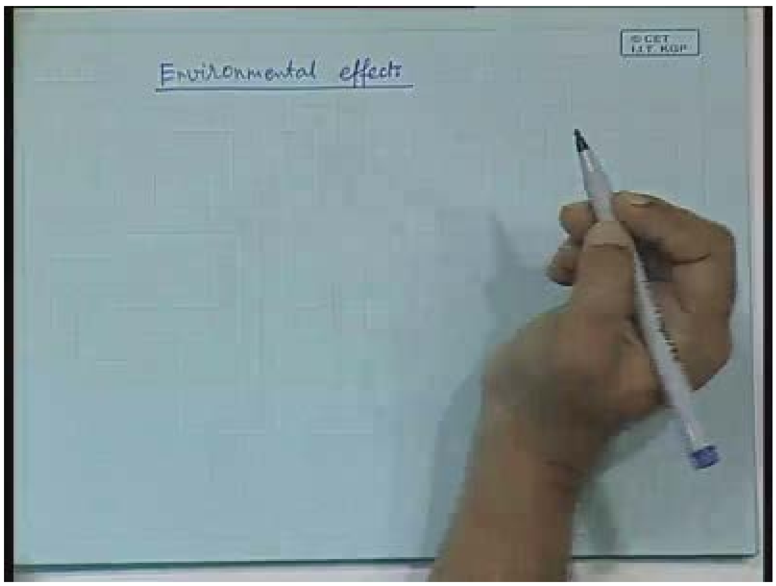
Energy Resources and Technology
Prof. S. Banerjee
Department of Electrical Engineering
Indian Institute of Technology - Kharagpur

Lecture - 14
Environmental Effects of Conventional Power Plants

… about the environmental effects of, today we will, we will cover all the power generation schemes, conventional power generation schemes.

(Refer Slide Time: 1:09)

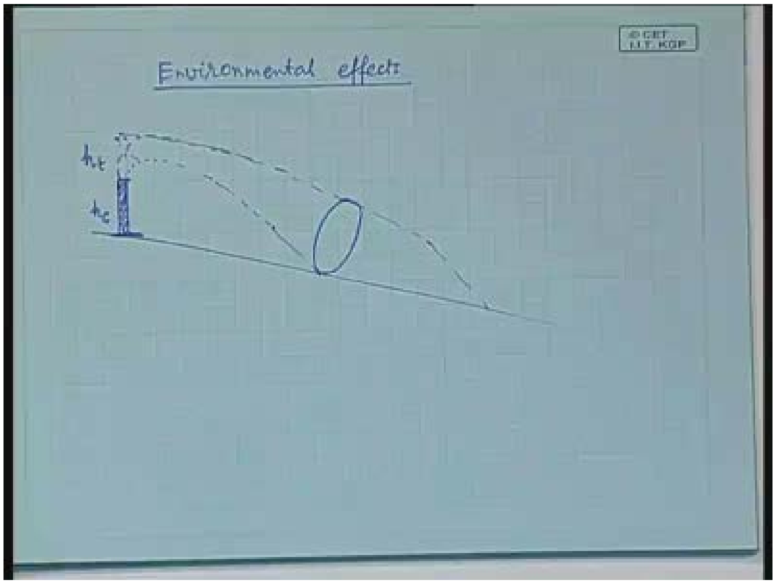


So, we will talk about … In case of thermal power, we have seen that it can be air pollution, it can be water pollution, it can be solid pollution, in the sense the ash dispersed into the environment is also harmful if the ash contains caustic substances. Let us first today take up the issue of the air pollution distribution. That means as I told you the flue gas that goes into the stack that has a certain temperature; it has to have a certain temperature, because otherwise it does not go out. In order to, in order to allow it to go out, it has to have a certain temperature, so that it has a buoyancy and it is not difficult to see that if it has a buoyancy, then it will rise a little bit above the end of the chimney, so it will go a up a little bit and then it will disperse and which part is the affected most, where the plume touches the ground.

So, if you have to calculate how much is the maximum pollution level caused by a power plant, you essentially have to talk about where the plume touches the ground and if you know the amount of sulphur in the coal, then it is not difficult then or if you know how much NO x is produced, because that is dependent on the temperature, you know the temperature, you can calculate how much NO x is produced. So, if you know the NO x concentration in the plume gas, the flue gas, then can you calculate what will be the pollution level at that place, right? So, that is, that is the prime consideration when you talk about the environmental effect.

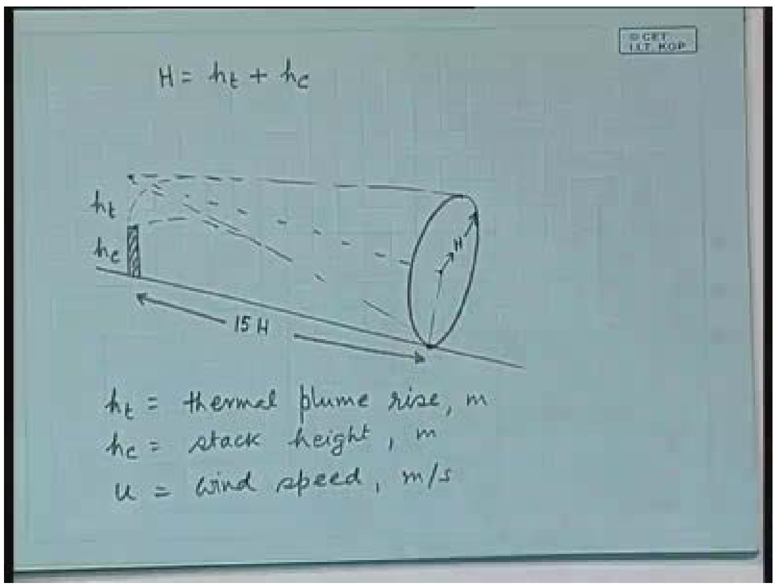
So, let us today first talk about the maximum level of pollution encountered in the region around a power plant. Remember, that calculation is also valid for any industry where the stack is giving out some kind of a noxious gas. It is also true very much for the steel industry. If you go to Jamshedpur, you will find quite a bit of smoke coming out of the chimney, so the same calculation really.

(Refer Slide Time: 3:43)



So, in this case you have some height of the, so some height of the chimney and above that it rises to some other height. So, you assume that it rises to this height or it actually goes like this. Can you see? So, this is the stack and if you join these lines, it reaches a point somewhere here. So, you can assume that the flue gas rose to this height and then it was dispersed. Even though these lines are not really straight lines it is not unreasonable to assume that. So, suppose this height is h c, height of the column and let this height be h t; this height means the height to which the plume rises. Now, it sort of, suppose this is the ground, it touches the ground at some level and you may see that here at this point you can assume a circular cross section, so here it has touched the ground. This is the ground level and you can assume a circular cross section in which it is sort of expanding, clear. If you draw a line, oh, I should draw it separately the drawing should be correct.

(Refer Slide Time: 5:32)

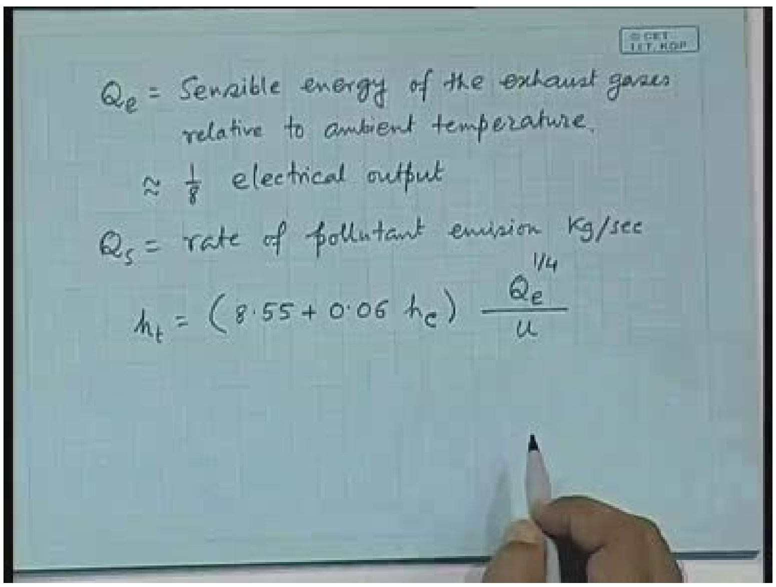


Suppose this is the ground line and this is the height of the chimney and suppose this is the height to which it rises, so this is h c and this is h t. At some distance it touches the ground, at which level you can draw, you can assume that to be, if you draw a line here you can assume that to be a circular cross section of radius this much. So, this height, this is how it is sort of expanding. It is actually going like this, but you are extending those lines to go there, so that the total height H is h t plus h c and this radius is also H.

Now, the question is after how much distance will it touch the ground? In general it has been found that this is of the order of 15 H, so things are expressed in terms of H. You might ask how much should be the h t, because everything if it is calculated on the basis of the total height, then you need to know how much will it rise. That obviously is dependent on the energy content in the flue gas and all that. So, let us see what they are.

So, what you have seen, h t is thermal plume rise, h c is stack height. These issues that we will be dealing with are very important, because you may notice, as you go to Calcutta there is a Kolaghat thermal power plant. It has three stacks that are shorter and then in the newer stage, they are, they are far taller stack. Why because, it was found that the shorter stacks were causing problems, so they have built longer stacks. So, these, these calculations that we are doing now are important in the sense that you need to bring down the level of pollution below a certain level and that really depends on the choice of the height. So, let u be the wind speed. These are all in meters and this is in meters per second, we will come back to that.

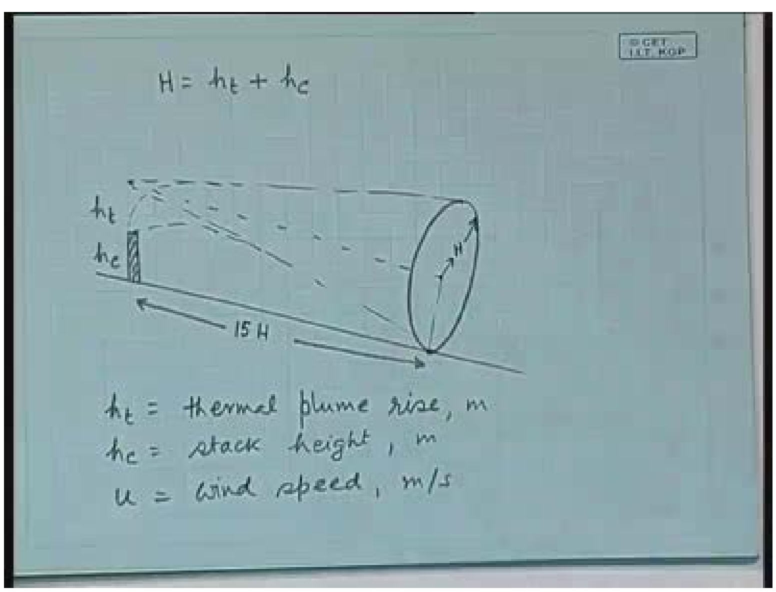
(Refer Slide Time: 9:00)



Your, let Q e is the sensible energy of the … relative to the ambient temperature. Do you have any idea how much it is? It is the energy contained in the flue gas. How much? In general, rough estimate is about one eighth of the electrical power output of the power station. So, this is approximately one eighth of the electrical output. So, one way of estimating this is to know the temperature, know the volume and then from there you calculate or at least for the rough estimate, you can simply say that the power stations power generation capability is 210 megawatts and therefore, the amount of energy content in that will be roughly one eighth. Q s is the … This is kg per second. What is this?

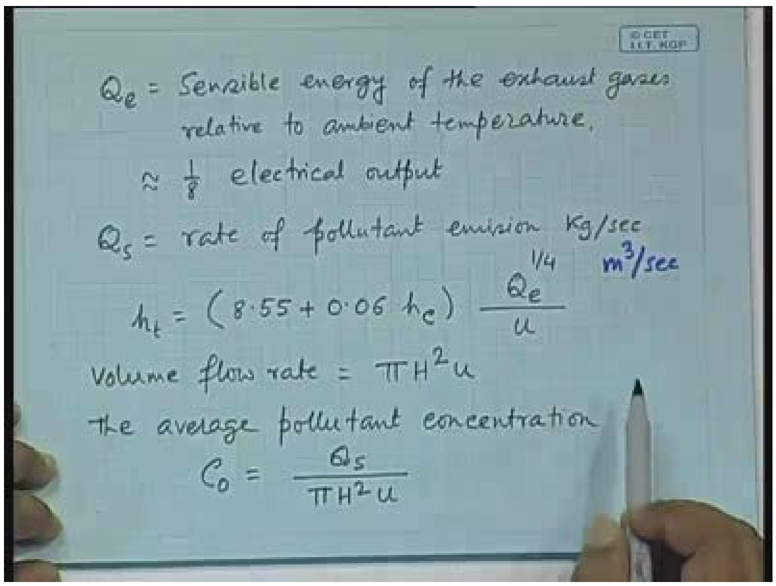
Suppose you are talking about the SO x pollution, then how much SO x is there in the flue gas in terms of kg per second that you will need to know in order to calculate. Then, a most important thing is to know the h t. How much does it rise? It cannot really be calculated, because it has to be obtained from empirical figures. People have tried, observed and seen that it has, follows a relation. So, normally this figure is something like this. It should depend on the energy content to the power one fourth divided by u. Obviously, it should depend on the stack height, it should depend on the energy content, it should depend also on the wind speed. It should be inversely proportional to the wind speed. The more the wind speed, the less the height, so, so on and so forth. So, the dependence is more or less intuitively clear, but the exact functional form that has been obtained from empirical studies is something like this and you have capital H is equal to h t plus h c.

(Refer Slide Time: 12:18)



Now, let us look at this. The plume rises to this height and then that expands like a, like a cone and finally it reaches this particular point. So, when it reaches this particular point, so what is the volume flow? We are interested where it touches the ground. That means it has come to this level and now we are interested in the volume flow rate of the pollutant. So, how much should that be? Depends on the area, depends on this flow rate.

(Refer Slide Time: 13:04)



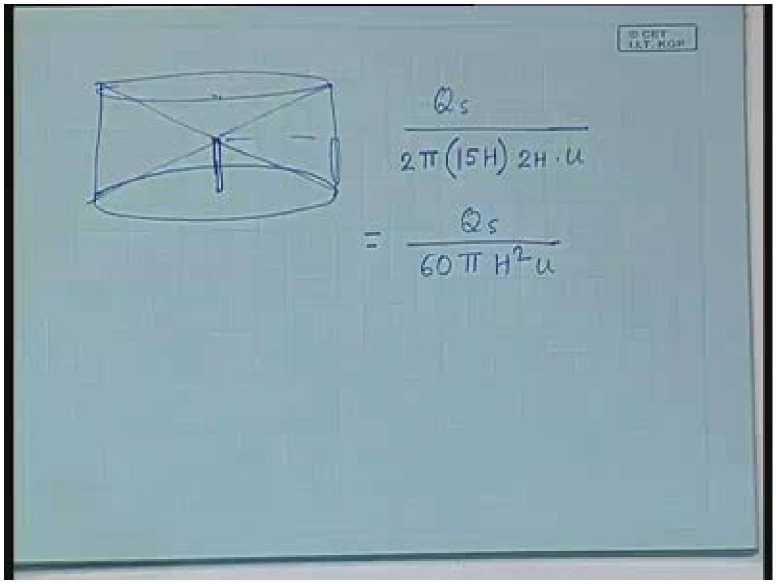
So, volume flow rate would be …, right, pi H square u. Now, the average pollutant concentration, average pollutant concentration in the plume in this plane, particular plane, in this particular plane would be C o is, it should be expressed in terms of the rate of pollutant emission, this amount of pollutant was emitted divided by the total flow rate. So you have, Q s divided by pi H square u. So, that is simple affair. You have this expression for the average pollutant concentration. So, what are the units, what are the units? Q s is in kg per second. This has to be expressed in, wait, wait, wait. You need to express it, because when you were talking about the pollutant concentration in a fluid, normally you do not talk in terms of a kg of fish or something like that, right; it has to be a very small, tiny, trace quantities. If something is in tiny, trace quantities, you do not talk about kg’s. It has to be, say microgram per meter cube, that kind of units, clear.

So, this fellow needs to be expressed in microgram per meter cube; that is the unit in which pollutant, pollution is expressed and here this fellow was available in kg per second. Why because, you knew how much sulphur is there in the coal. So much coal was used in kg's, a fraction of that, so much kg's and the rate of, rate at which the coal is consumed, if you know that that can be expressed in this term. So, this is available in this term and this needs to be expressed in that term. Can you check whether it will automatically express in this term? Check that, the units. This is available in kg per second, so this should be microgram times 10 to the power, how much and so you just calculate that.

The other way to express C o in which people talk about is ppm, parts per million. So, see this is a gas. How much of, SO 2, SO 3, SO x is there in a large quantity of air that is another way of expressing it. In that case, this also needs to be available in terms of the volume. So, remember, when you talk about this equation, remember these units, because ultimately if you say somebody that there are so many kg's of pollutant in your place, that does not make any sense. Either it is microgram per meter cube or ppm. So, if Q s is in, it can also be in say, meter cube per second. It is after all a gas, so it can be expressed in meter cube. If it is in meter cube per second, then it will be expressed in ppm. If it is in kg per second, it will be available in microgram per meter cube. So, we have understood at least this part.

Now, this is the instantaneous concentration. This much was being emitted and out of that, this much reaches there, but that is instantaneous. The wind is flowing in this direction. This fellow is standing there, so he is sniffing that amount, the maximum amount. But then, after all over the year what happens? Wind direction changes, so a particular radius around the power plant gets affected at the distance, 15 H. So, there if I ask you, ask you to calculate what will be the average level of concentration over the year, assuming more or less uniform directional changes of the wind, then can you calculate? It is a, it is a radius in which things are reaching and I want you to calculate the average of that. So, you have to assume the random wind direction. If it is directional, then obviously it will be skewed in one particular direction. But assume randomness, then you have, how will it be?

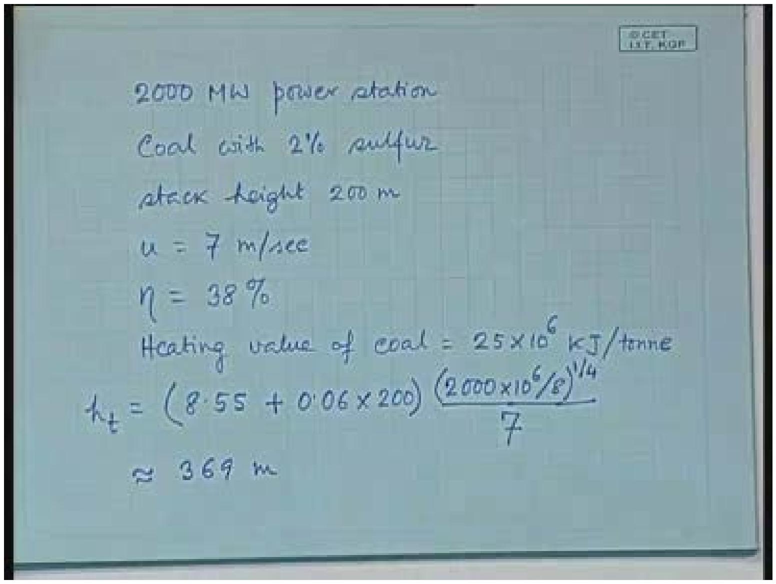
(Refer Slide Time: 18:57)



It will be like, if this is the height and this is the thing, you will, you will be talking about a cylindrical area in which it sort of spreads, right. It will, it will be spreading over this kind of cylindrical area and we are now interested in how much is the concentration there over the year. How will you calculate that? That will be Q s divided by this area of the cylinder. So, that is twice pi this radius is 15 H into this height is twice H. This height is H, right and the whole thing is twice H so, times u. Notice here, here this height is H. The whole thing is twice H, so you need to talk about twice H in this case. So, this is equal to Q s divided by 60 pi H square u. Again, depending on in which units Q s is expressed, you will either have it in ppm or in microgram per meter cube.

Let us tackle a simple problem, a practical situation.

(Refer Slide Time: 21:06)



Suppose there is a 2000 megawatt power station, very standard size of the super thermal power stations that NTPC is installing these days, the one in Farakka is about 2000 megawatts, the one in Korba is 2000 megawatts and so on and so forth and suppose it burns coal with, you just assume this, 2% sulphur. That can be known, Indian coal has relatively less, but nevertheless you assume this in order to calculate it, in order to learn how to calculate it. Stack height, let the stack height be 200 meters; let the wind speed be about 7 meters per second; all these are very standard values

Student: …

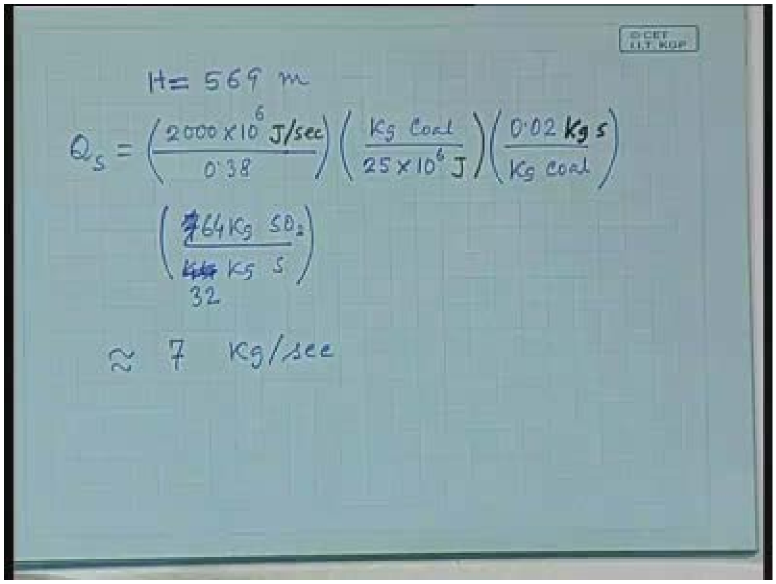
No, presently we are trying to calculate it now, at this present moment this is the speed at which the wind is blowing and so we are trying to calculate it. If you have to do it over the year, this speed has to be the yearly average mean speed at that particular location. So, this is the, what other information you would need? The efficiency of the power plant; efficiency of the power plant can be assumed with reasonably good figure about 38%. You need to know, you need to know this, sensible energy, right. Yes, so this, in order to calculate one by eighth is a very, very rough quantity as I said. You can always calculate that better, so this needs to be calculated and for that you would need the heating value of the coal, right. So, is 25 into 10 to the power 6 kilo joule per tonne, all right.

The first thing is to calculate this. So, let us calculate this. h t you need to calculate. How much will the plume rise? That is 8.55 plus 0.06 times, how much is this? 200, right, times it is Q e to the power one fourth by u. So, Q e is the, is the, so it should be, it can be calculated from there. You have total is 2000, 2000 megawatts. So, this is the power generation capability and approximately, therefore the heat contained in the flue gas would be one eighth, so and this has to be to the power one fourth, clear, divided by u. u is 7. Can you calculate what this is? You have a calculator? None of you have it? Yeah, do calculate. When I calculated sometime, sometime back it came to be around 369 meters.

Student: …

No, no, no, efficiency at this stage will not come, because the sensible energy of the exhaust gas that is what we are interested in. That is about one eighth of electrical output that is what you are using. Electrical output is 2000 megawatt and that is enough for our purpose now. So, we are using this relationship really. We will use the 38% later somewhere else, at least for this the approximate value suffices. So, the initial stack height is 200. It additionally rises to this much, so the total height is 569 H.

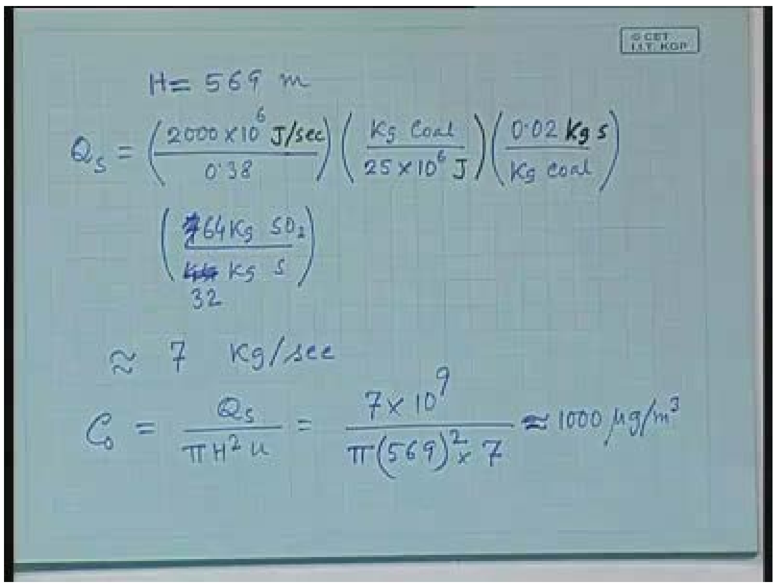
(Refer Slide Time: 26:51)



So, H is 569 meters. Now, you need to calculate Q s, Q s, this first. The total electrical power output is 2000 megawatt divided by the efficiency, you get the total heat generated. In order to produce that much of heat, how much coal has to be consumed and within that coal how much sulphur is there? So, you will understand the way of calculation it is there that you need the efficiency. So, you will do it like this, 2000 into 10 to the power 6. What I will do is in order to make things clear, I will also write the units here, so that you get things clear. This is joules per second divided by 0.38, non-dimensional. So, this is one part. This has given you how much heat generated.

Then, it has to be multiplied by the kg coal divided by, divided by, where did I keep it? Yes, the heating value. So, heating value is 25 into 10 to the power 6. Now, you have joule here, right. It was kilo joule per tonne was there, which comes to joule, joule per kg. So, you just multiply it, 10 to the power 3, divide 10 to the power 3. It comes the same. Now, you need to, need to use the, how much sulphur is there, how much sulphur is there? 2%; so, it should be 0.02,2%. This is kg in second, sorry, I was writing in black, divided by the kg coal. Then, this is the amount of sulphur that is generated per second, but sulphur is not what you are interested in. You are interested in, SO 2. So, how much sulphur generates how much So 2? Can you tell? You know that amount, that amount of chemistry. So, times approximately, so 76 kg of SO 2 by 44 kg of sulphur. S is 32 and 64 by, yeah then it has to be that, it is about 2. So, if you calculate this, then you get how much? Essentially, this will give you the value. Probably it will come to be approximately 7. You calculate it once. So, if it is approximately 7 kg per second, then the next step is to calculate this.

(Refer Slide Time: 31:57)



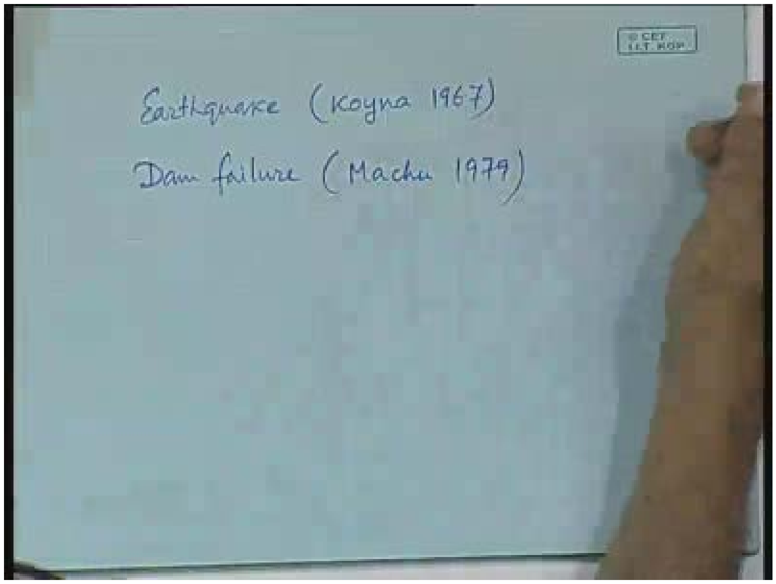
So, you have C o is Q s divided by pi H square u. Any problem, is pi H square u; this is again 7. We are talking about microgram, so it will have to be multiplied by … divided by pi H is 569 square into 7 meters per second. So, how much does it come to be? Approximately you can say 1000. So, this is how the calculation is done ... Do you understand? That if the pollutant substance is something else say NO x, say suspended particulate matter, say in case of any other industry some other thing is coming out of the flue gas, then you can do it the same way, the calculation. So, because …. need to talk in terms of numbers, amounts. You should be able to calculate the amount of pollution that reaches the ground at a certain level.

But, as I told you this is the spot pollution, the pollution that is that reaches a spot. But what about the pollution that reaches globally? The amount of carbon dioxide that is generated and released globally that as I told you is a major problem, because of the greenhouse effect, which we are feeling, right. Now, we are in the middle of a greenhouse phenomenon, the weather is changing. Every year Cherrapunji and Mawsynram used to receive huge amount of rainfall, this year it is desert. Every year Rajasthan is a desert, this year it is flood. So, we can see the effects that we are facing and all these are because of the increased release of carbon dioxide, methane and other greenhouse gases into the atmosphere.

So, coal, coal based power generation is not all that a benign source, you need to understand that. It is true the amount of carbon dioxide that is generated that effect can be at least partially reversed if we plant as much trees, because trees absorb carbon dioxide and release oxygen. So, it has the opposite effect, but the rate at which this is done, what has actually happened? The coal that we are now burning is accumulating the same process. That means in the past, the trees absorbed the carbon dioxide, released oxygen into the atmosphere, bounded the, they did bind the carbon and that is what is stacked and what was stacked over a million years is being released into the atmosphere over the period of 100 years. So, obviously it is extremely difficult to reverse that simply by planting trees. But, yes, we should plant more trees, because whatever we can do we should do. But, the effect is actually the opposite. What is actually happened is the denuding of the forests as a result of which the effect is even more pronounced.

In case of the hydel power, we need to understand its effects also. In the face value it looks as if it does produce no pollution, because it does not release anything into the atmosphere. The water that was there, the same water flows, so true, granted that as far as environmental impact is concerned, it has much less environmental impact, but there has been many. For example, where there was no reservoir, no water and therefore, no weight at a certain level, certain elevated level, if now you create a reservoir, you create a mass of water, there obviously that mass of water has weight, so that acts on the Earth beneath and it can create the seismic activities, the earthquakes that was not there earlier.

(Refer Slide Time: 36:39)



For example, there has been a major earthquake in the Koyna dam in 1967. The dam did not break all right, but there were you know cracks and all which had to be repaired with lot of expenditure. But, if it does break that means something like a dam failure that is as I told you is a major devastation and such things happened in one dam in Gujarat. It is called Machu dam. That was in 1979 that wiped off a complete village and caused devastation in the down side planes. So, that has happened. So, you remember this is a, something happens if you have a very big dam in a place where there is some kind of a possibility of seismic activity. But, it is also true that there are many, many other dams that are completely aseismic. For example in this part Maithon, Panchet and these things have not experienced any seismic activity.

The other problem is that the reservoir capacity that we create, that reservoir capacity normally it is told that a reservoir or a hydroelectric power plant lasts for a 100 years; it is said, you will find in figures, while a thermal power plant lasts for about say 40 to 50 years, not more than that. Naturally, the effectiveness of the investment is much more in case of the hydel power plant. But, the reservoir that you create, the dam, the base where the water is held you see various rivers and rivulets are coming into that, dumping water into that and it dumps not only water, but also silt and because the water is stagnant, the silt precipitates there. It does not flow through. So, the amount of water that a dam can hold that goes down over the years and over a period of 30-40 years, normally the capacity is too low to be of any use for the electrical power generation.

There are many places which are now being used mainly for irrigation purposes, because that has to be done and electricity power production is almost nil. For example, Bhakra Nangal dam in India, in Punjab, that has experienced this problem hugely, because in the upper reaches there has been, you know forests have been denuded, as a result of which the amount of soil that it could bind now had become loose. The rain comes, takes away the soil and dumps into the dam. So, I hope you understand this particular issue, because that needs to be understood.

The way you can check siltation or soil erosion is by having trees. Why because, the erosion actually happens when rain falls and if rain falls on bare ground, that etches away the soil, while if it falls on a leaf and then drop down, it does not have that much of kinetic energy to take it away. So, if you will find in Kharagpur itself, during the rainy season if you look at the water that passes through the drains, you will find in those places it is more or less clean water where it fell on the leaves and then it dropped on to the ground, but there are also places which are more or less …. in the sense and you will find that the water is muddy. So, the way to check this is actually in the upper planes, upper reaches, you have to have sufficient amount of vegetation ….. So, if that is not there it is ….

For example, in San Francisco delta, there has been a huge amount of this particular problem, sedimentation problem. Also, see the water is coming in and what happens to it? It evaporates from there, it evaporates and normally in such, such stagnant water, water hyacinths grow profusely. As a result, the evaporating surface increases, so the total amount of evaporation becomes larger. The water that has come in had certain amount of, different types of salts contained or content? in it. If it evaporates, then what happens? The salinity increases and that high salinity, that particular water actually is used for irrigation and when it flows through the hydroelectric plant, it goes to the lower reaches of the river, so there is a salinity problem and that particular problem has been quite prominent in some of the hydroelectric sites.

So, for example, on the river Volga, there have been a large number of hydroelectric power plants that has experienced this problem quite severely. Because of this salinity increase, the whole composition of water changed. Change in the water chemistry, if that dam were not there the water had a certain chemistry and that chemistry changes. For example, in the river Colorado in USA, the USA has been studied quite extensively, it is found that there has been a large change in the quantity of or large change in quantity of salts or the soil, water chemistry has changed. In some cases, in such cases, the water that is there in that dam may not be found suitable for irrigation purposes, because of the changed chemistry.

The biological effects include the increase in the water hyacinth; biological effects include the change in the fish population. Because it was a flowing river, if it is a flowing river there has to be, there can be one kind of fish that migrates. In some cases, there are fishes that migrate upstream to ponds to lay eggs. That obviously is completely blocked if you have a hydroelectric plant and a dam. So, the whole biological flora and fauna in the river that also changes and most importantly, the amount of people displaced is huge in case of a hydroelectric plant, because the amount of area submerged is larger and that has been a major problem, major bone of contention in the recent Narmada controversy.

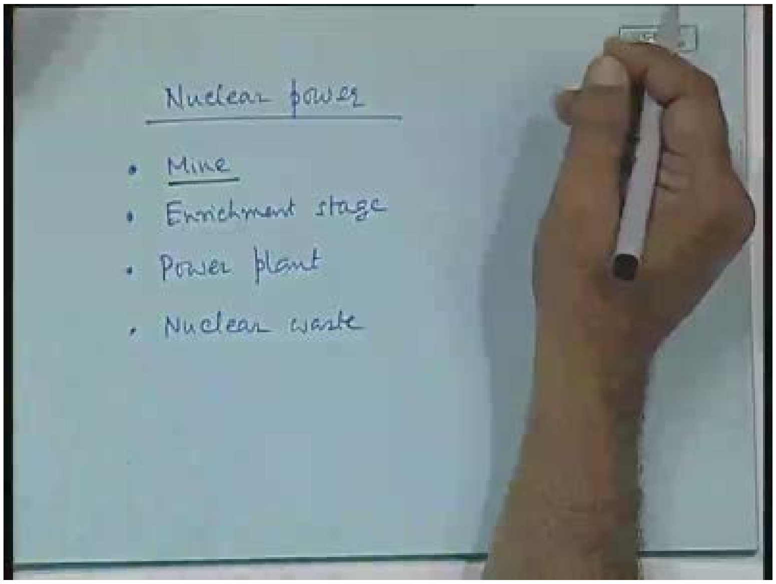
So, you see, hydroelectric plants even though that looks on the face of it to be environmentally benign, it also has its effects, environmental effects, which should be taken into account. At the same time, you should keep in mind that the effects are relatively lesser in smaller dams, effects are none in run off the river hydro plants, very little effects in the run off the river hydro plants and the more the size of the dam the more these problems. But at the same time, in order to have constant flow of power, constant generation of power over the year, even the dry season, you need to have that much of storage. So, it is a balancing act the engineer has to do.

In case of the nuclear power plant what are the environmental effects?

Student: …

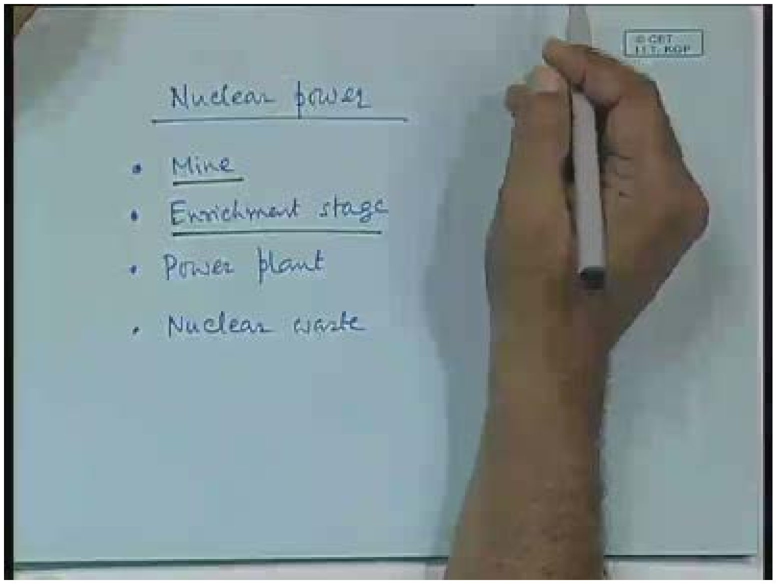
Well, well, well, there are a few things we need to keep in mind.

(Refer Slide Time: 44:48)



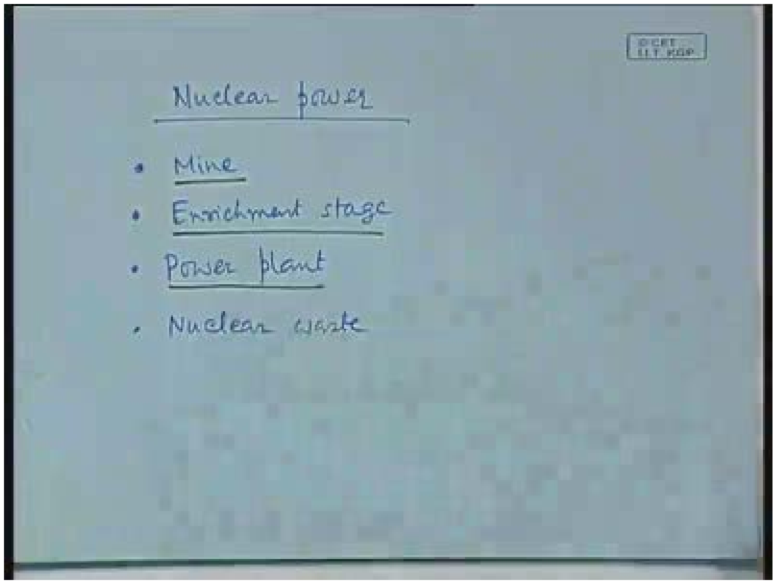
In nuclear power, there are few stages. Remember, the thing that you are handling is radioactive, but at the same time it is true that that radioactivity was there in the nature. In that phase it was there, but now you are concentrating it, it is becoming much more radioactive, much more dangerous. So, it starts number one, from the mine. Then, the enrichment stage, then the power plant, then you have to talk about the nuclear waste. In the mine, for example in Orissa, there is mine in Jaduguda and unless proper precautions are taken the miners or the people who are associated with handling that ore, mostly these are tribals who do not know the nature of this ore, they are affected very severely and it has been found that in this particular case in the Jaduguda mine, a whole area has been affected and there has been a very high increase in disabled children, the birth of disabled children there. You know, people with also sorts of deformities, in that cogenetic deformities. So, mine is one area in which there can be pollution, unless the people who handle it are careful enough and in India the problem is that people are, people can get away not being careful and therefore they are not careful.

(Refer Slide Time: 46:39)



The enrichment stage happens in some specific plants. So, the ore has to be transported to that place and the ore transportation, since it is a huge amount of mainly clay material that happens without much of precaution. That is another problem. It has to be, proper precaution has to be taken to contain that, say to the enrichment site. Enrichment means that you enrich it in the form of uranium 238, uranium 235 and the rest of the things are thrown away. Now, the rest of the things also contain radioactivity. So, that rest of the thing that is also radioactive and therefore its disposal is a problem.

(Refer Slide Time: 47:27)



Come to the power plant stage and many people point out that in modern power plants the possibilities, chances of accidents are very low and as we have seen, when we were talking about the different types of nuclear power plants, the one that has boiling water reactor is somewhat environmentally problematic, because the same water that goes to the core of the nuclear power plant, that same water goes through the turbine, to the condenser and stuff like that. So, the whole place becomes radioactive and that is obviously environmentally not so benign. But then, you also know that there are other designs - pressurized water reactor, the heavy water reactor, the gas cooled reactors, where the coolant is something else. The coolant is not the same as the fluid that actually boils. What boils is water, but the coolant is something else. So, as a result of which the radioactivity is contained within the area very close to the core.

So, you have the core and in India, most of the reactors are of that type. Therefore, things are relatively in better shape than the places where most are boiling water reactors. So, only in the core you have buildup of the radioactivity, but then it has a lifetime. It has a life time means after say, 30 or 240 years at most, the things are to be decommissioned. Normally if you decommission an electrical power plant nothing happens. You simply give a tender and somebody comes, takes away nut, bolt and every iron parts and sell them, no problem. But in this case there is a problem, because all the iron and all these parts have become radioactive. Now, you cannot handle them, now you cannot really sell them as scrap. So, what do you do with them?

Actually this problem is still a nagging problem, because the time the nuclear power plants started being commissioned, now it is time when they are starting being decommissioned and we understand the problem that really nothing can be done to them. They have to be there without, beyond reach of any humans for say about a million years, because they have become radioactive with half-life of that kind of range. Obviously, you cannot do anything about it. The fuel core that is spent what do you do with that? Obviously that contains a large amount of plutonium, remember, because the fuel had a large amount of uranium 238 that turns into plutonium and what many of the nuclear countries do, America especially, is to use that plutonium to make bombs and another thing they do, you should know that, that is the uranium 238 that was there, in spent fuel fill whatever amount of uranium was there, uranium 238 was there, that is extracted and made into bullets, made into bullets.

Why because, uranium is very heavy substance and this heavy bullets, small volume heavy mass they are the armour piercing bullets. So, they have been used this time in Iraq and they have been used in Afghanistan. So, wherever there is armoured cars or tanks, in order to destroy them, these bullets are used and these bullets are therefore scattered in the country side and the radioactive bullets are now found everywhere in those countries where they have been used. So, spent uranium bullets are now being used as traditional armour, traditional armour piercing ammunition. The plutonium used for bombs, uranium is used for … So, you can see much of it is used for war purposes rather than peaceful use. That is why it is opinion of a large number of people that the amount of peaceful use that we see around the world, they are essentially the background industry for military use. That is another opinion that is floating around.

So, these are issues that you need to understand that the countryside is being littered with nuclear waste, because these are also traditional weapons, not only nuclear bomb. But, apart from that what do you do with the nuclear waste? Supposing you are good enough, you do not want to do those things, what do you do with the nuclear waste? Actually nothing can be done, because they are radioactive and they will remain radioactive for millions of years. So, what can be done to them? Actually nothing is done to them and what are done to these things are somewhat hazardous.

France for example, encases them in concrete chunks and then drops them in the sea. USA for example does the same thing, but at the same time they also put them in concrete blocks and puts them inside the mines that are no longer used. Many of the advanced countries, many of the advanced counties buy out old mines in not so advanced counties. For example, in Africa they buy out old mines and they dump the things there; not in my country, but there. So, those things are also there. So, essentially the point that I am trying to raise is that we do not have yet a complete solution to the nuclear waste disposal problem. It is yet not scientifically dealt.

So, even though the nuclear power generation is environmentally not so hazardous as say thermal power, because it produces a larger amount of carbon dioxide, nuclear power produces none, but nevertheless these problems need to be overcome first at least on a scientific level, research level, in order to make the nuclear power really environmentally feasible. Since it has not been found, many of the advanced countries even, including USA are now going slow on installing new power plants. For the last 15 years, not a single nuclear power plant has been commissioned in many of these counties. So, let us stop it now, it is time. We will continue.