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

**Module 4:
Safety measures in design and operations
Lecture 3: Risk analysis example using
software**

Welcome friends now this is third lecture on module four in this lecture we are going to talk about risk analysis example using a software in the previous two lectures I showed you some of the important modules and some pull down menus on the software which is essentially used for risk analysis which his first risk from D&B this is third lecture in module four where we are talking about safety measures in design and operation on NPTEL course on HSE in offshore and petroleum engineering at IIIT Madras.
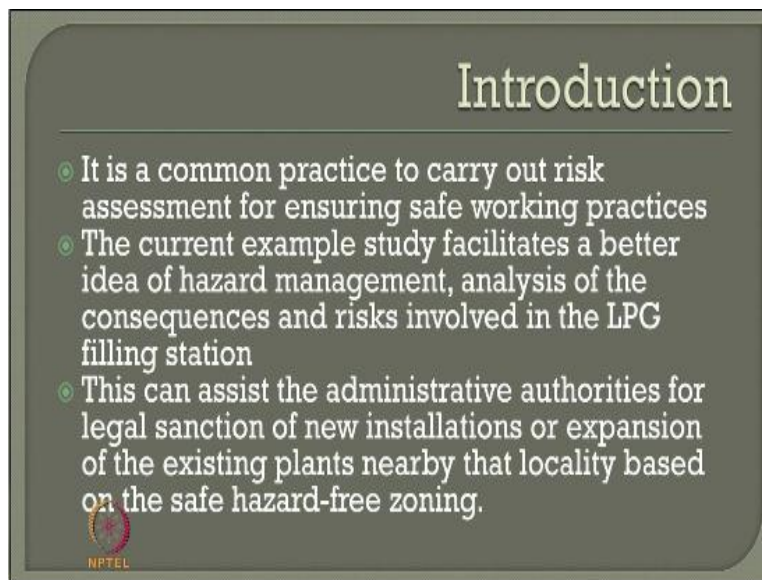
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Let us quickly see what we will be seeing in this present lecture and how we will show you a very quick hands-on experience on the software for a solved problem we are going to talk about

different failure cases and consequence analysis the failure cases what we will discuss in this presentation will be dispersion, jet fire, BLEVE and fire ball and we will also do a consequence assessment and ultimately we land up in risk analysis or risk assessment based on the consequences what we identified for a given problem the example considered in this study will be a LPG station located at xxx location in specific geographic location in the world.

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We all know that it is a common practice to carry out risk assessment for ensuring safe working practices the current example study facilitates a better idea of hazard management analysis of consequences and of course the risk involved in the LPG filling station this can assist the administrative authorities for legal sanction of new installations or expansion of the existing plants nearby that locality based on the safe hazard free zoning which is one of the important visible outcome from this kind of example studies.

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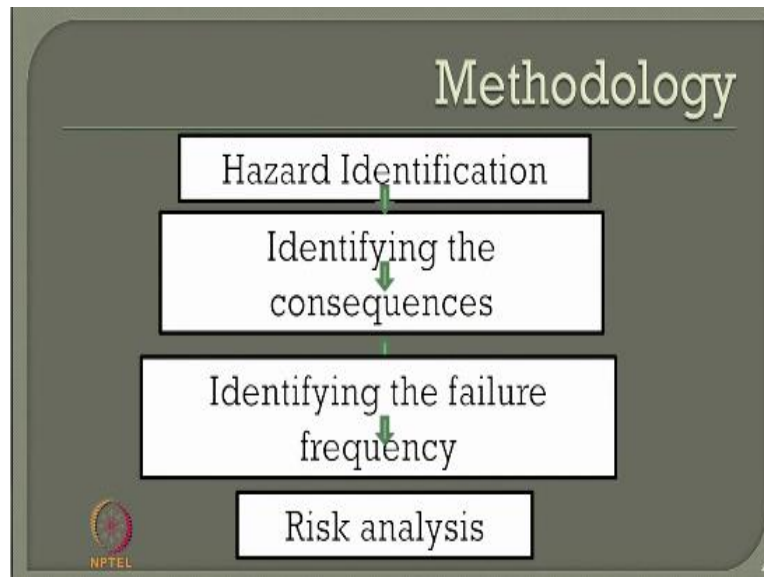
 The methodology followed to solve the problem will be following we will first identify different or various hazards present in the station then for every hazard we will try to identify the consequences or the respective consequences of every hazard then ultimately we have got to feed in the different failure frequency based upon what are the identifying consequences and based on these two frequency and consequences we will land up in what we call risk analysis which will become a to form output one will be the societal risk another will be the individual risk.

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Failure cases and consequences of LPG filling station

Sl. No.	Failure Case	Failure Mode	Consequence
1	Full bore / failure of LPG outlet line of Bullets	Random	Dispersion, Jet fire, UVCE
2	20% CSA failure of LPG outlet line of Bullets	Random	Dispersion, Jet fire, UVCE
3.	LPG pump discharge line full bore failure	Random	Dispersion, Jet fire, UVCE
4.	Road tanker failure	Random	Dispersion, fire ball, BLEVE
5.	LPG pump mechanical seal failure	Mech. seal	Dispersion, Jet fire, UVCE
6.	LPG Pump Outlet Line Gasket failure	Gasket	Dispersion, Jet fire, UVCE
7.	Road Tanker unloading arm failure	Random	Dispersion, jet fire, UVCE

Let us quickly see for our understanding what are those failure cases and consequences on a given LPG station which are generally considered in any such analysis the failure cases can be a full-bore or a failure of LPG outlet line which is arising from the bullets we can also have what is called twenty percent cross-sectional area failure of a LPG outlet line of the bullets one can also envisage LPG pump discharge line full bore failure it can be also a road tank failure LPG pump of mechanical seal failure LPG pump out let line gasket failure or the road tanker unloading on failure.

Most of these failures are considered generally random in nature and the consequences most commonly arise are jet fire, dispersion, BCE vapor cloud explosion and BLEVE.

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Sl. No.	Failure Case	Failure Mode	Consequence
8.	LPG unloading vapor compressor outlet line Full bore failure	Random	Dispersion, Jet fire, UVCE
9.	Catastrophic Failure of a Single Bullet (Capacity: 150 MT)	Random	Dispersion, Fireball, BLEVE
10.	Domino Effects Of Bullets	Random	Dispersion, Fireball, BLEVE

In addition one can also have LPG unloading vapor compressor outline full bore failure catastrophic failure of a single bullet of a capacity 150 thousand kg and Domino effects of series of bullets presented in the specific location.

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Types of damage

Thermal radiation (IS 15656:2006)

Incident Thermal Radiation Intensity, KW/m²	Types of damage
37.5	Sufficient to cause damage to process equipment
12.5	Minimum energy required for piloted ignition of wood, melting of plastic tubing etc.
4.5	1st degree burn
1.6	Will cause no discomfort to long exposure
0.7	Equivalent to solar radiation

As we said thermal radiation is one of the important input to be given depending upon the Pasqual stability class so various thermal radiation class are identified in the literature varying from the intensity of that of .7KW/m^2 to that of 37.5 KW/m^2 the consequences are the types of damages that arise from these kind of radiation intensity are also shown in the figure which in extract from an IS code 15656:2006.

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Types of damage

Overpressure (IS 15656:2006)

Blast Overpressure (Bar)	Damage Type	Casualty Probability
0.30	Major damage to structures (assumed fatal to the people inside structure)	0.25
0.17	Eardrum rupture	0.10
0.10	Repairable Damage	0.10
0.03	Glass Breakage	0.00
0.01	Crack of Windows	0.00

Similarly the second kind of damage could be over pressure which arise from the blast over pressure indicated in bar varying from 0.01, 2.3 and the type of damages caused by variation of this blast overpressure is also shown in the table and the casualty probability as advised and guided by the Indian code is also given in the last column of the table what you see in the screen.

Now we wish to do an consequence assessment on these kinds of problems so failure frequency becomes a very important input for such analysis using a software let us try to understand what all the possible failure frequencies which arise or may arise from a full-bore failure a 20% cross-sectional area failure LPG pump discharge road tanker failure LPG pump mechanical seal failure LPG pump outlet line gasket failure or road tanker unloading on failure one can ask a question interestingly that how do you fix up these kind of failure frequencies.

Of course there are two methods by which these failure frequencies can be arrived at one look at the annual or biannual statistics of these kinds of failure which has occurred elsewhere on a similar plant in the world take a mean try to relate this with that of the relevant Pasqual stability class applied to the new location and comparable to the existing location where such accidents occurred.

If they become comparable then one can find an average value of this and say that is going to be my input value frequency alternatively one can also visit the plant try to conduct what to survey try to conduct hazard service and try to understand what would be the expected failure frequency of these kind of failure cases if at all the failure occur in the specific plant location for different

Pascal stability class and different windward directions as given in the literature so based on such studies conducted an example problem was arrive saying that serial number 127 have respective value frequencies as a show in the right hand side of the column here which is one of the important input to be given for the software analysis.

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Sl. No.	Failure Case	Failure frequency
1	LPG unloading vapor compressor outlet line Full bore failure	2.9E-6/Average year
2	Catastrophic Failure of a Single Bullet (Capacity: 150 MT)	2E-6/Average year
3	Domino Effects Of Bullets	2E-10/Average year

Similarly for LPG unloading vapor compression outline catastrophic failure of single bullet and Domino effects these are again studied from the previous examples or previous experiences occurred from a similar industry elsewhere and one can always feed them as an input value frequency.

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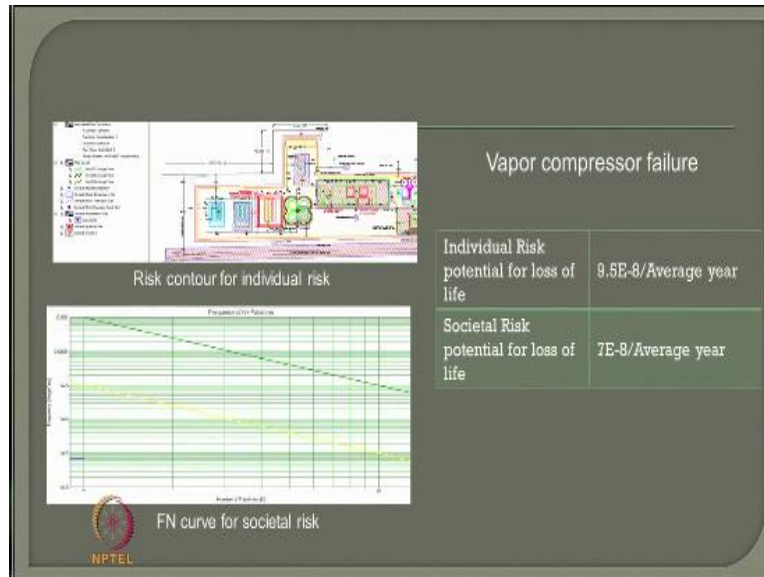
Now these are the results which has been obtained after analyzing this from the software which will show you now step by step procedure as we discussed in the last two lectures but now I will run a video very quickly to have a hands-on experience on this software but let us quickly see what are the typical output I will generate from the software for example for a full bore failure or pipeline I would be able to compute the individual risk and societal risk in terms of average year.

And they can be also plotted graphically they can be also seen as the different sources where the failure could be concentrated and could be occurring similarly one can also look at twenty percent catastrophic failure catastrophic failure of the storage bullet which can be seen as a radii envelope as you see from here as one of the important output graphically as well as in terms of f1 curve for societal risk, so societal risk in all the cases for example previous case also are given in terms of f1 curve which is frequency versus number of fatalities whereas individual risk is again given on risk contour where the legend show different kinds of failure risk levels.

For example the red one here shows a contour of failure risk level of 1^{10-6} average year and you are able to array and the catastrophic failure of the storage bullet for individual risk for the potential loss and societal risk based upon what you see from this table here. What different

modes of failure for example of your road tank failure for LPG pump discharge line failure for LPG pump discharge line gasket failure and for Road tanker unloading on failure one is able to identify the societal and individual risk as an outcome from the software.

Let us try to understand how this can be studied very easily using the software now I will show you as an hands on experience.

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Sl. No.	Failure Case	ABC plant		XXX plant	
		Individual risk (per average year)	Societal risk (per average year)	Individual risk (per average year)	Societal risk (per average year)
1	Full bore failure of LPG outlet line of Bullets	2.5E-008	1.7E-008	2.4E-008	2.2E-008
2	20% CSA failure of LPG outlet line of Bullets	8.5E-009	5.6E-009	8.2E-009	5.8E-009
3.	Catastrophic failure of storage bullets	1.1E-004	7.4E-005	4.4E-005	3.3E-005
4.	Road tanker failure	1.2E-005	8.7E-006	9.1E-006	8.5E-006
5.	LPG pump discharge line full bore failure	1.7E-006	1.2E-006	5.4E-007	4.9E-007
6.	LPG Pump Outlet Line Gasket failure	2.5E-008	1.9E-008	4.1E-007	3.7E-007
6.	Road Tanker unloading arm failure	3.6E-005	2.2E-005	2.7E-005	2.2E-005
7.	Vapor compressor line failure	9.1E-008	5.5E-008	9.5E-008	7E-008

Once again this I will be able to simply compile them for two different plant locations and I will know what are those individual and societal risk for different failure cases which you already seen as one of the envisaged consequences of the specific problem so these are the results in terms of risk assessment done from the plant.
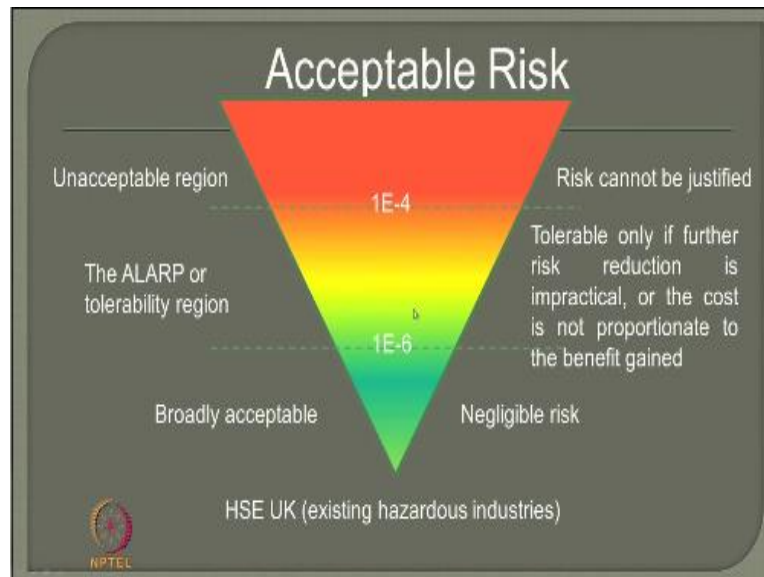
Now I compare this with acceptable level as given by oil and safety industrial directed in this example we have compared the results with that of HSE UK for existing hazardous industries then I know what is acceptable region what is ALARP region and what is the unacceptable region in terms of the risk value if my risk number lies in any one of these regions of this triangle then we will categorically qualify them as broadly acceptable or ALARP region or unacceptable region.

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Sl. No.	Failure Case	ABC plant		XXX plant	
		Individual risk (per average year)	Societal risk (per average year)	Individual risk (per average year)	Societal risk (per average year)
1	Full bore failure of LPG outlet line of Bullets	2.5E-008	1.7E-008	2.4E-008	2.2E-008
2	20% CSA failure of LPG outlet line of Bullets	8.5E-009	5.6E-009	8.2E-009	5.8E-009
3	Catastrophic failure of storage bullets	1.1E-004	7.4E-005	4.4E-005	3.3E-005
4.	Road tanker failure	1.2E-005	8.7E-006	9.1E-006	8.5E-006
5.	LPG pump discharge line full bore failure	2.4E-008	1.8E-008	5.4E-007	4.9E-007
6.	LPG Pump Outlet Line Gasket failure	2.5E-008	1.9E-008	4.1E-007	3.7E-007
6.	Road Tanker unloading arm failure	3.6E-005	2.2E-005	3.7E-005	2.2E-005
7.	Vapor compressor line failure	9.1E-008	5.5E-008	9.6E-008	7E-008

Now I compared this and the table now shows a comparison so the table shows very clearly that the catastrophic failure of storage bullets at a specific plant location both individual and societal fall on unacceptable range whereas they fall on ALARP region whereas the remaining falls on the acceptable are broadly acceptable region so the study will lead to different kinds of variable outputs in terms of graphical and we show societal and individual risks.

Ultimately they can be compiled and compared with ALARP triangle as applicable to oil and safety industrial direct rate or any oil and gas industries then one can easily come to a conclusion whether the risk in this next in given plant is acceptable within the limits are not within the limits.
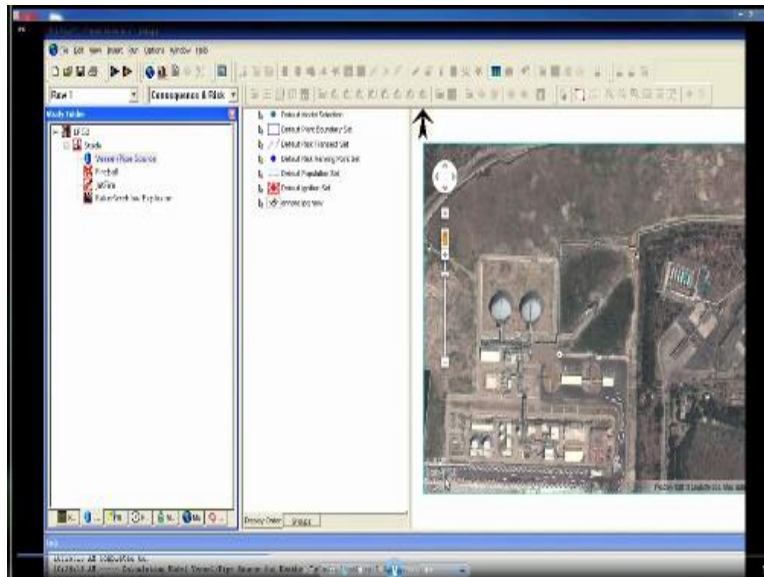
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So now we will see how we can have an hands on experience of this software.

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So friends the first screen the of software will show you that we are operating on fastest 6.7 as seen from the previous slides let us open a new file let us create run rows so let us select the raster image for a given material inventory insert the image select the image or the raster file from your computer as you see in the screen here select any one specific image and select the coordinates the coordinate system can be either analysis offset from the coordinate system printed on the map images or you can also convert them in terms of models to have a standard system printed on the map images itself.

So in this example we are trying to do the alternate way and we have to give the local coordinates or local location of the origin as East and North coordinates as you see in the screen now once they are given then you have to select a space for it is projection and geographical area in the file give the file name or the origin information then identify the storage space in terms of coordinate system where are they the storage spaces available in the given plant once it is indicated then give the geographic space graphically select the area which is appearing on the right side of the screen now.

Select the area then once you click it gives you the raster image of what we have selected in terms of coordinate system then you can show the important location where the material properties can be now identify insert the mixture or the material I am working out a new mixture in this specific case so once I click new mixture I see on my left hand side a new mixture available and the material head so I click that I go to the basis of adding them my new mixture is having a specific combination of butane of a mole amount of forty five percent and I also have the next possible chemical is propane which is fifty five percent.

So I add them and say it is general I can always calculate the overall characteristics of the specific new mixture by simply saying calculate you see here it is calculated now the mixture data is being collected for internal mixing rules and override any property data available to you and therefore recalculates the value you say yes it recalculates and you will give you now the critical temperature the critical pressure the normal boiling point the melting point and whether the mixture is flammable or not and what about the equation of State applicable and what will be the reactivity with atmosphere these are taken from the database of software the moment you say calculate automatically it does and say okay except these values and say okay now the new mixture has been predefined and now you are going to define what we call the default weather conditions.

Now in this table on the left hand side you see these are FD nomenclatures are related to Pasqual stability class and of course the number what you see adjacent to these legends or 1.5 meter per second five meter per second etc...then these are nothing but the wind speed available at a specific Pasqual stability class associated with so you select the default weather then you say okay now select a specific Pasqual stability class now you see here on the Cascade menu pulled down menu you will see there are various stability class available varying from ABCD as you see they can be even the moderate wind and windy night.

So all classes geographically of 24-hour period is covered in the specific submenu you click the moderate specific class then also pick up the suitable substrate data and do this for the remaining stability class as well and save the file and create a model now the study model has got different sources of failure or consequences because I am doing I am actually doing a consequence

analysis you see here we are doing a consequence risk analysis. So I want to create different sources like jet fire, fire ball, down bakes to low explosion etc…

Now for each one of them I create I want to specify the location you can see here I can specify the location on the screen directly using a graphical raster image and associate that particular point with that of the any kind of feature of failure so say select then you can always adjust this by moving this using this particular Menu by moving this location to something somewhere else if you are interested in as in this case you have selected a point wrongly now we are moving it towards some other location.

So one can re-associate these points and do this for every kind of failure cases and associate the fuel related to this we already defined the mixture therefore the mixture is now available here as you can see a new mixture the moment is say new mixture defined by me earlier in the material the new mixture now as a category of specific composition of nutone and propane so I select that an inventory mass participating should be given as an input in this case as I said is 150 metric ton the saturated liquid pressure is also given in terms of bar which is an input for the analysis.

So I must simply say what is my even frequency of this kind of failure we are talking about vessel of pipes or failure we have to be a specified the material now we are talking about the risk and in this risk column we are trying to give the even frequency which is one of the important output either given based on experience or base an existing data so in this case we are entering 1.3^{-5} and select the scenario there are various scenario available for a specific type of failure.

So in this case being a vessel or a pipe I should look for a either a line rupture I can go for leak the moment is in leak I must say it is a liquid phase to be released and therefore I must say what is the hole diameter friends please note depending upon what we are selecting here accordingly this menu and according the data demanded will be in white remaining all will remain in grey which becomes inaccessible for you for a choice and data that is a very interesting part in the software so these guides you through and through how this can be easily done for a better understanding.

So I are given a hole diameter 50 millimeter now I want to also select what is my vessel hit because I am talking about vessel as well as pipe. Pipe I have given the diameter whereas vessel I must tell me I must also show what is the tank head because depending upon this the volumetric discharge will be calculated, so I say 4 meter and I must show what is my geometry burn data etc..

Which I already showed you the previous presentation slides, so I now select horizontal and now I also select what is my T and T equivalence and check out and now I fix up these data for a specific vessel source and save it and now run the analysis the moment is say I have to run the analysis since the data I prepared is not stored first I have to store the data first save it now on a specific file name I say LPG2 save it now I run now it is running the value calculating model for vessel pipe source for a default weather or Pasqual stability class F 1.5 meter per second wind speed.

It will do for the remaining class also you will see that now it is doing for D 5 meter per second and so on D 1.5 meter per second it does calculation for all now the calculation is available now I can show the graphical output for all the three you can see here for default whether for LPG2 file for a specific vessel pipe source run in the row 1 for a consequence and risk analysis I have got results for all Pasqual stability class F 1.5 meter per second D 5 meter per second and D 1.5 meter second for all default weather data.

Now I select all of them and show the graphical output which is one of the typical output which I will get from this kind of analysis.
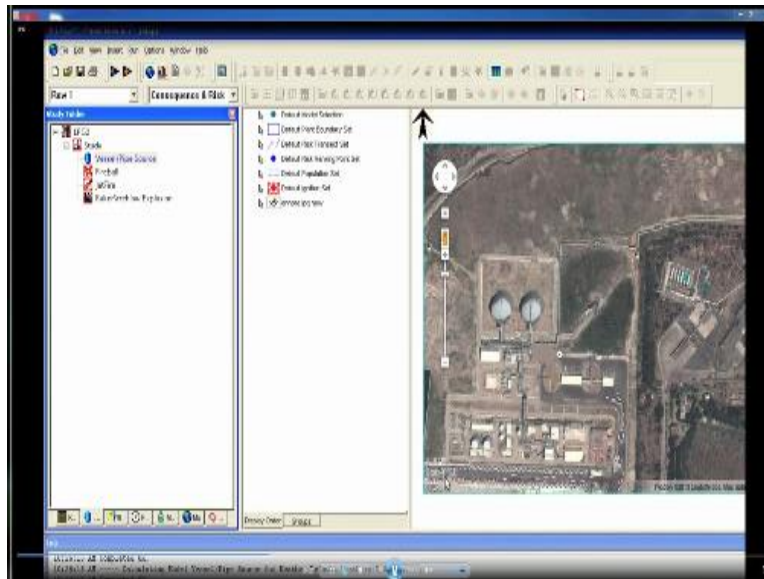
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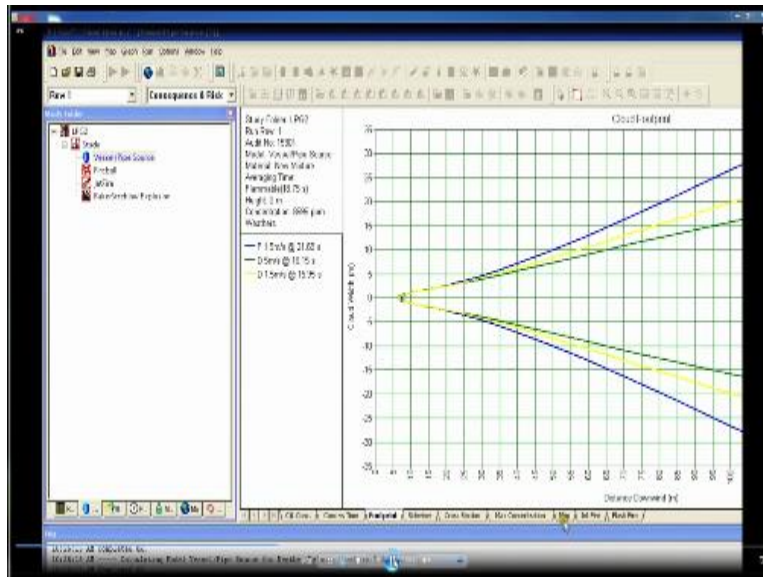
You can see here the first output water generate is actually the central and concentration verses distance the run row is 1 as you see here study folders LPG2 which you remember here and material what we use new mixed and flammability already we are given and default weathers are what we have selected now one can see here where this is actually occurring in terms of concentration parts per billion.

So you can see the yellow line corresponds to the yellow line corresponds to the concentration of PPM in downwind distance in terms of Pasqual stability class 1.5 meter per second the blue one what you see here which is overlaid and the green one is also partially over laid or for different stability class as you see from this result here this is talking about the constant line centre line concentration one can also see different output from here in terms of maximum concentration the cross-section failure footprints etc…Which will show you subsequently so one can look at this one can also look at the mapping.

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So look at the mapping of this select the source where you want to identify.
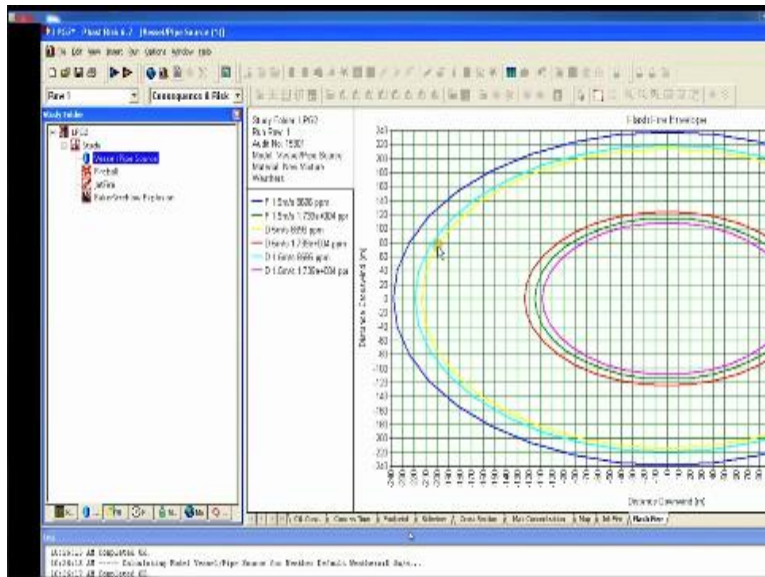
Say what is the possible Jet fire arising from this which gives me the plot now for different radiation now we all know the radiation with resistance we are selected the radiation level in terms of kilowatt per square meter so what is the radiation level we already know as we have an input from here so for different radiation levels for different Pasqual stability class you will see that the failure scenario is being shown now.

For a specific stability class in terms of this one can also look at the intensity radii from the selected source we already selected a source where the vessel is located graphically you know what is the windward direction that is given in blue that is an input data there is a windward direction and this all becomes now down wind direction or what we call release direction now we know what is the width of the specific radii intensity.

Now for a given in intensity one can easily say the red line which you see here is actually a plot of Pasqual stability class D for a wind velocity of 1.5 meter per second for a radiation of 35 kilowatt per square meter one can plot this for different intensity of course the example shown here on the screen now is plotting only for all the Pasqual stability class the radiation intensity is kept as30 kilowatt per square meter.

One can plot this for define or user-defined radiation intensity so intensity radii for the jet fire is now seen on the screen one can also plot what we call let lethality radii or the flash fire for a given source selected in the screen one can also look at the flash fire once I say flash fire it shows me for different concentration for example the k on one what you see here is the concentration of Pasqual stability class D for a velocity of 1.5 meter per second which is occurring at a specific concentration and the downward cross wind direction is shown here.

This will be useful for you to plot the isopleths if you are interested in so one can see for different results as you see as a flash fire for a specific vessel pipe source now continuously one can look for saving of this file as a result.

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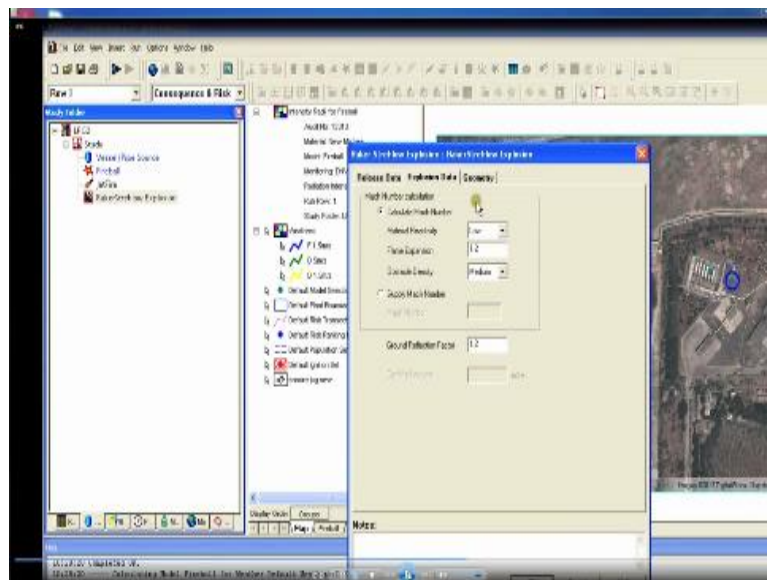
One can look at the different input data what we have given you can see here what all input data we are given for a given problem one can also look at the commentary which is generated from the software for use fast is being used here unique audit number has been generated automatically for the given analysis we are given already default weather and wind speed taken automatically because Pasqual stability class and wind speed is 1.5 meter per second stability

class is D that is missing in this table anyway here the dispersion results are given that is a summary or the commentary what you have the commentary runs in number of pages or 4.

One can see all the data available in terms of how for different Pasqual stability class the warning has been generated and the results have been produced once you do this for a vessel pipe source then we are going for the next consequence failure which is a fireball so again the fireball I have to calculate the risk and I must say what is my fight or what is my mixture for a fireball I already have the new mixture available in my list I pick up that and say okay.

Then I must apply what we call the burst pressure as an input data which is if you understand we are given seven bar then even frequency is becoming one of our important input data which depends upon the experience or the mean data available for similar accidents occur elsewhere in the industry.

So give this and try to compute the fire ball shape one can identify the released mass and give the mass correlation factor and vapor fraction of the mass then one can also calculate the couture data automatically and one will generate the value and run for the report and locate the source where the fireball is located and run the analysis once you run the analysis the analysis run for different Pasqual stability class and you can see the results select all of them and then one can see the results for different stability class as you see from here.

So one can see interestingly the fire ball is developed for different weather conditions the contours generated and that will tell you what is the societal risk and individual risk respectively so one can do it for the jet fire as well so new mixture is again selected which is a given inventively material give the elevation at which going to discharge because you know Jet fire discharge very important for the plume and puff models we already saw in the last module of presentation.

So give the elevation from there they have been released what is the storage pressure in terms of bar what is the temperature at release and what is the hole diameter which is 50 millimeter calculate now what are all the different values required you can also give for a cone model what

would be the angle of horizontal and the crosswind angle or one can give a jet velocity or one can estimate or calculate the jet velocity give the radiation data as an input calculate the geometry from the point and then also do it for the beckets to low explosion model select the mixture as a new mixture available in literature as a standard data.

Give the flammable mass present in cloud as you see here and also give the minimum and maximum distances of interest of your choice where you want to look at or the step size for analysis because vacant stove all model is a numerical model which does this calculation by every step interval so select the step interval select the material reactivity in terms of Mac number one can also supply the Mac number if you know the Mac number for this calculation and give the ground reflection factor because you know interference is a physical presence in the ground will affect the plume and puff model as shown in Bacon's to low explosion models.

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Select the geometry it is a point source and run the data for the given analysis so one can always say it is my new mixture run the data and store the data for a specific location as you see from here for all default weathers as you pre give in the problem so interestingly now you see the contour has been generated for the default risk ranking points it as available from a given source

four different Pasqual stability class no one can calculate the risk consequence and risk analysis from this problem compute there is contours click the risk contour select the default equation system or the ignition point.

Where you want ignite selected from the graph that is the ignition point selected and one can always say what is the ignition probability and operating probability of the specific source of ignition give that as an input data and select the geometric point a specific eluviations then one can also select different sources in terms of what is my ignition there may be an electric line and what is the operating probability of that particular failure or ignition point one can also select default population set for a given problem insert the data for the default population set select the geometry and say that is my population set available that is my population point.

And the population can be given as an input data in this case we are saying two and say okay then population set data can also be given as a rectangle where is an area or density of population is given in input data select the area draw a specific control line or rectangle where you are giving the intensity of population so we are saying for this particular area the density of population is given as an input data which is calculated and given as so and so for a given plant so enter the data and say okay and the population data is now given as a population rectangle which you see here which is Hatcher fill.

One can also give the population intensity for two sources I can create two different intensities as you see in the screen here earlier was 50 the present is also 50 I can create two different intensities then calculate the risk ranking point where I want to calculate the risk selected from graphic point so select that as a point of elevation selected from the geometry automatically also now calculate the plate boundary plant boundary set which you want analyze that is very important as I said it is generally done segment wise.

So we go for a plan boundary as you see selected from the screen now and that is my plan boundary once I select the plan boundary then I show the plan boundary becomes blue in this case after selection then I go for the weather data then you run the row for analysis I have select only one row for the analysis now you can see here now the first row of analysis for consequence

has vessel and pipe source fireball, jet fire, Bacon's to low explosion model all are predefined all weather data are predefined we are now going to do for run all select rows for calculation select all of them estimate the consequence and risk as well for all of them then also give the different factors for analysis which is seen from the screen now for different run rows.

I am giving one it means all of them could occur simultaneously or subsequently run the analysis percentage of progress for running is shown it is doing calculation for every weather window and every Pasqual stability class for different wind speed for different failure analysis now you view risk contours select this particular button for viewing this contour then select that button now you are viewing the risk contours for different failure modes as you see here.

This may risk contour because that is my source that is my population rectangle as you see here two rectangles one here one here for different intensity we also given a specific population concentration now the risk level in terms of what is available average per year in terms of risk density a contour is plotted for example the arrangement shows the risk level is 110^{-6} per average here and so on so forth.

So this we can output of the software then you try to magnify this and see the differences or understanding you magnify this and show where is my source and where is my risk level where is my risk contour etc…one can also generate a report for different run rows.
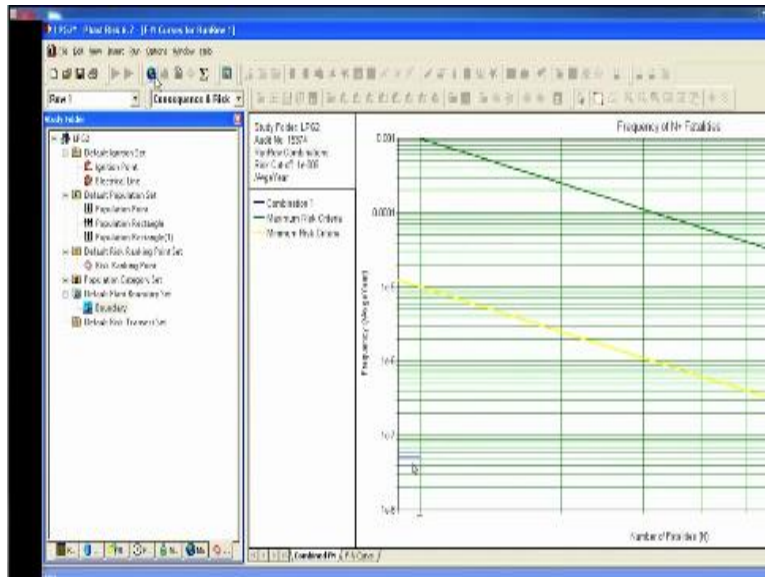
One can see a graphical output which will give me in societal disk now for example for maximum risk criteria which we have specified in the problem minimum risk criteria is also specified in the problem for an f1 curve which gives me the societal risk is also now plotted which can be seen and the combination problem is now the risk level is somewhere here which is much lower than the minimum one for a specific combination of run row one so again select for different sources for different ignition points.

(Refer Slide Time: 32:43)
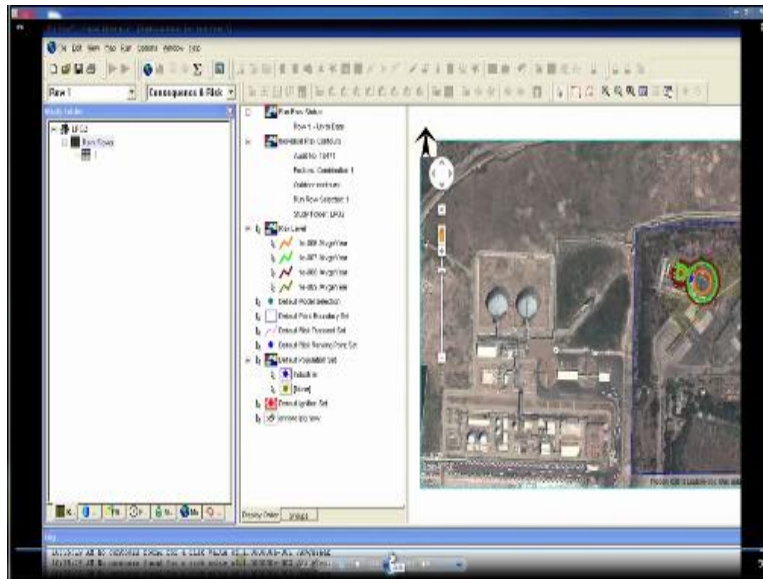
Selected for any other point available choice for example let us say defend the population set change the population set now insert a new population set or edit the existing population set for a run row one now you are giving a new population dimension you are taking the population closer to the source as you see from the screen here so I call this is population rectangle 2 I am giving population earlier I gave 50 now I gave 50 when you move the population concentration to these specific source and the source now categories industrial.

Now I read in the analysis you will see that the acceptable risk level will now change so I have to follow the same procedure giving the factor as one I'm calculating risk for default population two for industrial type run the analysis how for the graphical output risk contours graphical output now you see here interestingly the earlier accept combination line was somewhere down here 1^7 10^7

Now it has moved up closer to the minimum risk value as the population intensity move towards the point of source you will obviously see the risk on the society is much higher so the software gives you a very visual and graphical output in terms of better understanding as you see for the

specific problem one can also see the risk contours is plotted and the risk contours can be available in terms of individual risk contours available here.

And now we can see also the orange one has got now change 1^{10-6} average year it has moved to the point where the population density is being now focused so it gives you both societal and you individual risk in terms of graphical output.

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And that is the point of interest so it is a fastest software which has been demonstrated for you for your problem so interestingly ladies and gentlemen we have understood that how the problem can be solved using a standard software which gives you an hands on experience of better understanding we picked up a specific example define the consequences also understood how to give input frequency of failure for each one of them identified the risk estimated from the software elaborated them in terms of India societal risk which can available it is graphical contour or of graphical plot.

So these kind of software experience will help you to understand physically visually virtually how he risk analysis can be understood very easily and first-hand experience can be achieved thank you very much.

(Refer Slide Time: 35:19)

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