Applied Ergonomics
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Lecture – 24
Eutectoid transformation (cont..)

So, in the previous lectures we started with understanding physical work environment and in that category we discussed about the effect of noise on the human performance.

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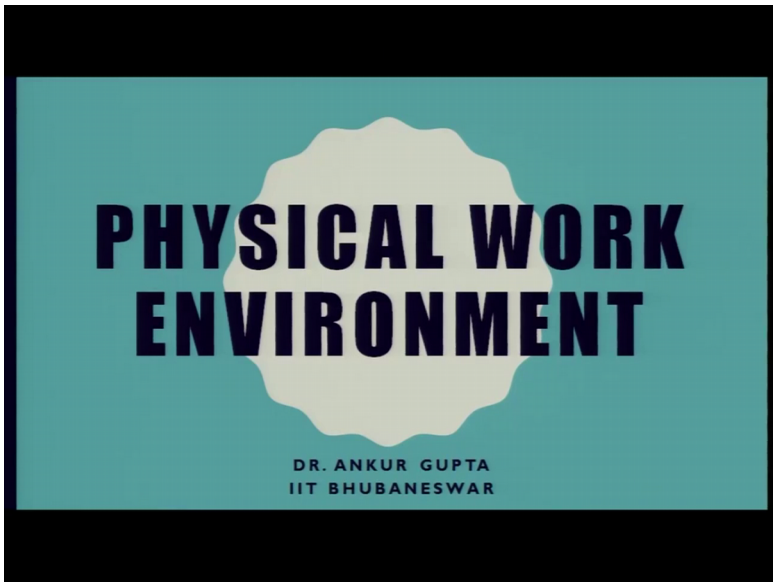

So, we discussed about various factors that are responsible for noise and the fundamentals regarding the sound intensity. So, in continuation with that we will try to cover in this lecture the noise control and noise factors and affects the summary of that. So, first of all noise factors and their effects.

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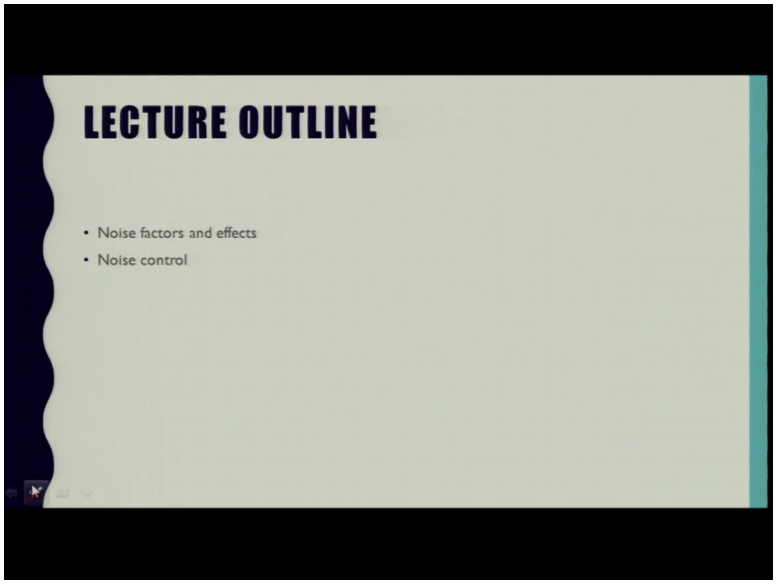

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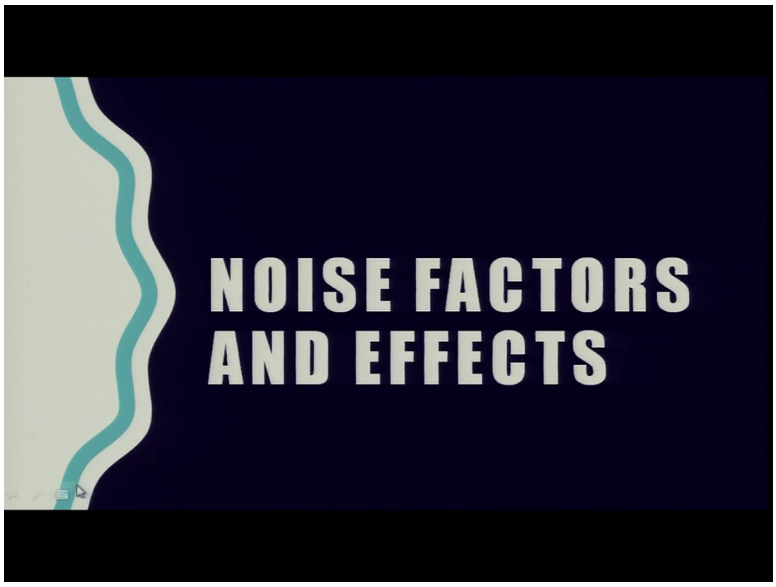

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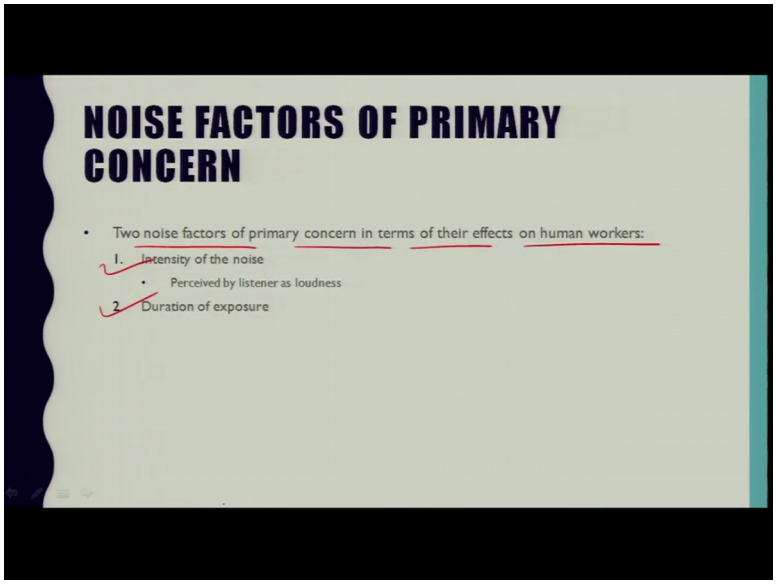

So, basically the noise factors of primary concern the 2 noise factors of primary concern in the terms of their effects on human workers is that intensity of the noise and duration of the exposure.

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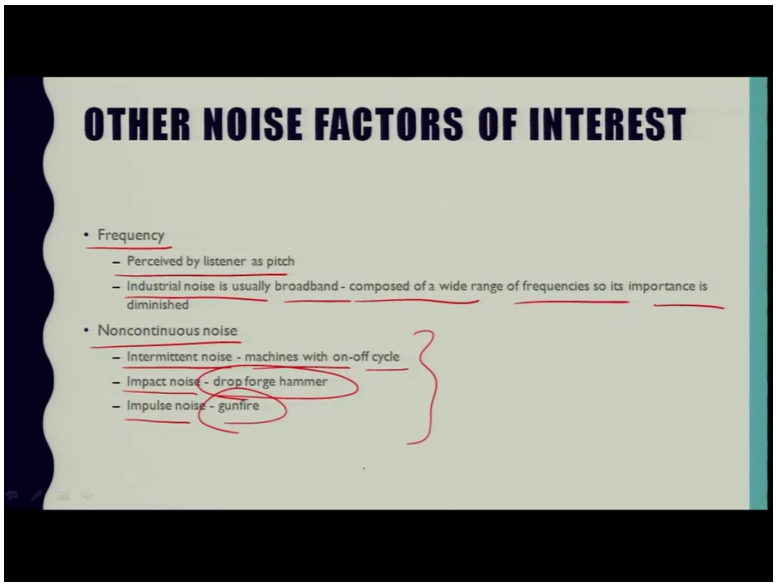

As per as other noise factors of interest, this frequency that is perceived by listeners as pitch and industrial noise is usually broadband composed of a wide range of frequencies. So, it is important and is diminished, non continuous noise they are intermittent noise, machines with on off cycle, impact noise just like in manufacturing industry drop a forge hammer and an impulse noise in a gun fire industries. So, these are the some of the examples through which you can have an idea of non continuous noise and a still it

makes a large impact on the workers that are add that are working in the surrounding, as far as the physiological effect of noise is concerned.

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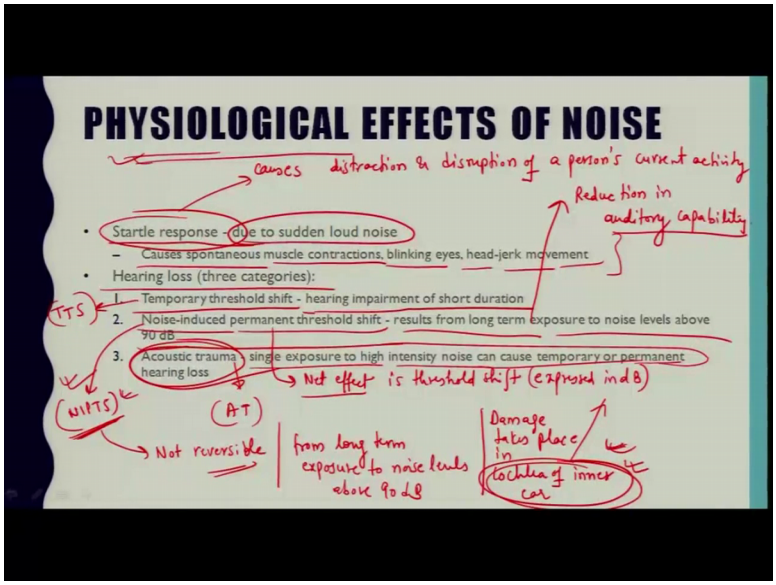

So, when a person is exposed to a sudden loud noise it is a like an impact. So, that impulse noise is known as basically this, the rake reaction is known as startle response. So, when a person is exposed to sudden loud noise.

So, the reaction is known as startle response which causes a spontaneous muscle contractions or blinking eyes or closing of the eye and head jerk movement. So, that are the reaction when sudden a noise comes to you and your response appears in the form of blinking of eye or sudden eye closing and or your sudden head jerk movement, other physiological effect that you can experience like a slower and heavier breathing, variation in a heartbeat rate and at the dilation of eye pupils.

So, this startle response cause, this particular startle response causes distraction and disruption of a person's current activity and although it is physiological effects are transient and in a every momently in nature it can an (refer Time: 03:54) alliance and other negative reactions you can say or negative emotions as well. So, of particular concern in ergonomics the hearing loss due to noise is very much important and serious factor.

So, like sudden blast happens and that the sound intensity while passing through the auditory channel in your ear and sudden it may distort, it may damage your eardrum. So, that hearing loss can be categorized into 3 points, the first point is the temporary threshold shift it is a hearing impairment of short duration, noise induced permanent threshold shift it basically it results from long term exposure to noise levels above 90 decibel and third is acoustic trauma. So, this acoustic trauma is a single exposure to high interest in noise which can cause temporary or permanent hearing loss.

So, in that case so abbreviation of these thing like if you can write in short form. So, temporary threshold shift can be write, written as TTS this particular noise induced permanent threshold shift can be written as NIPTS and this particular acoustic trauma I can be written as AT. So, this is just for pronunciation. So, now, this particular noise induced permanent threshold shift that is NIPTS this is a hearing loss that is not reversible, a full hearing is never recovered this NIPTS it results from long term exposure to noise levels above 90 decibel. So, that damage takes place. So, the damage mostly takes place in cochlea of inner ear which contains this cochlea of the inner ear as we studied. So, basically in that this particular damage is in cochlea of the inner cell.

This cochlea is having a microscopic auditory hear cells and high intensity noise exposure over the extended period of time destroys these cells the cells. So, the net effect this NIPTS. So, the net effect of permanent damage is a threshold shift expressed in, which is expressed in decibels. So, NIPTS that does not imply complete deafness it means a reduction in auditory capability. So, this particular NIPTS means reduction in auditory capability. So, this is not the permanent deafness, it is just a reduction in auditory capability and amount of hearing loss is depending on the intensity level and it various among individuals. The third kind of hearing loss is acoustic trauma, so this is caused by just single exposed to high intensity noise of short duration and depending on the intensity of the noise the hearing loss can be temporary or permanent.

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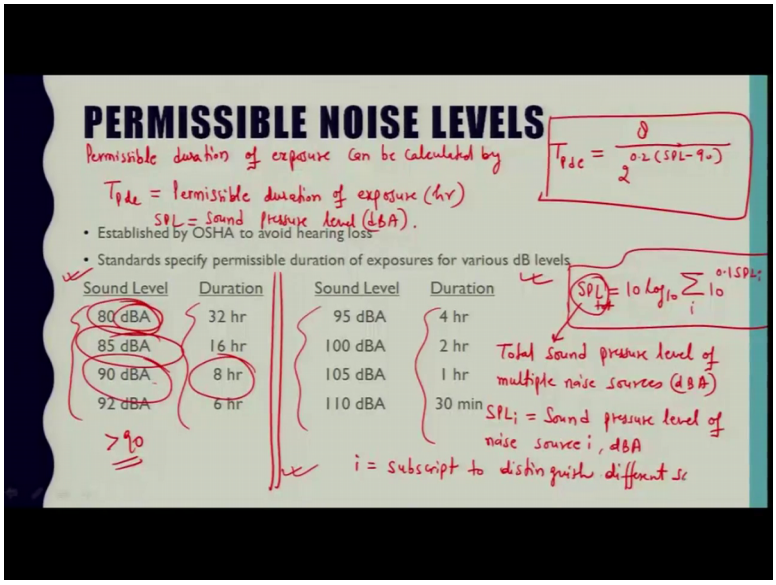

So, now we come to the next topic that is permissible noise level that this levels basically have one agency is there, whose name is OSHA, O, S, H, A which is meaning in meaning its full form is occupational safety and health administration.

Which those noise level standards to set by this particular agency and it is designed to avoid the hearing loss, effects that we discussed some time before. So, the standards specify the permissible duration of exposure for each of various sound pressure levels using dBA skill, a partial listing of the standards is shown here. So, here we can see that there are various sound level values its duration sound levels and its duration. So, there are basically this particular table is like that. So, here we can see that a continuous sound pressure level of 80 dBA is acceptable and requires no abetment steps, a value of 85 decibel is customarily used as the threshold level threshold level at which employees should be began to take action to control the noise. A sound pressure level of 90 decibel must be limited to 8 hours of exposure and any level above 90 means that noise abatement procedures of some kind are required. So, for sound pressure levels that are not given in this particular table.

So, the permissible duration of exposure for a given sound level can be calculated by. So, this particular permissible duration of exposure can be calculated by this one formula T pde 8 upon 2 to the power 0 point 2 SPL minus 90 where this Tpde is permissible duration of exposure that is expressed in hour SPL is the sound pressure level that is expressing dBA.

So, it is not uncommon for a worker to be simultaneously exposed of the sources expressed as an equivalent sound pressure level can be obtained by the following equation that I am writing here, that SPL equals to 10 log base 10 summation of I 10 to the power 0.1 times SPL and this is i. So, here we can say that this SPL in as a total is a total sound pressure level of multiple noise sources it is total. In fact, t o t we can say add here SPL t t o t is total sound pressure level of multiple noise sources that is expressed in dBA and this SPL I equals to sound pressure level of noise source I that is expressed in dBA where I is a subscript to distinguish different sources.

So, we are going to start with the next topic that is noise control.

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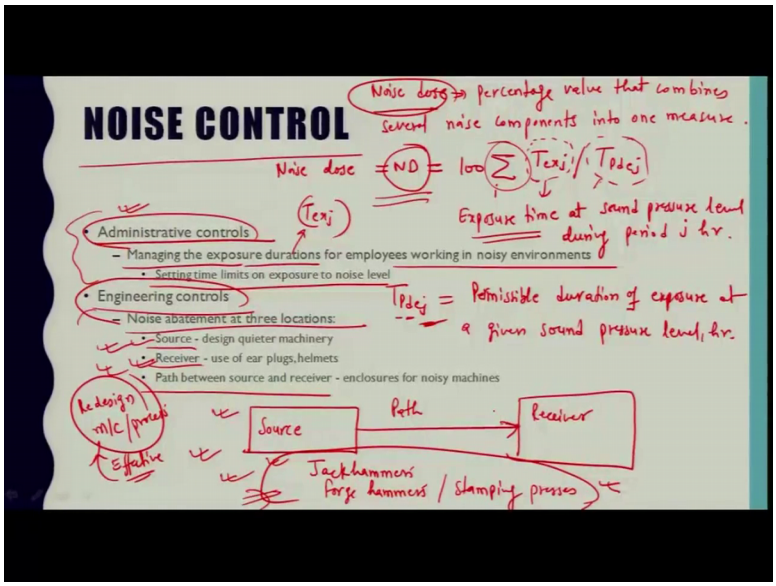

So, here like another common situation as for workers to be exposed to several different noise sources for different duration throughout the given a work day. So, combined effect of different sound intensity is can be summarized as a noise dose. So, another factor that I am giving here has a noise dose which is nothing, but percentage value that combines several noise components into 1 measure, such that any value above 100 percent exceeds the OSHA permissible limit. So, this particular noise dose value that is less than or equal to 100 is accepted so. In fact, this noise dose value can be calculated as, noise dose value can be calculated as if you can write it as a n d that is 100 summation of T e x j upon T p d e j where this nda is noise dose this t x j is exposure time.

This exposure time express at a given sound pressure level and like a during period a period has to be defined during some period, let us say n j hour and this Tpdaj is this T pdaj equals to that is basically permissible duration of exposure at a given sound pressure level. So, here you can just defined as basically permissible duration of exposure at a, at a given time at a given sound pressure level in hours. So, and the summation is carried out of overall period during the shift. So, this summation is used for that. So, in this way noise dose can be calculated. So, now, we can now explain this noise control because the fundamentals has been covered so now, just given the existence of a noise problem in a particular facility. So, there are there can be 2 general approaches which can be persuaded to address this problem. So, first is administrative control and second is engineering control.

So, in that so because there are 2 ways that to control in any organization that particular noise level, so if it is some technical faults are there in the, in any system which is responsible for creating noise. So, the engineers will take care of that, if it is something beyond technical. So, administrative will help in reducing the excessive noise level there by creating the ergonomic system. So, here at the administrative control to avoid hearing damage. So, just basically administrative controls are directed at managing thus exposure duration for employees working in noisy environment.

So, administrative control are directed at managing the exposure, duration that exposure duration we can this exposure duration is T exj for employees working in noisy environment, by scheduling the exposure time to achieve a total no noise dose less than 100 percent. So, the scheduling involves balancing the time spent in noise environment against off setting time spent in quite environment. So, another form of administrative control involves education and training of workers, which is the training will be about making them aware of the potential hazards of intense noise and importance of using the engineering control that have been installed for noise abatement.

So, the importance of administrative noise control must not be minimized it is generally agreed that more desirable and potentially more effective approaches through engineering control. So, here we can see that noise abatement at 3, locations we can think of the source receiver and path between source and receiver. So, the as per as this engineering control is concerned it involves various techniques and ways that can be implemented to reduce the noise intensity level in the work environment. So, basically

there are 3 regions where the noise level can be think of, can be thought of to reduce. So, first at the at the point of source, second at the region of a receiver and third is the path between the source and receiver. So, in this way like if this is source and this is the path and this is the receiver. So, source, path, receiver view point in the design of engineering control for noise abatement. So, noise control at the source involves the redesigning of the machine, redesigning of the machine or process that generates the noise.

So, reducing the noise level emanating from the source is usually the most effective approach to abatement, but also it is you see the most difficult and one of the most expensive approach, because then machine installation is very expensive thing and if you are thinking to redesign or this system and process so that it will cost too much. So, that is why it is very much expensive approach. So, the machine or process has been designed to accomplish a given function. So, if a noise is coming it means that ah.

Noise is also will be noise will also be responsible for wear and tear of that particular machine, example of inherently noisy machine include like jackhammers, forge hammers, stamping process when now noise level is too high. So, it is difficult to design these machines for quick and operation without entering their productivity. So, in this case it is when the, when the interaction between the tool and work piece is taking place and that is the required like in forging operation in manufacturing. So, that forging the like in the drop forging when sudden impact is essential to put.

So, here the now noise will certainly becoming and you cannot control that noise level at that particular moment of time when the sudden impact is going to put over the work piece, in order to change its dimensions size or shape with the help of plastic deformation. So, for that plastic deformation of a particular work piece is it is essential that you will put an impact over that particular substrate or work piece which you want to provide a desired size and shape. So, in that noise will come; obviously, and it is, it will be ideal job of an engineer if you if you could reduce or if you could manage that noise level and particular manufacturing industry specially for those who work which essentially we having some sort of noise.

So, engineering control we have to think that because as we mention that there is a way to control noise on the administrative or engineering level so engineering level as much

more convenient for utilizing it for noise control in an industry. So, let us take a one example.

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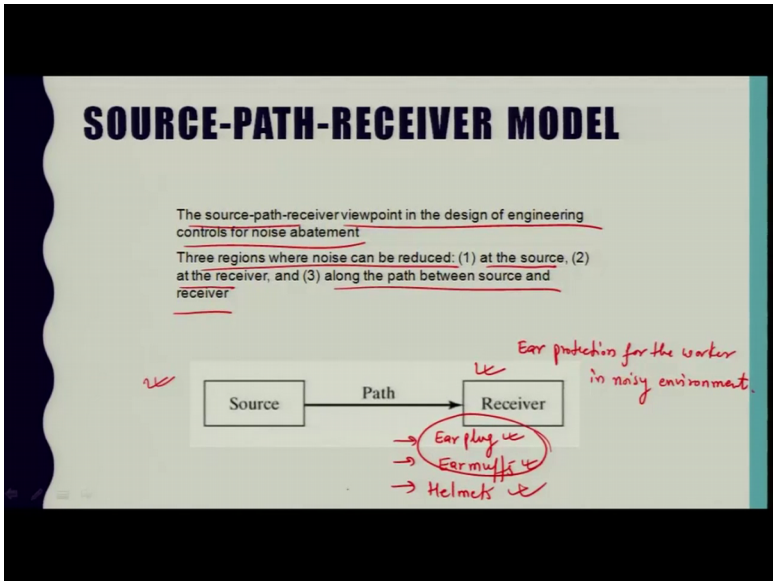

So, before that we covered this particular thing that source path and receiver. So, this particular source path receiver view point in the design of engineering controls for noise abatement. So, 3 regions where noise can be reduced at the source, at the receiver and along the path of the path between source and receiver so there are situation in industry where the noise is compulsorily re coming.

So, in that situation the worker is continuously being exposed to that particular noise level. So, what could be the possible remedy in order to provide the better environment to those workers who are directly exposing to that noise level. So, in that context engineering control, engineering controls at the receiver means providing some ear protection for the worker who is constantly working in the noisy environment. So, the types of ear production equipment may include ear plug, may include ear muffs, it may also include helmets.

So, this particular ear plug is made up of pliable material that can be fitted into the auditory canal that is outer ear passage to reduce the sound that reaches to the middle ear and inner ear mechanism. Ear muffs cover the complete outer ear to reduce noise and helmet effects over the head and ears in some cases completely enclosing the head. So, ear plugs and ear muffs are often combined to increase the protection level over either

one alone. So, all of these ear protection controls are considered less satisfactory than engineering controls at the source.

So, like I am giving you possible engineering controls at the source of noise, like if you target some machines or process and possible engineering control at source.

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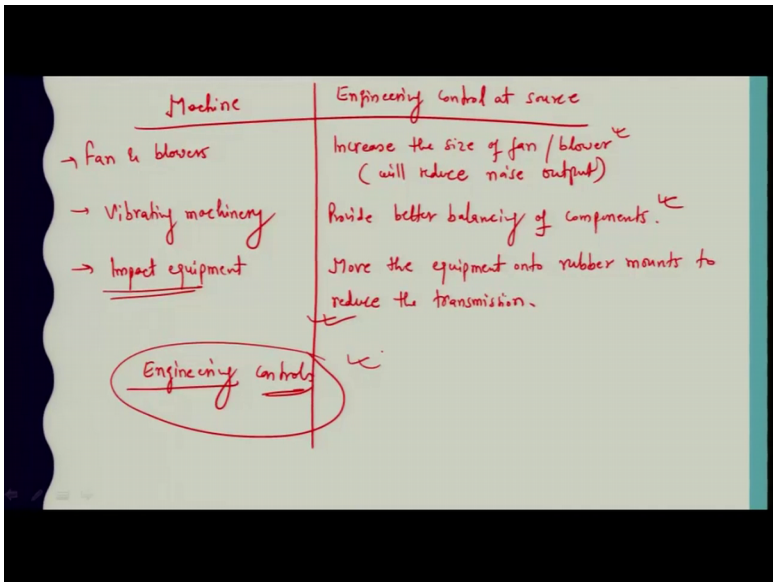

So, if the noise from fan and blowers are coming. So, engineering control maybe the increase the size of fan or blower. So, that it moves the same amount of fluid at lower rotational speed. So, this generally it will reduce noise output; if the sound is coming on the lets say vibrating machinery. So, we have to provide better balancing of the components, such noise often results from generally in balance of rotary or rotating members, impact equipment such as stamping or forge hammers used in manufacturing industries.

So, we have to move the equipment onto rubber mounts to reduce the transmission, if possible. So, impact noise of this kind of equipment is often partially transmitted through the floor of the plant. So, we need to take care of the base or floor of the plant and so the engineering measures need to need to implement engineering. Engineering controls are necessary for any manufacturing industries in order to reduce the noise level. So, with this I am closing this lecture and then as per our culture I am giving you one line.

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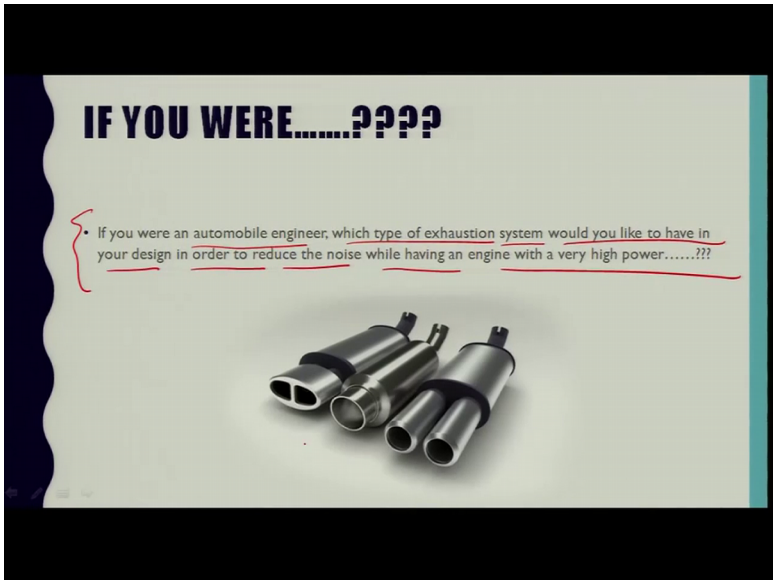

To think that if you are an automobile engineer which type of exhaustion system would you like to have in your design, in order to reduce the noise while having an engine with very high power? So, think about that.

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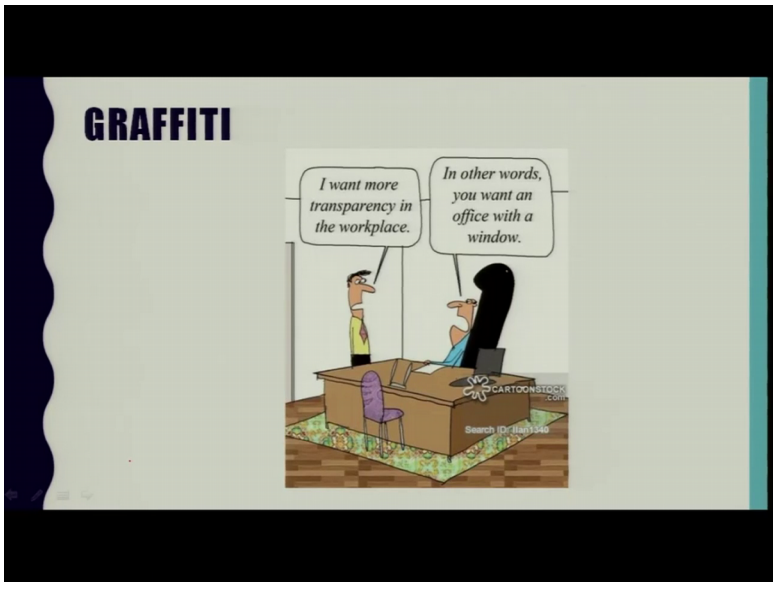

There is a graffiti for you enjoy and that is all for now we will be dealing with the climatic control conditions and that is affecting the work environment in the next lecture.

Thank you.