Introduction to Machining and Machining Fluids
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Lecture - 15
Machining Fluids/Cutting Fluids and it is Emissions in Machining

We were discussing about Machining Fluids or the Cutting Fluids and it is importance in the Machining Process, at the same time it has as some problems with its emissions just summarise about.

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What is its importance manufacturing sector if you see it is sector with largest waste contributor? So, waste in terms of machining fluids are chips and so are so cutting tools those are broken and warn out and in the manufacturing sector if you see the basic problem comes with this one is a machining.

Basically manufacturing sector the machining is one of the most important part of the manufacturing, at the same time I was telling about the you that manufacturing cost about 60 percent are the 60 billion tons of the waste in the complete waste per year this is as per the US standards, which is taken long back. So, current trends are not given here. So, the most waste that is given is this manufacturing followed by the mining, oil and gas, agriculture, mini discard coal and other ok. So, the major important one is manufacturing.

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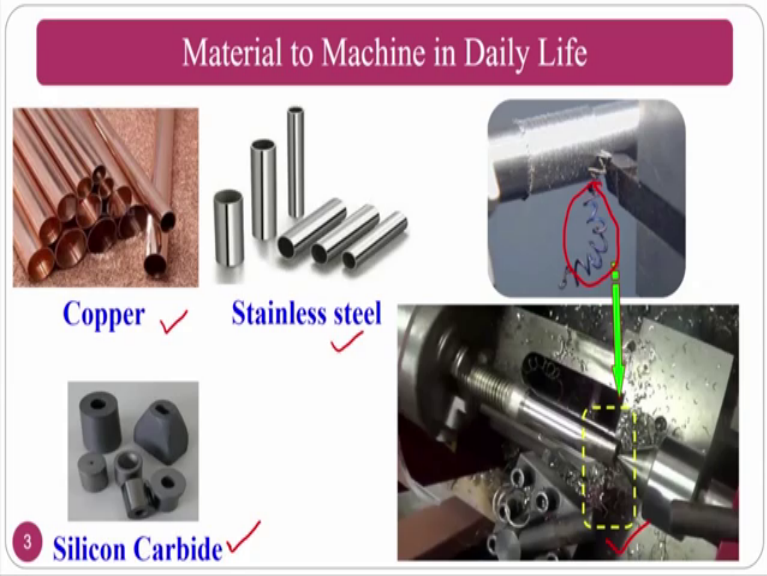

Normally what the common materials in the daily life that are machine in the small scale industry to the large scale industry are copper stainless steel that is iron based alloys and the other things.

If you see, if I want to machine the stainless steel these are the common materials if you see the copper and the stainless steel are the common materials that are machine and if you see the advanced machines like ceramics silicon carbide is one of the materials, that one can machine if the customaries product has to be fabricated, if you see the machining operation as such machining of a stainless steel are a p based alloys.

Normally this is the area where you can see zoomed up and this is how the machining takes place, if you are the seeing at the chip that is here it has different colours from brown colour to the blue colours. So, this is because of the temperature that is developed in the machining process from this you can understand the basic problem in the machining processes is heat generation and its temperature distribution.

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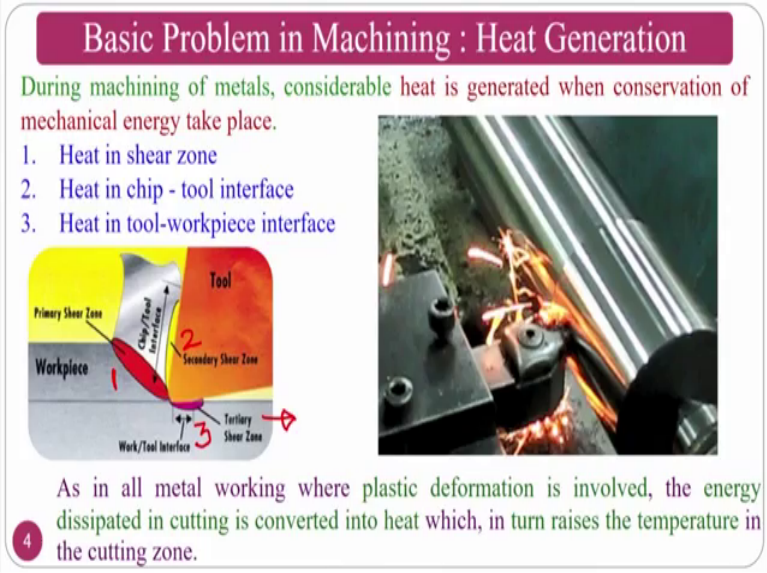

That we have said it already, so the basic problems in machining is heat generation if you see the during machining of metals basically the materials are which we are studying in this aspect is basically the materials, the considerable heat is generated when conversion of mechanical energy takes place, mechanical energy that is plastic deformation followed by the shearing which leads to the heat in shear zone that is called this one is here.

So, heat in chip tool interface this is 2 and heat in tool work piece that is 3 these are the 3 heat generations that are developed the first one is because of the plastic deformation followed by the shearing. The second one is because of the rubric action between the hot body that is a chip and the rake surface. The third one is tool flank surface and the workpiece that is coming out, this is the workpiece which is coming out this is 3 generations or 3 are the heat generating sources. So, in all this metalworking where the plastic deformation involved the energy dissipated in the cutting is converted into the heat which in turn raises the temperature with cutting zone.

So, that heat generation creates the temperature, if you see here that we have specially taken a video how the heat is generated. So, for exaggeration purpose we have given the high depth of cut and feed. So, that you can see the fire also I cannot see it is a fire you can see the chips that are redded chip that are glowing you can see here, the machining operation is going on even if the machining operation is going on. So, continuously there are workpiece is rotating with the high depth of cut and feed that is given already. So, whenever its cutting this is normally what we are cutting is hardened steel with carbide tool.

So, you can see the how the chips are coming with red hot and you can also see some of the continuous chips forming there itself, which may also destroy the surface finish you can see now the chips are entangled there itself in the machining region. So, it is if this is a situation now you can understand how the heat generation in this picture.

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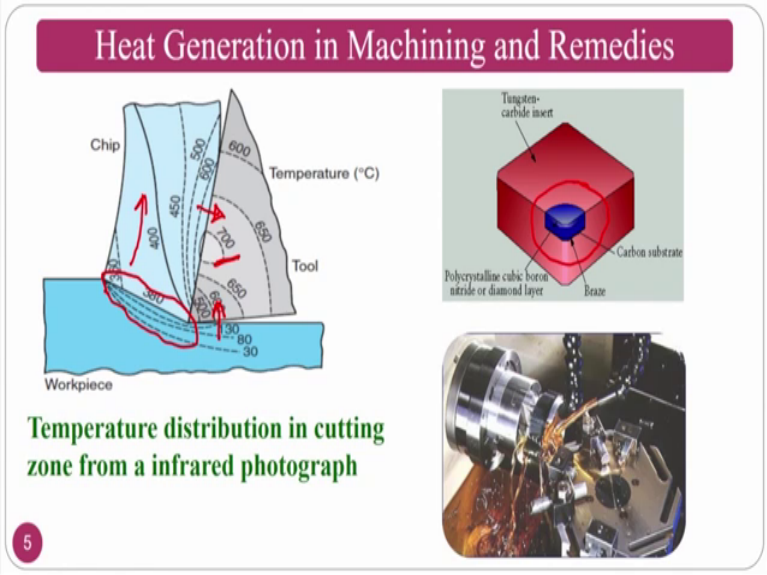

So, now if you see here in the previous slide, which we have seen here is that heat generation and all those things which we have seen that is corresponding to the temperature distribution and all those things. The heat generation in machining, if you see a common materials like h s s versus mild steel or some other carbide tool versus some of the mild steel and all those thing and this is a common material, temperature distribution because this is the shearing zone, where the maximum heat is generated and this is mostly carried by the chip.

This is the chip mostly carried by the chip, and this chip conducts into the work tool material and work piece also carries this also conducts partially to the tool. So, the chip carries most of the heat that is generated that is why the chip tool interface is the major temperature you can observe. So, approximately in this picture you can see the 70, 700 degrees what temperature that is recorded which we, we have see from the picture.

So, the chip and tool interface gives the maximum temperature. So, in order to prevent the problems that are facing here, because if the temperature goes up the basic problem comes is thermo softening of the tool material and tool were takes place to avoid these

are to find some remedies, in order to increase the tool life and all those things. There are basically two ways, one is finding the harder tools that is using the diamond cutting tools are C b n ceramides, and all those things that is what you can see in this picture which is C b n polycrystalline cubic boron nitride are diamond tools that are the given here.

The other thing is we can use the cuttings fluids, since we are studying in this particular area about the machining fluids or cutting fluids we will see what are the problems and what it its functions of this cutting fluids.

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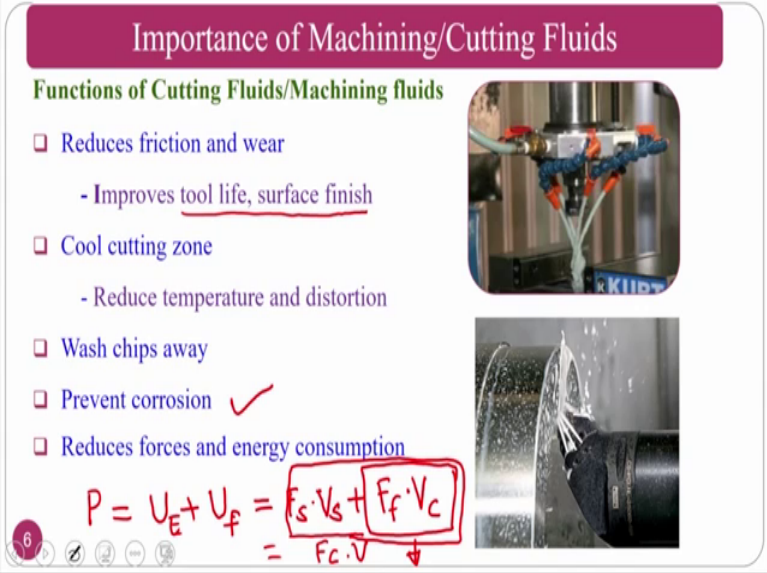

So, importance of machining or cutting fluids basically the cutting fluids are used for many functions they have few functions which is one is reduces the friction and wear, between the machining region I mean to say that between the tool and chip tool and workpiece and all those things in order to improve the tool life and surface finish. So, and the cooling the cutting region are the job that is reduces the temperature. So, that the thermal softening of the tool do not takes place such that the tool life goes up, washes away the chips it is also helps in washing away chips from the machining region, because if it pushes up or pushes away the chips though the entanglement in the machining region is less.

So, that you can enhance the tool life the prevent corrosion basically the cutting fluids will have the rust preventers as additives, helps the cutting fluid in preventing the corrosion and reduces the force and energy consumption. So, whenever the lubrication

see as we have already seen this like, the two basic properties that are cooling and lubrication, both if the lubrication is proper in that circumstances the frictional force goes down.

So, that the forces also goes down the remaining, so that the energy consumption will be mostly useful, waste energy will be minimised if you use the if you reduces the forces. Like whatever the power that you are going to give equal to useful plus useful energy or useful power that is and going to the friction ok. So, this is equivalent to shear force into shearing velocity plus frictional force multiplied by chip velocity. So, this particular thing will goes down if the friction reduces by proper lubrication.

So, this is about how the energy consumption goes down because this completely is total power this is completely is nothing, but the total power that is called cutting force in to velocity that is F C in to V. So, this is the input power whatever we are seeing here. So, the useful power will be utilised and the frictional energy goes down.

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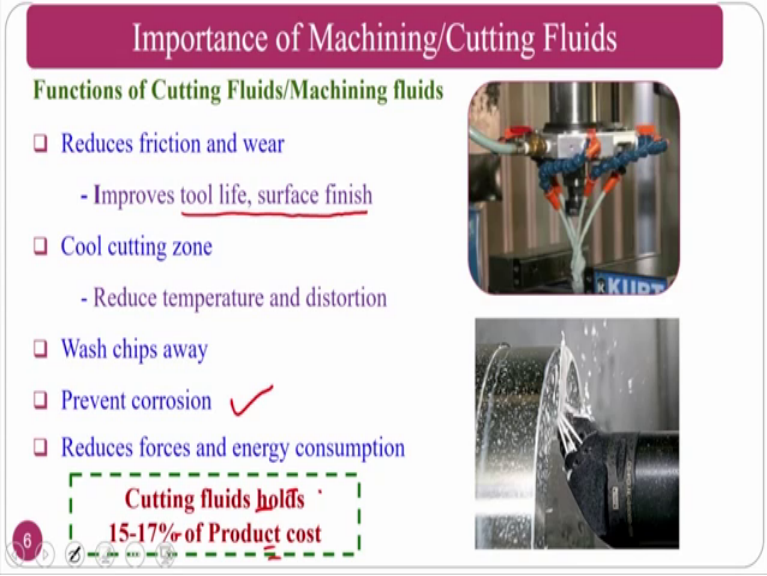

So, the additional thing that we can see here is normally the cutting fluids also accords approximately 15 to 17 percent of the product cost. So, if you can reduce the cutting fluids, so you can reduce the product cost, so that the product can be competitive in the market, so that is also there.

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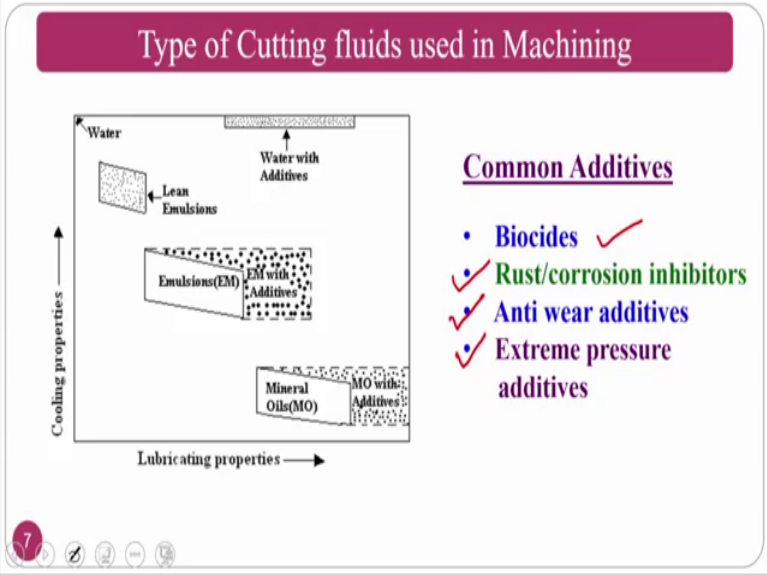

So, types of cutting fluids used in machining if you see the cutting fluids classification. So, on the x axis you have lubricating properties on y axis you have cooling properties. The better cooling property fluid is water you can see a it is a water, water is normally a better coolant and basically the mineral oil that are petroleum based mineral oil are good lubricants.

So, whenever we see our workshops that normally whenever we give some components to be machining or something. So, normally they will go for mixing the water with the mineral oil, and forms the emulsion. If you see the lubricating properties mineral oils will have better lubricating properties, water will have better cooling properties, and if at all I want to mix both mineral oil plus water I will give get the emulsions these are all normally used in the workshops.

So, if at all I want to improve the other properties like anti-corrosion properties or to prevent the fungus formation in the cutting fluid tank and all those things. We have to add some additives those additives you can see here also this emulsions with additives you can see here also and mineral oil with additives we can see here also. So, these are additives plays the major role. So, now, what are this additives? What is its function? That is the question.

So, the common additives that are used in the machining processes that you can mix with the cutting fluid are some of the advanced cutting fluids also contain this by default, some of the additives are biocides. The basic function of this biocides is to prevent the

fungus formation and at the bacterial or the microbial in general terms microbial formation in the cutting fluid tank, because whenever the cutting fluids are used they are recycled in the common workshops.

So, they are used for many days if you are having a water content along with the mineral oil the basic problem comes is the microbial formation in the cutting fluid, to prevent that one has to mix the biocides the second one is rust inhibitors are the corrosion inhibitors. So, this is normally for the workpiece materials that are proven to have rust that is corrosion, to prevent that rust inhibitors are used anti wear additives anti wear additives are used to decrease the friction during the machining operation and extreme pressure additives, these are the additives that are added to whenever you want to send the cutting fluid at very high pressures.

So, that the temperature that you want to extract by force convection. So, the cooling normally takes in the flood cooling is free convection whenever if I want to send that high pressure. So, that you can extract the heat that is generated in the machine that is by the forced convection in that circumstances you can use this.

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Extreme additives now this is about just a glimpse of the cutting fluids. So, now, we will see the cutting fluid emissions and its causes what are the causing diseases, this is one of the important area as per the present scenario is concerned because environmental problems are generated due to the cutting fluids will see what are the basic problems.

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So, basic problems with the cutting fluids if you see; so as per the international agency for the research on cancer it is concluded that sufficient evidence is there when the mineral oils are used as a workpiece in the machining that is are carcinogenic. So, carcinogenic means this causes the cancer, so whenever if somebody uses the cutting fluids in the machining operation for the emission that are causing or with the use of this one the emissions that you are getting or some other things that you are generating in the machining region.

And those are carcinogenic, if you see the machining process if the cutting fluid is falling because of the temperature that is generated in the machining region if you see the machining region temperature that is generating if the cutting fluid is falling.

What will happen this is a petroleum based this will crack chemically and destroy its properties at the same time this will whenever this cutting fluids are falling on the high temperature body, that is chip tool interfere this causes the emissions. We can see in the upcoming video you can see here how these are for the better understanding you can see just we are dropping the cutting fluid. If you clearly see the cutting process is going on that is the machining process is going on and we are dropping the cutting fluid drop by drop if you can clearly see there is a droplet which is falling in the machining region.

So, when the drop of cutting fluid is falling there is a huge amount of fumes are coming out, you can see some high amount of cutting fluid is dropped the fumes are coming this

is a vapour are coming where this vapour course this vapours are going to the operator. So, because the operator is near to the machining region and the fumes which are coming because of the cutting fluid falling in the machining region, due to high temperature that is generated these are normally goes to the operator, so how this will cause.

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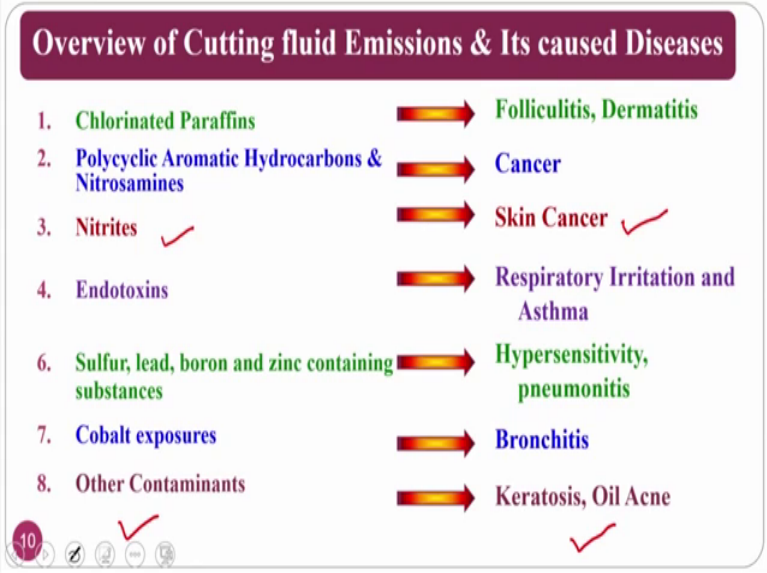

Damage to the operator that first we will see; that means, how it will damage the human ok. So, the first 1 is chlorinated paraffin's normally coming as the chlorinated paraffin's is a first one, the second one is the second one is polyaromatic hydrocarbons. So, the first one chlorinated paraffin's normally causes the folliculitis as well as dermatitis these are the diseases these are the chemicals that are generated these are the problems causing problems ok.

Chlorinate and paraffin's is the first emission which is high in terms of metalworking fluids or the machining fluids which causes the folliculitis dermatitis, the second one is polyaromatic carbon that is called p a h and nitrosamines this causes the cancer, third one is nitrites which causes the skin cancer basically, the fourth one is endotoxins which causes the respiratory irritation asthma the sulphur lead boron zinc containing substances.

Which causes the hypersensitivity and pneumatics cobalt exposures cobalt are one of the common material in carbide tools as a binder, which can causes the bronchitis other contaminants keratosis and oil acne these are the some of the problems ok. So, this is the

over view and we will see in the, the first emission is chlorinated paraffin's which we are going to see.

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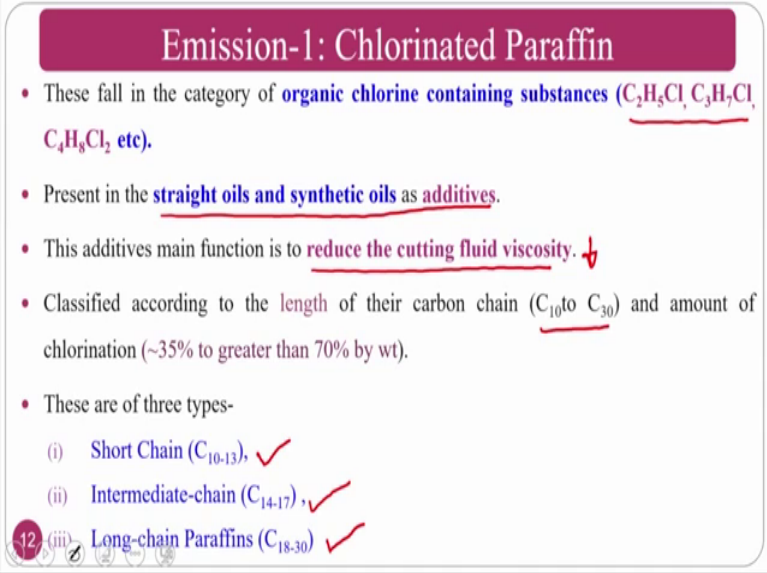

And see first of all we should know what is chlorinated paraffin's ok. So, for that purpose we can see this falls in the category of organic chlorine containing substances that is C 2 H 5 C l C 2 H 7 C l, this is called carbon based things the present these are called straight oil or synthetic oils as additives that are added to it these additives main function is to reduce the cutting fluid viscosity ok.

So, in the straight oils or synthetic oils as additives if you are adding for the function of to reduce the viscosity, if the viscosity goes down what will happen the fluidity will increase; that means, that it will penetrate easily into the machining region. So, that the cooling and lubrication will be done in a better way, for that purpose normally these are used these if you are using this chlorinated paraffin's see this chlorinated paraffin's are classified according to the length of their chain ok.

So, carbon chain 10 to 30 and so on. So, there are 3 classifications of this chlorinated paraffin's one is the C 10 to C 13 that is called is short chain, intermediate chain which is ranging from C 14 to C 17 and the long chain paraffin's that all C 18 to C 30. So, so if you are use this chlorinated paraffin's, this is the over view about the chlorinated paraffin's how the chlorinated paraffin's are what are the chlorinated paraffin's and all those things.

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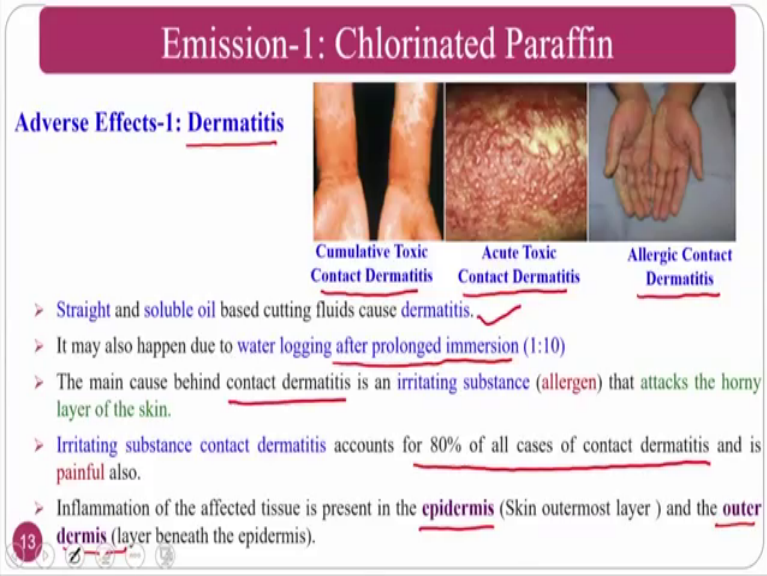

So, now we will see what it causes in the overview we have seen already it causes the dermatitis folliculitis and all those things. So, these are the problems, so the first adverse effect of this chlorinated paraffin's is dermatitis, dermatitis derma means skin it is outer layer ok. So, cumulative toxic contact the dermatitis this is called contact dermatitis this acute toxic contact the dermatitis and allergic contact dermatitis this is all are on the surface, whenever they certain chemicals come on the contact and causes is.

So, these are normally happened when straight and soluble base cutting fluids are causes the dermatitis we have seen that the chlorinated paraffin's are straight and soluble oils in the previous slide. It may happen due to water logging for the prolonged immersion normally, if you are putting for longer time normally this will deteriorate and the main cause behind the contact dermatitis the see contact dermatitis all the 3 that are shown in the pictures are contact dermatitis is an irritating substance that attacks on the horny layer of the skin that is nothing on the top surface, whenever you are machining operation is going on whenever the cutting fluid falls.

Because of the rotation of the workpiece are in the milling process, because of the rotation of the tool normally we considered as turning operation whenever the turning operation is going on because of the splashing due to the workpiece rotation are because of the emission that is coming due to the high temperature, this falls on the hands or the skin different parts of the operator.

This causes the contact dermatitis this irritating substance contact dermatitis accounts for 80 percent of all causes of contact dermatitis, which is painful also. So, this is a irritating substance which falls and causes the contact dermatitis. So, it is holds good for 80 percent inflammation of affected tissues present in the epidermis that is nothing, but the skin outermost whatever you are seeing here is a epidermis it is a outermost layer. Where the contact dermatitis will come and the outer dermatitis is layer beneath the epidermis the, it also causes on the second layer beneath the epidermis that is called outer layer of the skin ok.

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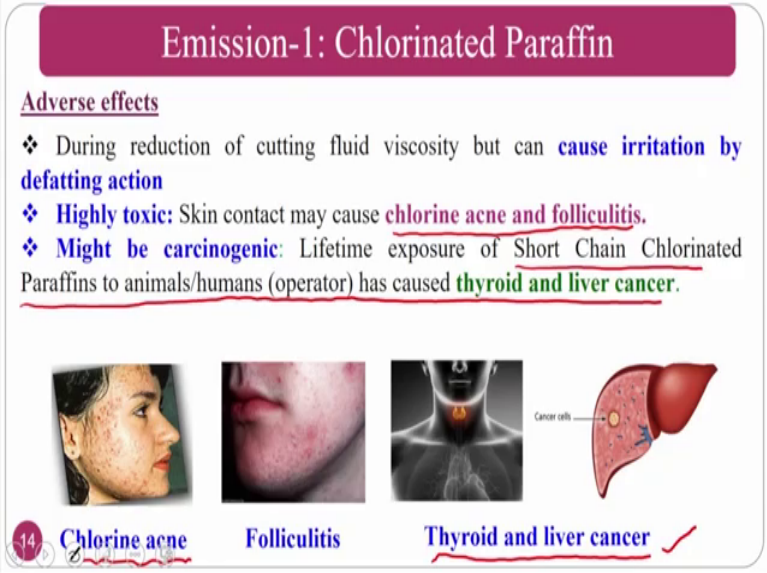

So, the second one chlorinated paraffin's adverse effect if you see during the reduction of cutting fluid viscosity, but causes the irritation. Normally what we have see, this chlorinated paraffin's are used for reducing the viscosity that is the positive side of the chlorinated paraffin's, whenever we are using in the cutting fluid, but it causes irritation it is what we have seen it is highly toxic ok.

So, skin contact may causes the chlorine acne and folliculitis chlorine acne these are the pictures are taken from the website ok. So, most of the pictures are taken from the Google, so we are not mentioned here courtesy, but; however, we are saying thankful for the internet various sources some of the pictures we are not getting appropriately. So, we have used the internet source. So, we are thankful for the Google, highly toxic this is called chlorine acne if can see this is chlorine acne if on the face, the picture shows not

because of the machining, but the disease the disease that we want to show here how the chlorine acne look like ok.

So, chlorine acne also causes whenever chlorine content is not properly maintained in the swimming pool. So, whatever the picture we have taken is the adverse effect of the chlorine if the content of the chlorine is not good in the swimming pool, but this is the disease if the chlorinated paraffin's also causes ok. So, might be carcinogenic lifetime exposure of short chain chlorinated paraffin's in the animals and human this operator causes the thyroid or liver cancer.

So, the long term exposures because whenever a person gets the job in the workshop. So, normally at the age of 25 to 30 years, whenever you comes to the retirement stage. So, about thirty years of his life if he is continuously expose exposed to this one. So, this may causes the thyroid or liver cancer ok, so one should be very careful about this chlorinated paraffin's.

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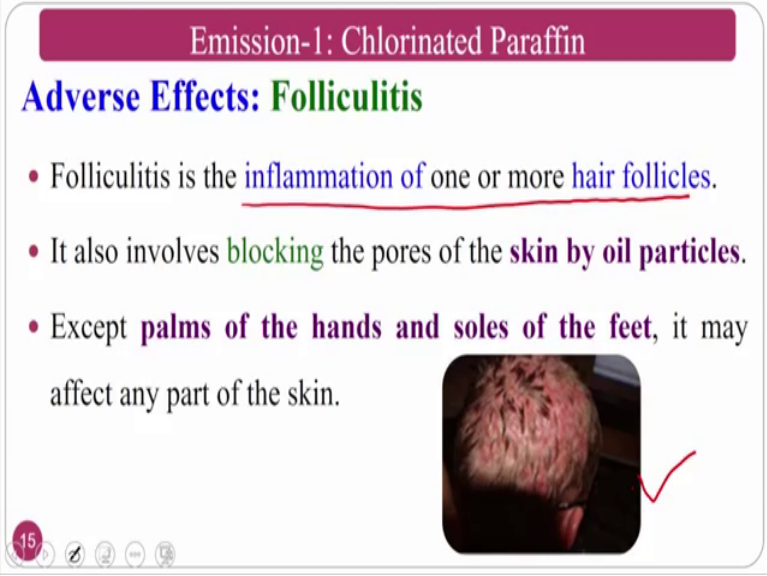

So, the other one is what we are looking at is of other adverse effect of chlorinated paraffin's folliculitis ok, folliculitis this is inflammation of one or more hair folliculitis ok. You can see here hair folliculitis that is nothing, but improper hair growth ok, whenever the operator is operating by bending his head looking at the workpiece what will happen because of the splashing of the cutting fluid on the head this cutting fluid goes and occupies the pores which are there and it may affect the incoming hair.

So, that is why you can see the improper hair growth on the hair it also involve blocking of the pores of the skin by oil particles that is what I was saying that when of the oil particles are sat on the head. So, this may occupy the pores and prevent the hair growth. So, that wherever the oil particles are blocked there the hair will not come, wherever the oil particles are not blocked their hair become because of which can see the improper or irregular hair growth, except palms and hands and the soles of the feet it may affect any part of the skin ok.

So, this folliculitis can come except on the palms of the hands and the soles of the feet because like this portions it can come wherever they were hair on hairs are there ok. So, if your hair is there if the higher the chlorinated paraffin's fall here and it may block the pores. So, that the hair would not grow wherever the it blocks that is about the folliculitis the second one which we are going to see is polyaromatic hydrocarbons this is another important emission commonly we can see in the cutting fluid emissions ok.

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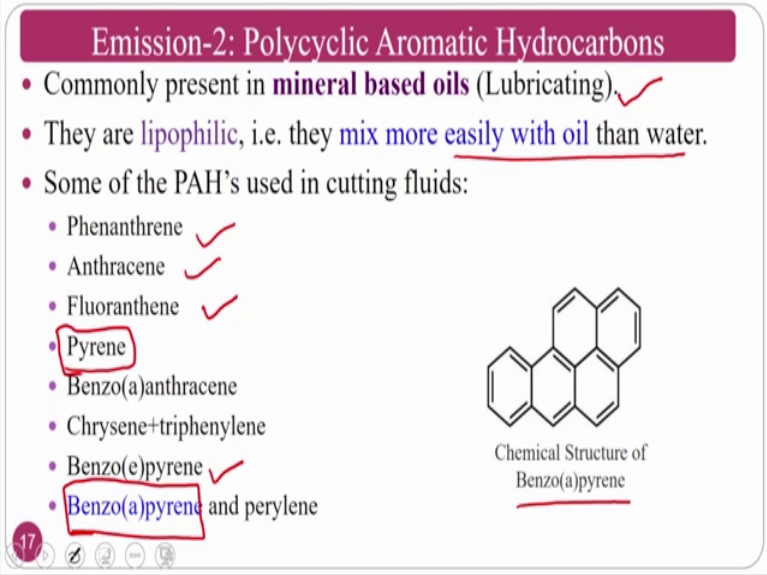

So, polycyclic aromatic carbons are commonly present in mineral based by oil that is called whenever the lubricating oils are there. So, there it is commonly present these are lipophilic that is the mix more easily with oil rather than water ok. So, lubricating oils what I mean to say is here wherever you are using only lubricating oils where the water content is very less or something like a metalworking applications like where the temperature goes up and all those things, if we are not using water or if you are using

some of the cutting fluids that contain more polycyclic aromatic carbons these are comes.

The lipophilic means this mix with oil not with a water ok, some of the PAH that is polycyclic aromatic hydrocarbons using the cutting fluid are these things ok. So, among all this things pyrene is one of the important thing and the same time, benzo a pyrene we talked about in this one benzo e pyrene is there benzo a pyrene is what now we will discuss, how it will effect or how this turns out to be the carcinogenic ok, so the mechanism if you see here.

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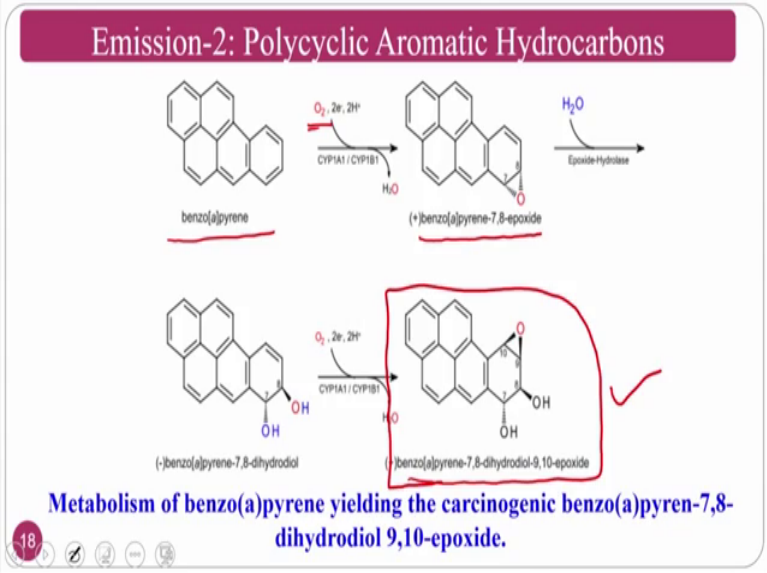

How this will convert into the carcinogenic that is called how the benzo a pyrene converts into the benzo a pyrene 7 a epoxide and all those things and how it will convert into the benzo a pyrene 7 8 dihydrodiol 9 10 epoxide, this is a final thing that is carcinogenic how it will convert just to see the mechanism.

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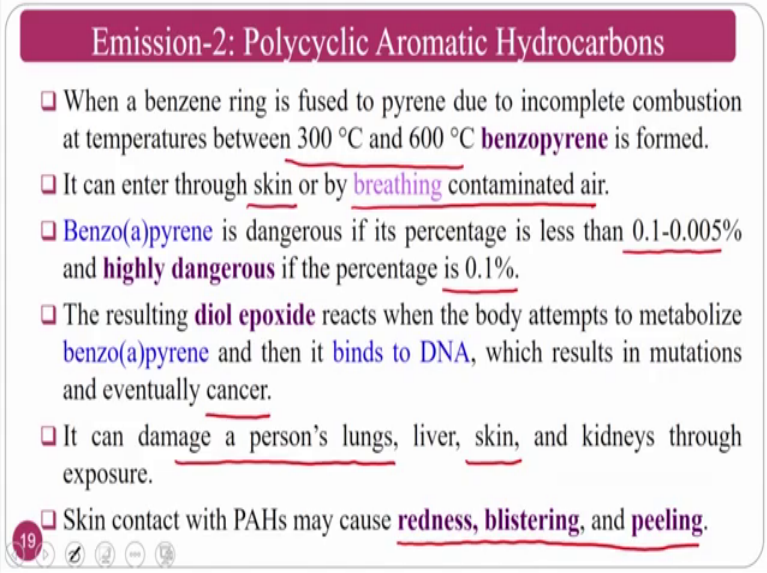

We will come back again, when the benzene ring is fuels to the pyrene due to the incomplete combustion at the temperature between 300 to 600, benzopyrene is formed ok.

See whenever the machining operation is going on, the temperature that is normally generated is in the range of 300 to 1000 depend on your work piece material depend on work tool material, I mean to say the combination of this things. So, when the benzene is falling fused to the pyrene because of incomplete combustion normally my cutting fluid is falling. So, whatever it reaches to the machining region that will get lot of temperature, I mean to say that will extract the lot of temperature, but the second which is adjacent to it may not get sufficient.

So, because of which the improper combustion takes place, whenever there is improper combustion takes place, I mean to say in proper temperature is extracted because of which it is not properly got the complete temperature, in the range of 300 to 600 benzo pyrene is formed it can enter through the skin or by breathing the contaminating ok. So, whenever a benzo pyrene is formed operator is operating and he do not know what is coming out if we do not know about this emissions.

So, it can enter to the skin or by breathing the contaminated it that is the fumes that is coming that we have seen in the previous videos, benzo a pyrene is dangerous if the percentage is less than 0.1005 percent is, but it is highly dangerous if the percentage exceeds 0.1. The resulting diol epoxide reacts with when the body attempts to metabolize

benzo a pyrene and then it binds to DNA which results to mutations and eventually cancer, that is what is given here when the benzo a pyrene is fall on the skin or whenever it goes to the nose or if you the operator breaths to the nose it will first react with oxygen which is present in the body and forms the benzo a pyrene 7 8 epoxide and the body also contain water.

So, it will forms to benzo a pyrene 7 8 dihydrodiol then what I mean to say is once it enters into the body through the nose or through the skin it binds to the it will attempts metabolized benzo a pyrene and then binds to the DNA, when it binds to the DNA. The control of the original DNA control goes off and it will do its own mutations that is called uncontrollable cell growth that is nothing, but the cancer. So, this is the carcinogenic which causes the cancer by binding to the DNA of the cell and causes the cancer. So, this if it the benzo a pyrene passes through the lungs it causes the lungs cancer, if it goes to the skin it may cause the skin cancer and all those things skin contact of the polycyclic aromatic hydrocarbons causes redness blistering and peeling also.

So, that is a another problem that because of this will come is blistering redness that is called redly looking and all those things this is a how the polycyclic aromatic hydrocarbon are dangerous to the operators the third one is nitrosamines. So, the first two are most important these are all also important and the first two are highly contain in the cutting fluids coming to the nitrosamines.

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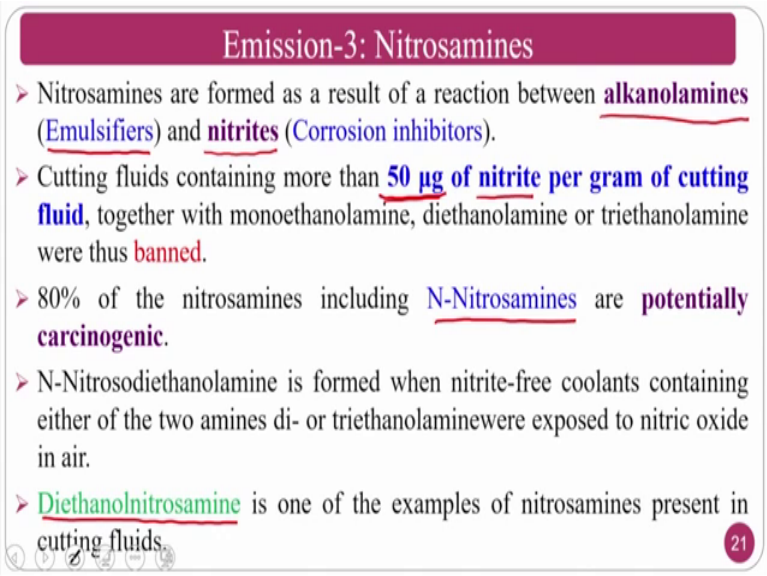

Nitrosamines are formed at the result of reaction between alkanolamines that is called emulsifier and nitrate. So, normally emulsifiers are used in the cutting fluid to make proper emulsion. So, if you are using emulsifier in the cutting fluid, so in the form of alkanolamines and a nitrites are corrosion inhibitors as I said some of the additives that are corrosion inhibitors if you are using, so in the form of nitrates.

So, if there is a reaction between alkanolamines and nitrites, nitrosamines are formed ok, the cutting fluid containing more than 50 micrograms of nitrate per gram of cutting fluid together with the monoethanolamine are diethanolamine or triethanolamine were normally banned actually. So, as per the health organisations or concern these are all banned if you are cutting fluid is contains more than 50 micro grams of nitrite.

So, 80 percent of nitrosamines include N nitrosamines are potentially carcinogenic these are all carcinogenic. So, N nitrosamine diethanolamine is formed in the nitrite fee coolants containing either the 2 amines di di or triethanolamines were exposed to nitric air this is about the di diethanolnitrosamine is one of the examples of nitrosamines is present in the cutting fluid. This is the one that is emission that is causing because of the alkanolamines and nitrites that are reacted in this ok, so, emission 4 that is called nitrites.

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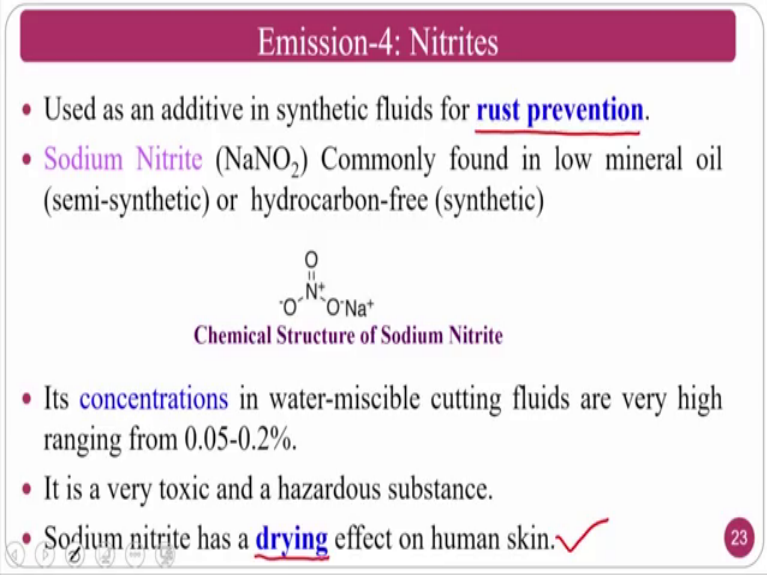

If you see the nitrites chemical structure of sodium nitrate used as additive for the synthetic fluid for the rust prevention, basically nitrates are use in the form of rust preventers that is called the corrosion inhibitors sodium nitrate is commonly found in the

low mineral oil that is called hydrogen mineral oil are synthetic mineral oil. So, the concentrations in the water miscible cutting fluids are very high ranging from 0.5 to 2 it is very toxic and hazardous substance.

So, the basic problem with this one is the drying effect on humans skin; that means, that nitrosamine nitrates when the nitrates are come into contact with human skin it will causes the drying effect.

That is it makes your skin completely drying. So, if the skin is dry what will happen as many people if you see our lips sometimes will become dry and cracks comes and bleeding also comes, so that is the problem with the nitrites.

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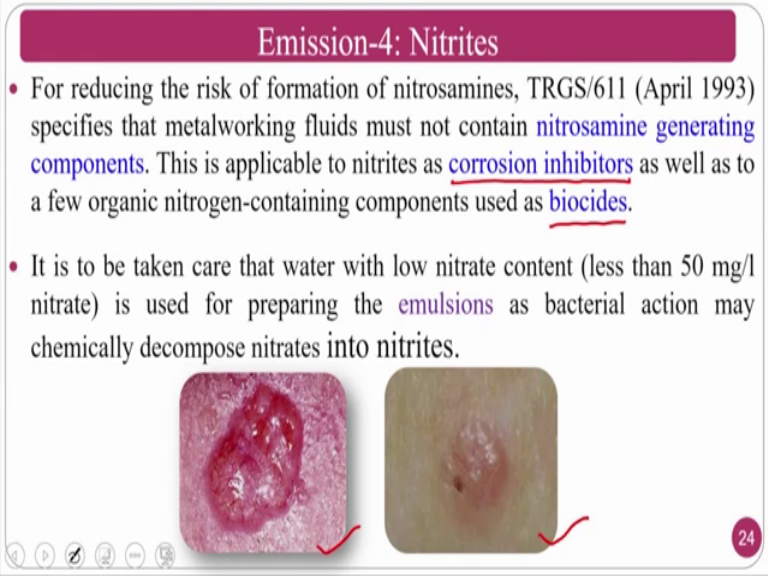

So, the other thing about the nitrates is for reducing the risk formation of nitrosamines the specified that metalworking fluids must not contain nitrosamine generating components, because which are used in the form of corrosion inhibitors for the this or it can also be used as a biocides this causes the basically the cancer ok. So, this is the you, you can see the skin cancer these are the nitrosamines which causes the skin cancer.

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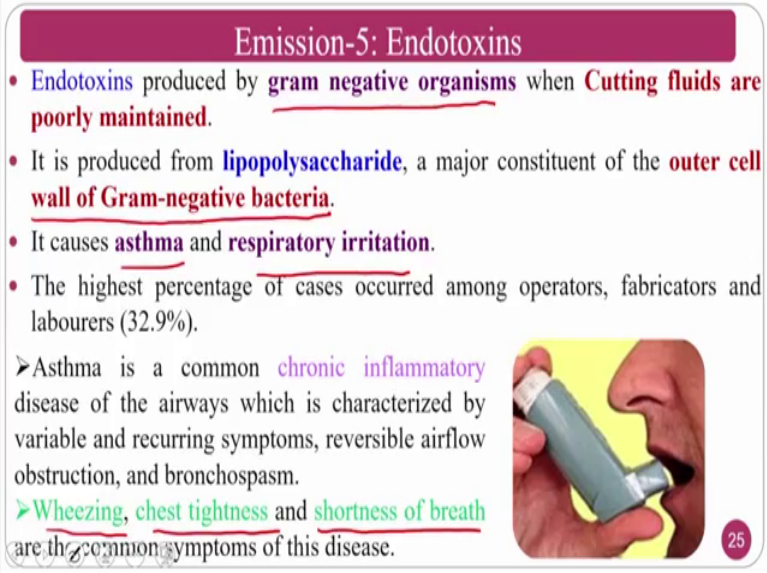

Though emission 5 that is called endotoxins. So, endotoxins are produced by gram negative organisms when the cutting fluids are poorly maintain this is nothing, but whenever the cutting fluids are used in the workshops are the laboratories. If you are maintaining poorly the means that if you are not circulating properly, if you are not using the filter properly if you are not changing the cutting fluid timely this gram negative organisms are formed.

So; that means, that you have to also use the biocides if you are not using the biocides also this gram negative organism grows, it is produced from the lipopolysaccharide a major constituent of outer cell of the cell wall of the gram negative bacteria it causes asthma and respiratory irritation problems. So, you can see here the highest percentage causes among the operators is this one. So, the basic problem in the machining operators is asthma.

So, I mean to say the majority of the people gets the asthma, so this is causes by the gram negative bacteria that is formed because of the endotoxins, asthma as you know it is a chronic informative disease a of the airways that are there in the human body, which is characterize and wheezing chest tightness and shortness of the breath these are the other things that are side effects of the these diseases.

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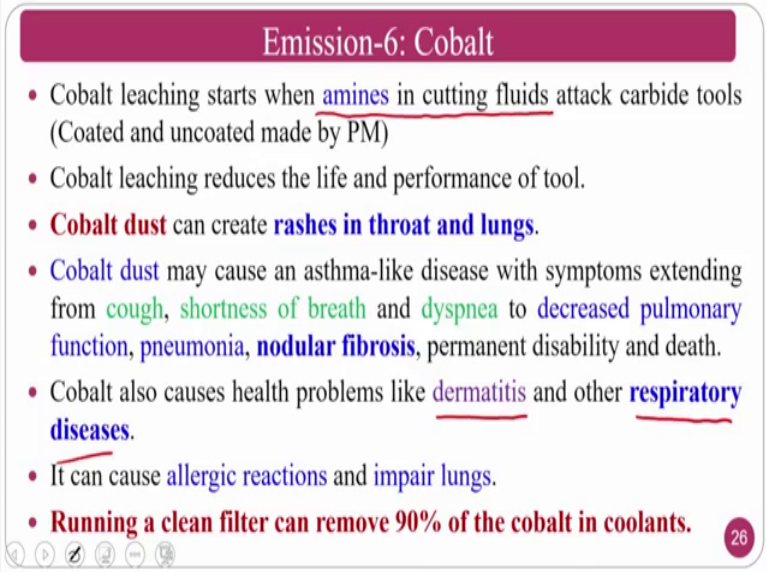

Coming to the emission 6 that is cobalt, as I said the cobalt leaching; that means, at whenever I have a cutting tool, that is I want to do the machining operation cutting fluid is falling under cutting tool, when the amines of the cutting fluid composition. So, I mean to say the amines are 1 group of chemicals that false on this one what will happen it has a affinity towards the cobalt, cobalt thermal in the tungsten carbide are made up of tungsten carbide plus cobalt, cobalt is a binder when the amine falls on the cutting tools this carbide cutting tools.

The cobalt will start leaching the cobalt leaches leaching reduces a tool life that mean that if I want to construct a home, I need the bricks, I need the cement sand composition and all those things. So, cement sand composition if we leached out what will happen, the building collapse. So, if the cobalt leaching a is done the basic problem is the tool life goes down that is the one of the problem cobalt dust can create the rashes on the throats and lungs.

So, cobalt dust may cause asthma like diseases many other disease cobalt also causes the health problems like dermatitis and respiratory diseases it can also lead to the impair lungs and allergic reaction. So, how to avoid all these things is if you can run a filter properly, if you know the particle size of the cobalt if you run the appropriate filters you can filter out this whenever the cutting fluid is recycled.

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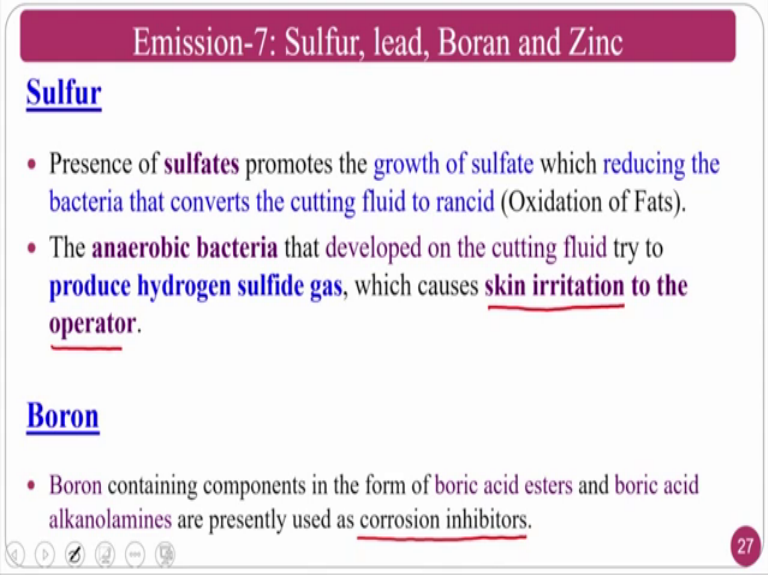

The other emissions are sulphur lead boron and zinc, so 1 by 1 we will see first we will start sulphur, does the presence of sulphates promote the growth of sulphate which reduces the bacteria that converts into the cutting fluid to the rancid. Normally the sulphates are use as the biocide that is what the meaning says then anaerobic bacteria that is developed on the cutting fluid try to produce the hydrogen sulfide gas, which causes the skin irritation normally the sulphur causes the skin irritation to the operator.

So, this is about the sulphur, so next one is boron, so the boron containing components from the boric acid esters are the boric acid alkanolamines presently used in the corrosion inhibitors, basically these are all used as the corrosion inhibitors this will also causes some way to the operator.

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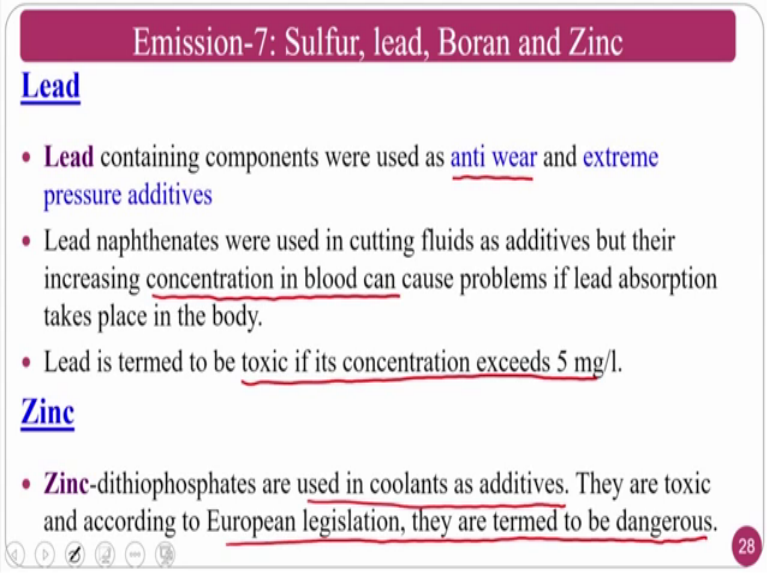

Coming to the third one lead, lead is containing components were used were anti wear and extreme pressure additives basically anti wear normally lead is a very soft material. So, shearing of this one is very easy that why these are all used for the anti-wear application, lead naphthenates were used in the cutting fluid as additives, but their increasing concentration in the blood can cause the problems lead to, so if it enters into the human blood then it is dangerous.

So, that is what it mean, so the lead content should not increase in the body. So, keeping away from the lead is always preferable termed as a toxic if it is the concentration levels exceed 5 milligrams per litre. So, whenever the operators want to mix the lead see as such lead nobody mixes, but whenever you want to use for anti-wear are extreme pressure ready tool try to avoid the lead containing elements, chemicals last one is zinc, zinc used in the coolants as additives they are toxic and according to the european registration they are termed as to be the dangerous, this are also dangerous in the cutting fluid try to avoid lead zinc boron and sulphur to the limited levels if the limit exceed then everything is problem.

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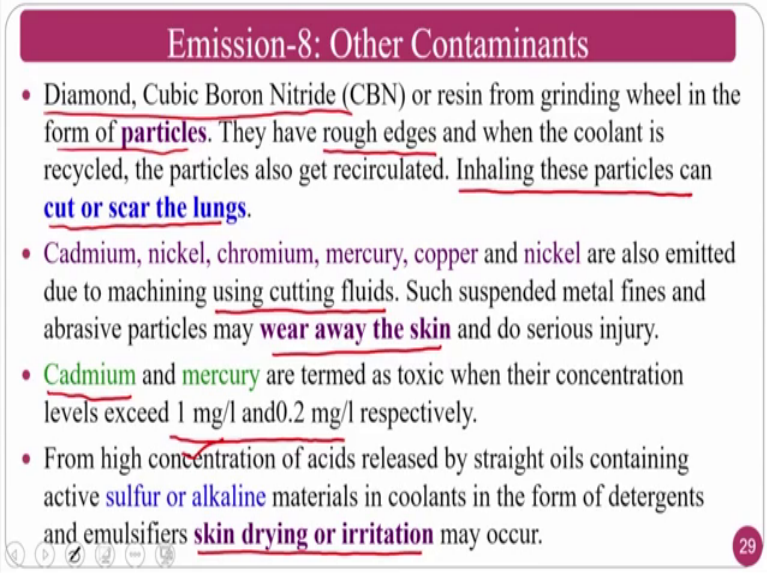

So, the other contaminants normally if you see the other contaminants like diamond CBN resin this grinding wheels from the particles. Normally these particles are whenever if you see the grinding operation these particles will come out along with the cutting fluid and if assume that it is comes in the in the form of vapours, and particles are moves they can enter into the lungs if you inhale the particle size if he the particles are Nano size. It if it enters into the through the nose it may because your nose articles skin, but out the body parts are too soft and this diamond particles are cubic boron nitride particles are very sharp with the rough edges this will cut the scar the lungs that is one of the problems.

If you inhale this particles cadmium nickel, chromium mercury copper and nickel are also emitted during the machining while if you are using the cutting fluid suspended metal fine particles are abrasive may wear away the skin ok. If this metal particles are fall on your skin and this may also causes the wear and scare cadmium and mercury are termed as toxic when their concentration level exceeds 1 milligram per litre and 0.2 milligram per litre respectively; that means, cadmium level if it is exceeds 1 milligram per litre and the mercury level 0.2 milligram per litre if it is exceeds it is dangerous.

That what it is a from the high concentration of acid releases by straight oils normally this sulphur or alkaline causes the skin drying that is called irritation.

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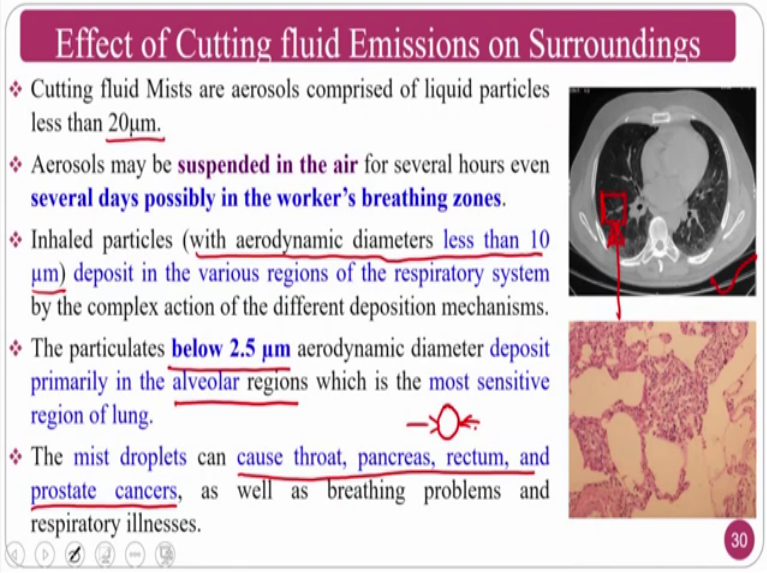

So, the other things which I want to say is surroundings includes the people who are adjacent to the outside. So, cutting fluid mist what I mean to say it cutting fluid mist is nothing, but it is the vapours that are coming out are the aerosols composed of liquid particles less than 20 micron, aerosols may be suspended in the air for several hours even several days possible and in the breathing zones; that means, that normally Nano particles are sub Nano particles the surface area is very big. If the surface area is very big what will happen this will suspend in the air or if operator breaths it in the breathing zone it may suspend like because small, small hairs are there in the noses it may suspend there also inhaled particles that is called aerodynamic diameter less than 10 microns.

Deposit in the various reasons of the respiratory system by the complex action of different deposited mechanism. Normally our nose the operator nose me I mean to say the human nose will accept 10 micron size particles or less than 10 microns ok. So, if the particle size is below 2.5 microns that is aerodynamic diameter normally if the particle size aerodynamic diameter assume that it is p m normally this is the diameter normally.

So, if the diameter is 0.2.5, it it can enter into the alveolar region which is most sensitive part of the region; that means, that it nose nose accept 10 microns, but it cannot enter into the lungs, but I mean to say if the particle size is below 2.5 microns, the particles can enter whenever the operator breaths into the lungs also and it can reach to the alveolar region of the lungs and which is very sensitive for the breathing system of the humans and it causes a lot of problems.

The mist droplets can cause throat pancreas and rectum and prostate cancer this mist particles; that means, mist is nothing, but normally the, the gaseous form of the cuttings fluid this mist droplet can causes various problems like various cancers like throat pancreas rectum and all those things what you can see here is a lungs picture and if you take a small portion of this one this is nothing, but this one this is about the what if the particle sizes goes into the noses.

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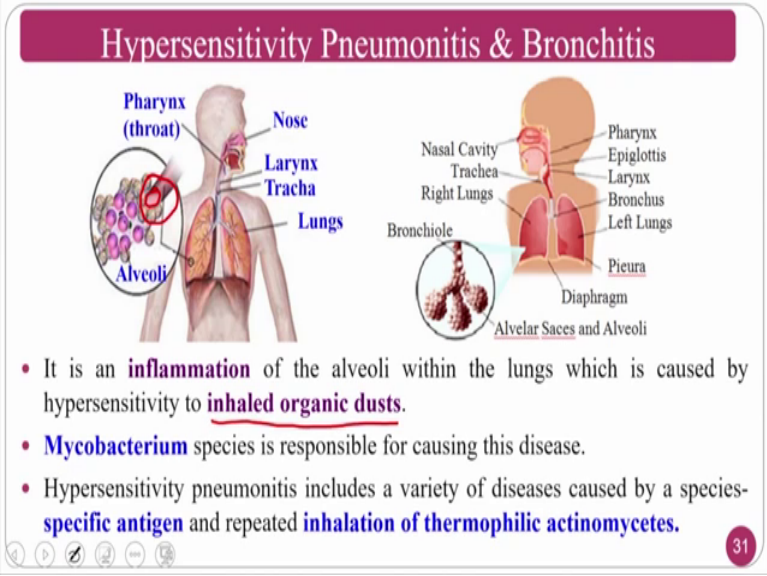

Hypersensitivity pneumonitis and bronchitis if you see I was telling about the, the inflammation and dust that is going inside the lungs and all those things if it can goes it is an inflammation of alveolar region within the lungs which is caused by the hypersensitivity inhaled organic dust in the previous slide which we were seeing the alveolar region. Normally alveolar region if you see this is alveolar region, if the particles which are approximately 2.5 microns less than that one it will enter into this one and it may block this the alveolar region. So, it is the very dangerous that is what I mean to say in this slide ok.

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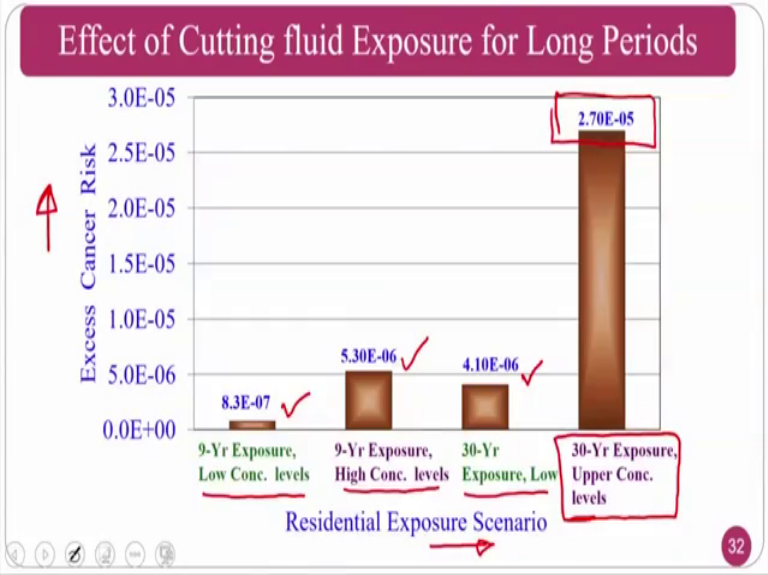

So, the cutting fluid exposures for short period long period how if the cutting fluids as I was telling you that a operator works in his lifetime approximately for a 30 years or a 35 years, because when a operator get the job around 25 years and retirement is about 60 years.

So, he has a span of 35 years of job, so if he is exposed if a operator is exposed for 9 years, for the low concentration levels this is the cancer risk on y axis we can see the cancer risk the probability and the exposure. It is not only the operator exposure residential exposition are; that means, at nearby industries are their people are staying nearby, if has somebody constructed their home near to where company where the emissions are large what will happen if it is exposed to about 9 years.

So, the concentration levels are less; that means, that this is the level of that cancer risk if the concentration levels are high and if it is exposed for the 9 years this is the risk level the cancer risk level, if the exposures are low and for 30 years this is the chance of the cancer risk if the it is exposed for the 30 years and the concentration levels are higher. So, the cancer risk are very higher if a person construct a home and if those people are continuously inhaling this gases that are emerging from the machining industry or the cutting fluid this chemical industries there is a heavy chance of that one.

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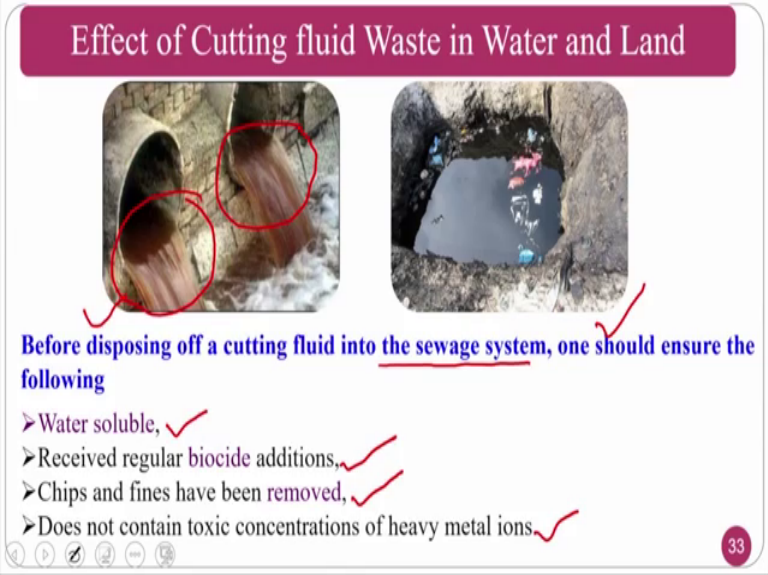

So, the other effects that normally if you see the cutting fluid. So, that their the companies machining companies big companies are small companies that are the 2 ways what they will do, and how they will dump is 1 is dumping into the nearby water bodies just they construct some internal canals or the pipelines and they will just connects to the nearby water bodies, which is very dangerous.

The other people normally other way of disposing the cutting fluid is just digging the some pot of the soil in the premises of the company and just putting it, this leads to the first one sending to the nearby the water bodies leads to the water pollution and the second one leads to the soil pollution because you are digging a hole and your putting inside.

So, if you can take some precautions, before disposing of the cutting fluid into the sewage system or nearby water bodies, which we can prevent some of the adverse effects that is like you should make it water soluble like we will see in the upcoming. So, what is the c o d p o d and all those things. So, how to make water soluble what is the carbon oxygen demand and all those things which will see the received regular biocide additions and chips and fines have been removed you have to use the filter.

So, that the chips and fine particles if you can remove ok, does not contain toxic concentration of heavy metals what will happen if you have a heavy metal concentration or if you are contaminating in a contaminating in this way, what will happen the ecosystem in the nearby water bodies will dies off assume that the fishes are there or

some of the organism there which are assume many things likes prawns are fishes are something those are all will die and it will destroy the ecosystem.

So, one should take care about the cutting fluids if the cutting fluids are sensitive as per the current scenario is concern, that is why the importants of these should be learnt, if you if the person lungs learns about the cutting fluid emission and how it has to be disposed where it has to be disposed on the how it has to be disposed.

So, we can make a good ecosystem and we can make the country clean up to certain extent and we have to make the operator these are the problems if you inhale and all those things. So, one has to provide the mask apron and all those things if at all not provided then the problem comes is the emissions causes lot of problems to operator the company should not see only at the profits they also should see at the safety of the operators. So, that you can maintain the ecosystem and the operators also will operate in a very good way ok.

So, this is about the cutting fluid emissions and how the emissions are causing various diseases and all those things.