we just now saw is represented as F-N pairs of curves where F indicates the frequency of failure of fatalities and N indicates the number of fatalities under given condition. So, F is the frequency of outcome and N is the number of fatalities for each outcome.

Interestingly one estimates the risk in terms of societal and individual SLIR societal specific, geographical specific are for the group in case of PLL. Then it has got to be implemented for what we call Risk Management.

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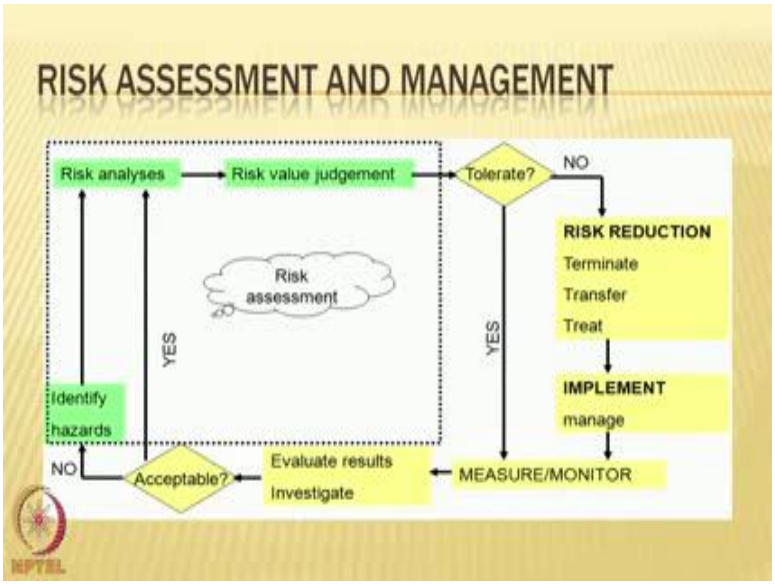

Kindly pay attention to the flow chart indicating risk assessment and management. Let us say once I understood the risk analysis methods and you have given identification of hazards. If the risk value judgment is tolerable then you measure a monitor and keep on checking that the risk analysis tools used or connect and the risk valued by you are tolerable.

If the identified hazards are acceptable then evaluate the results, investigate them for safety if they are no then keep on changing their procedure and add in mitigation methods to controlled risk. So, this part of the problem is what we called risk assessment. Once the risk estimated is non tolerable then apply risk reduction techniques to terminate, transfer or treat the risk. Implement the policies manage them and keep on monitoring them to check back weather the hazard identified now have to implementing risk reduction tools are reducing the risk or not. So, this part is what we call risk management and this part is what we call risk assessment.

So, putting together coupling them together is what we call the overall tool in risk assessment and management in offshore industry. So, ultimately the outcome should be in terms of loss maybe human life or financial loss or public ascertain property. So, one prepares what we call risk assessment matrix. So, kindly pay attention to the image shown in the screen here.

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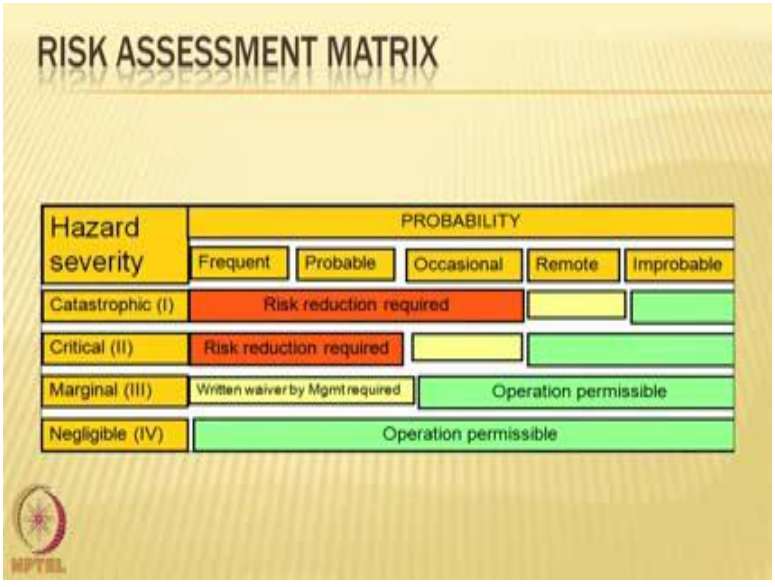

In case of risk assessment matrix there are two basic variables which is being plotted one is hazard severity other is the probability. The hazard severity is classified into 4 stages, 1 2 3 and 4. One may be called as catastrophic, where as 4 is negligible in between their marginal and critical. Whereas the probability is classified into 5 issues that frequently

occurring probably they may occur, occasionally they may occur, remotely they may occur, they never occur at all.

So, if you have any incident or event which is frequently occurring, whose probability is also known which is very occasional, but least to catastrophic hazards then they are called as red banded values which requires risk reduction immediately. If we have hazards severity's in the marginal scale which occur frequently or probably then you can always wave off those risks under management control what we call risk acceptance criteria. So, they are called yellow banded risks.

If you have probability which is very remote or non-occurring at all even though they are catastrophic which are called green banded then, one can safely operate the system and go ahead with the operation to the good high degree of permission. So, risk assessment matrix will try to place the risk of your specific system or set of events in this band then advice accordingly whether risk reduction is required, is it permissible in to operation or is it tolerable under the management conditions. So, one has got to ultimately narrow down the whole scenario of risk assessment in terms of a matrix which includes the hazard severity and probability.

So, friends we have estimated and understood how to calculate individual and societal risk in a given system. Risk assessment management how do they actually differ, how are they coupled together to understand better risk management policies. We have also seen in three different modules how reliability and risk assessment can be interestingly coupled. We discussed about various terms and hazard, safety, reliability and risk assessment management together in this entire course.

I hope you have enjoyed all the lectures in given modules of 3, all modules are posted with individual tutorials for yourself learning purposes. There will also be an exam at the end, after completing this course which is going to be an online exam you can pass the exam and try to take certificate - online certificate by NPTEL IIT, Madras which can worth of completing this course equivalent numbers of credits which will be useful for your carrier improvement programs.

I hope you have enjoyed the lecture. Please give me a feed back in all these in positive modes and try to indicate the parts which are ambiguous, which can be improved upon, which request further discussion interactive sessions. I will be available through email for clarifying a doubts, good luck and bye.

Thank you.