Industrial Safety Engineering
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Lecture - 56
Energy Isolations

Hello viewers, last session I mentioned for the success of occupation health, and safety management system.

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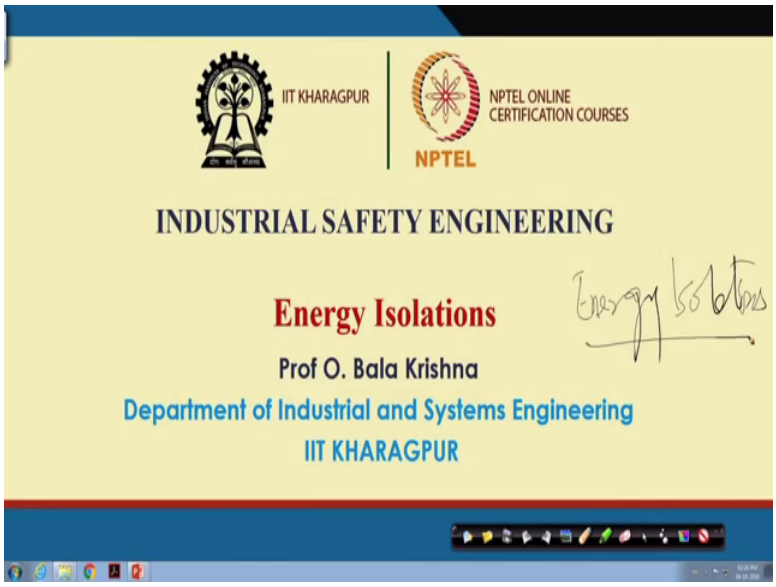

One activity is very very important that is Energy Isolations. I will tell you what is the energy isolations in the coming slides.

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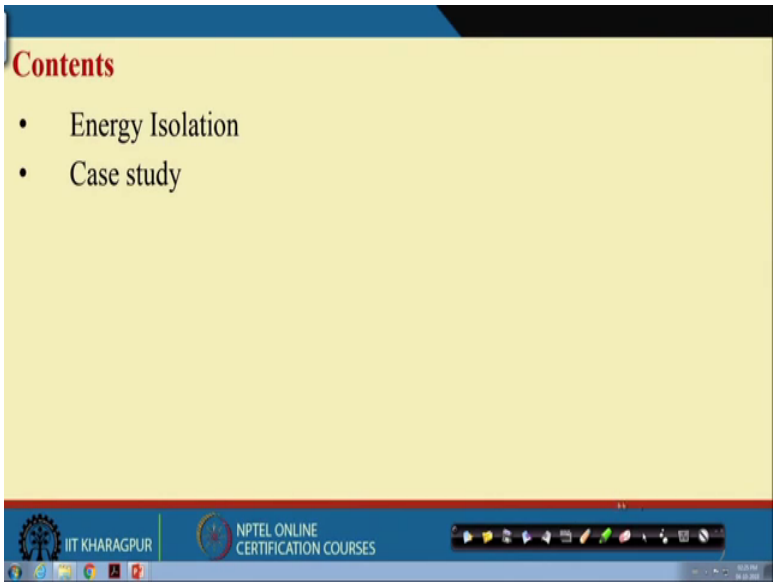

In this session we will discuss in detail what is energy isolation? Why it is required? How it is done? In detail we will talk what are the statutory requirements for energy isolation? To make you more understand the whole concept I brought a case study also with that case study we must able to understand thoroughly.

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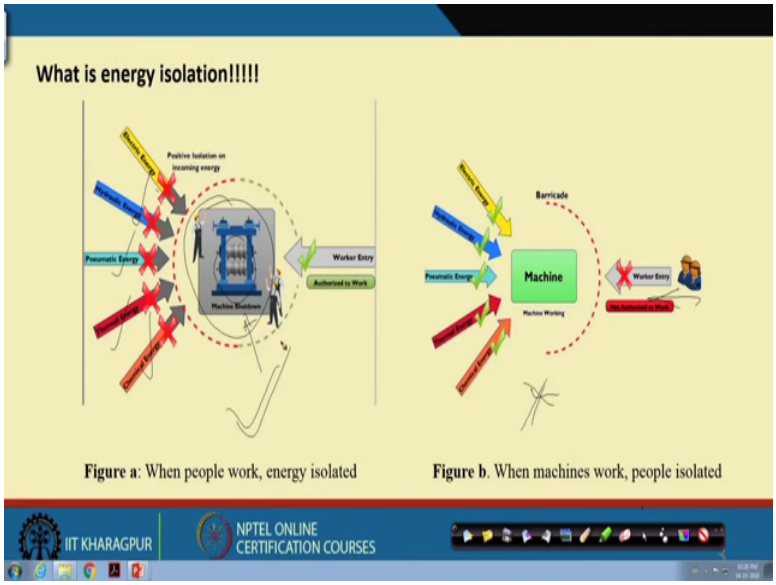

Look at the industrial scenario any scenario you have machines many times people have to work in the on the machines, or processes, or equipment people have to go and work, but this machines are processes may have many energies coming on that, that is why that

that have become machines. There could be electric energy, there could be hydraulic energy, there could be numatic energy, there could be thermal energy, there could be chemical energy and there could be gravitational energy.

If man what energy man has got? He has got brain, he has got ideas if you has to separate this machines first he have to make all this energies 0, otherwise if any of the energy opens out people will be killed. So, primary requirement for the occupational safety health is when people are going to work on the machines are processes are equipment which have got energy that energy has to be made 0, 0, 0, 0 this is one scenario. Other scenario, but why the machines and processes are there? They have to work otherwise how the output will come.

So, when the machines processes are working people should not enter. If the machines are working, if people enter that there will be trapped in the energy and there will be died. Second case is very simple to stop people put the barricades thorough barricades so the people will not go.

So, this we will not be discussing in this session. We are discussing this when people are work going to work on the machines, how you make energies positively 0, that is called energy isolations, that is called positive energy isolations, that is called isolations. All these terms are same people talk about these terms different people talk differently.

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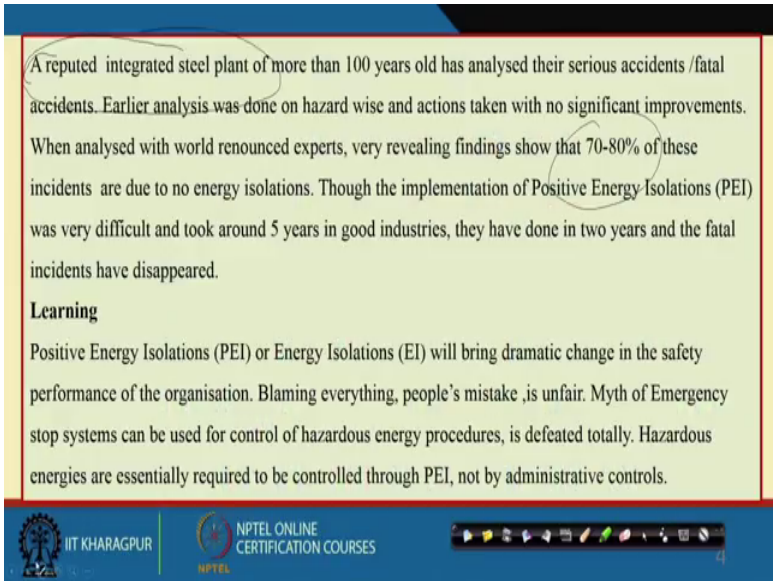

Let me give an example a reputed integrated steel plant which has got reputation of work more than 100 years very very successful a benchmark steel plant. When the incidents happened for all these 100 years major incidents, fatalities were analyzed by a very reputed consultant.

Very revealing factors come around 70 to 80 percent of these incidents major incidents major fatalities are because of no energy isolations. People thought I am doing this job nobody will put I put on the put of the switch and started working somebody came put on the switch. I finish my job I told people do not put on the power I will go there and see after 5 minutes you do it, after 5 minutes you have put on the power. Mean while I could not come out of it and died such incidents are mean numerable.

So, the 70 to 80 percent of the incidents happen in the major hazard industries because of the no energy isolations. So, what is the learning? Positive energy isolations are energy isolations will bring dramatic change in the safety performance of the organization dramatic change.

See change blaming everything people make people make mistakes people are careless this statement making is very very unfair, or there is a myth we are got emergency stop system we can put the emergency stop when it is required that is also missed.

The purpose of the emergency stop is different. So, hazardous energies are essentially required to be controlled through positive energy isolations, not administrative controls, not warnings, not signages. They have to be controlled by positive energy isolation which is engineering way of doing the isolations, not administrative way.

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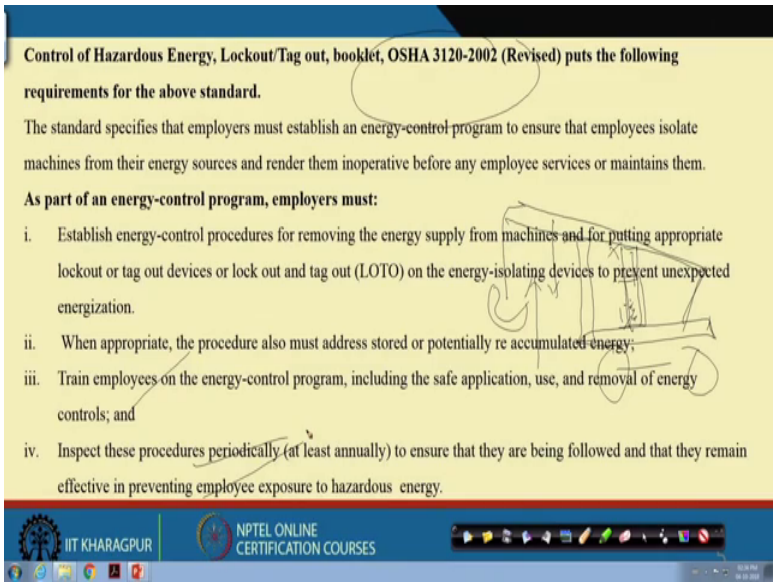

This control of hazardous energy lockout, tag out, it is also there in the OSHA 3120 to 2002. What is OSHA? OSHA is Occupation Safety and Health Administration of the United States, this say OSHA statute says establish energy control procedures for removing the energy supply from all the machines. We should have energy control procedures to take out all these things. And putting appropriate lockout tag out devices or lock out tag out both which is called LOTO on the energy isolating devices.

So, this say you isolate the energy then you put the lock or tag or both. When appropriate, the procedure also must address stored potential potentially re accumulated energy. There are sometimes stored energies are there. What is stored energy? In a hydraulic system say you have a crane; it goes up and down with a cylinder, hydraulic cylinder. This hydraulic cylinder will take it up bring it down.

Suppose if you put off the energy still hydraulic power is there inside the cylinder, the boom is in the inclined position. So, there is a stored energy inside if you sent people to work here. While working if there is any leakage of the hydraulic fluid it will come down and it will kill the people.

So, stored energy means he says the stored energy also should made zero, and you put a mechanical stop here before people work. With the stored energy people cannot work. We have mechanical stored energy, we have electrical stored energy, we have hydraulic stored energy we will talk about those things. So, OSHA says that also should be made 0,

and you have to train the people and you have to inspect periodically whether these things are in position or not. This is the requirement of OSHA.

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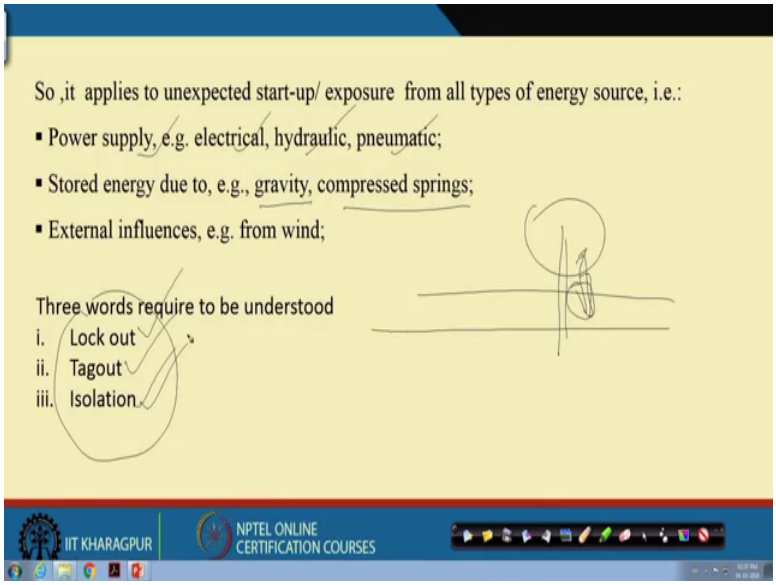

So, what are those energy sources? What are those energies we are talking? Power supply; what is the power supply? Electrical, hydraulic, pneumatic, power supplies; stored energy due to gravity, compressed springs.

When you put the spring compressed, it has the stored energy. If people have to work that compressed springs have to made normal position then only people should work. External influences suppose some wind energy coming while working all those things also to be isolated before people go. Friends, there are three important words which we should remember in this whole session. One is lock out, tag out, isolation.

What is lock out? When electrical power is there you put off the switch put off and put a lock that is called lock out. You put off and put a lock that is called lock out. When the gas is moving in a pipeline there is a valve you close a valve, put a lock here, lock out. Tag out means you close it and put a tag warning sign I have closed it do not put on, that is a administration control that is called tag out who had locked who had closed it? So and so had closed I so and so closed do not put on that is tag out.

First is lock out, second is tag out, third is isolation. Isolation is putting off and separating it you have to put off the power and separate it, in no cases they will join. In

many cases if you do not separate, there is a chances of the getting join because of various conditions. So, isolation means you put off and separate then you put the lock. So, you put off separate and put the lock no where the energy can come that is called energy isolation.

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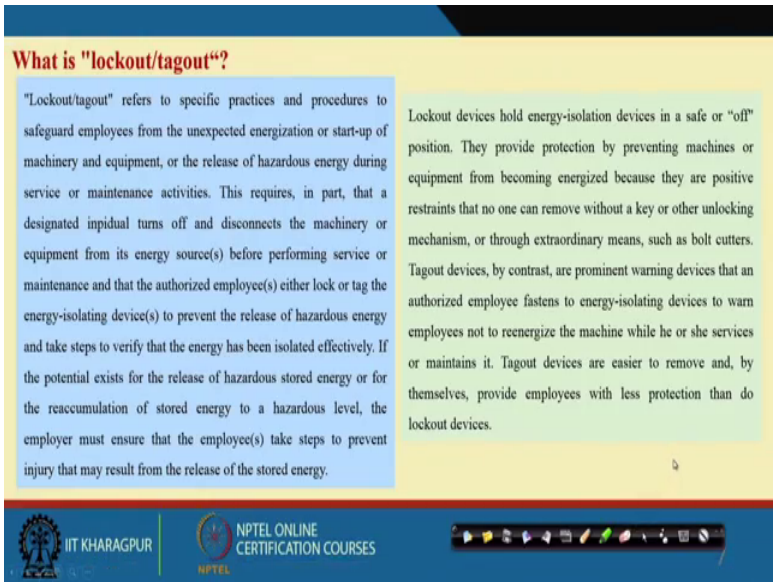

So, this is what we are talking the lockout tag out what I discussed with the same we have mentioned it here. So, tag out is a warning signs, lockout is a locking. Both cases we are putting off power putting off the energy that is all.

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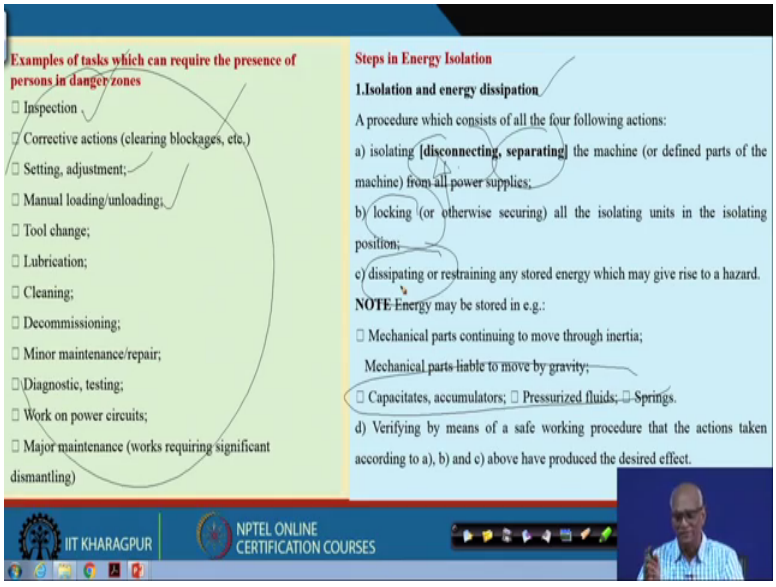

So, when you require putting off the power? When you require lock out, tag out, or isolation? There are various activities if you want to do thorough inspection of the machines you have to go side and check various things. If you want to do corrective actions some adjustments you have to do, some blocks you have to put, some edges you have to put, you have to do adjustments, settings, or you have to load many things in the machine, unload by going to the machine, or if you want to change the tools, or you have to put the lubrications in the machines very very places which is if you do not put of the power you may you may get and trapped.

Cleaning, decommissioning maintenance, diagnostic work on the power circuits, major maintenance when you have to do all these things you required you are in the danger zone, you are in the danger zone. If you want to be not in the danger zone and do the job you it calls for isolation. What is isolation? Isolation is disconnecting, separating. You have to disconnect and separate two activities disconnecting, separating.

In lockout and tag out only disconnecting in lockout and tag out only disconnecting in isolation disconnecting and separating then you have to put the lock. And you have to dissipate, then you have to dissipate the energies. Isolation is not completed unless you dissipate the energies which are there at the in that.

So, energy storing means mechanical parts continued it to move through inertia; flywheels even if you put off it will keep rotating. The in the helical circuits capacitors in the gases accumulators, pressurized fluids springs they are all called they are having energies all these things are to be dissipated, deenergized.

It is over with that? No afterwards you have to see you have to see by means of various techniques whether isolations has happened 100 percent what you wanted you have to verify. Verify through procedures, verify through gauges, verify through testing then you have to start the job. This is the process of energy isolation.

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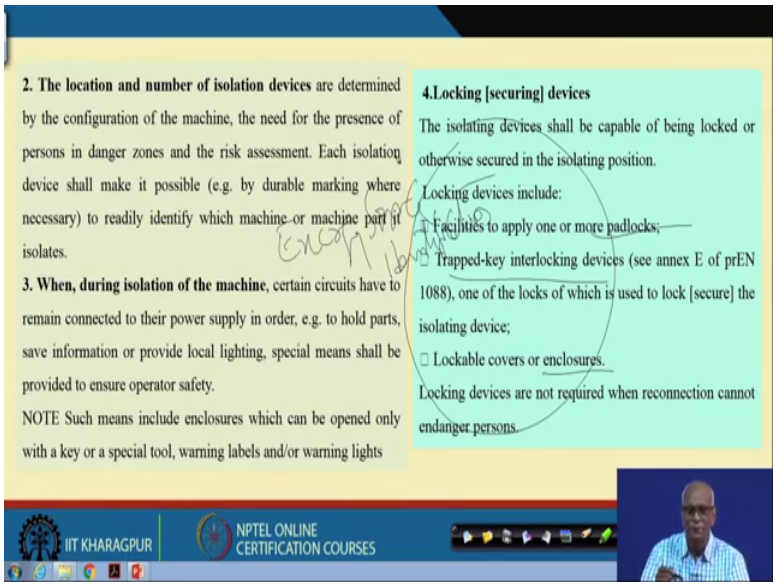

So, isolation the location of the number of the isolation devices, where is to be isolated, I know that I am working there, but where is to be isolated this is called energy source identification energy source identification. Where I have to put the locks energy source identification? When I have to put the locks and locking devices.

So, what are the locking devices? Padlocks, trapped key somewhere outside the external keys locks are key incorporated to the machine itself or lockable covers and enclosures. You cover the lockable covers and enclosures there all the various devices for the locking.

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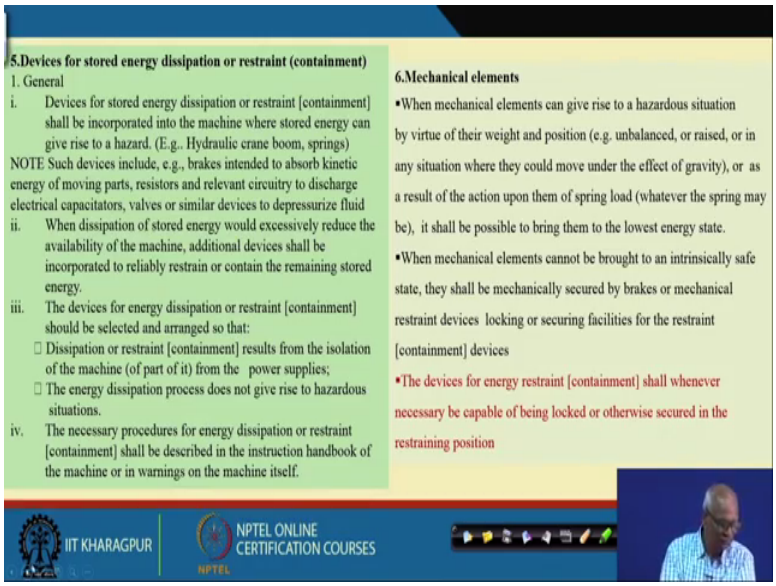

So, the devices which have got stored energy. The devices for the stored energy dissipation shall be incorporated into the machine where stored energy can give raise to hazard. Such devices includes brakes which absorb energy resistors.

When dissipation of the stored energy would be excessively sometimes you cannot dissipate because if you dissipate the energy for starting it will take lot of time. Then you should have separate devices the energy, without dissipation how could you hold the component in position you should put separate devices. But normally we avoid it.

The devices for energy dissipation or restraint should be selected and again you show that dissipation results from the isolation of the machine. The energy dissipation process does not give rise. See while dissipation the energy you should not trapped in the hazardous.

Suppose if the spring you want to release you should very carefully very through a procedure you have to dissipate. So, energy dissipation procedures are also should be there. There are there are many many energy dissipation of the flywheels, energy dissipation of the pressurized fluids I seen cases while dissipating the energy people have died especially in hydraulic circuits. High pressure circuit if you want to release the high pressure, that high pressure liquid hits the people; they will get injured and died.

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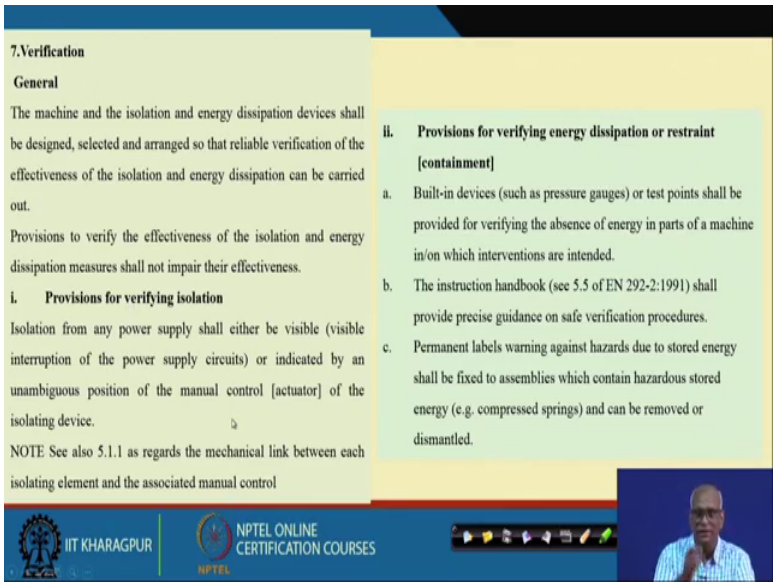

So, there are procedures where how to dissipate the energy? Verification there are verification is very very important. If everybody has said that you have put off the power, separated it, put the locks; put the tags, everything they have done. But it is very essential whether it is done properly, or not final place where people are working their issue you should be able to see that really it is done or not?

There are there are there are many ways of verification. There are visible verifications, there are built in verification pressure gauges, all these things if the pressure gauge is put. If the pressure is flowing 0; that means, pressure is there is no pressure instructions books; instruction hand book say that you check all these things if it yes then it is dissipated, or if you electrical thing you put the tester measure and see whether the power is there or not? So, you have to verify by different means to ensure yes isolation is done.

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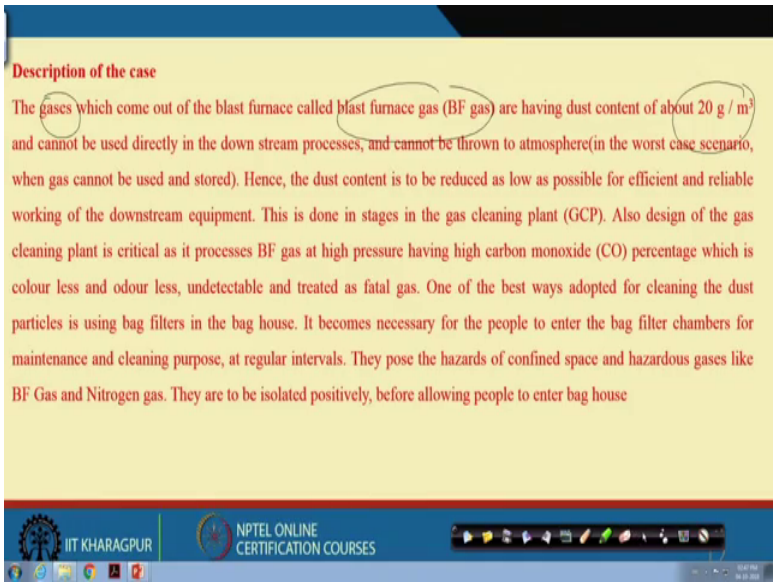

Let us go through the case study. We are talking about the blast furnace case study. Blast furnaces generate gasses, blast furnace gas, very very hazardous colorless, order less. But very hazardous if it is more than 30 PPM, people will be people will die, it is more hazardous than LPG gases and all these things.

So, when from the blast furnace when the gases come out they will have some dust content in that. We have to reduce the dust content to minimum levels, because the dust will not be burnt anywhere; it will go through the atmosphere finally. If it goes to the atmosphere it will it will create atmosphere like hazards, or all the equipments we are this gas which we used to for burning those equipments will be gammed.

So, we have to reduce the dust content to allowable limit. So, this blast furnace gas is sent to the gas cleaning plant, where the dust percent is reduced this is the case study. So, blast furnace gas initially has got lot of dust content, it has to be it is having around 20 grams for meter cube. We have to reduce it to the allowable limits this is the case study. So how it is done? And why energy isolation is required?

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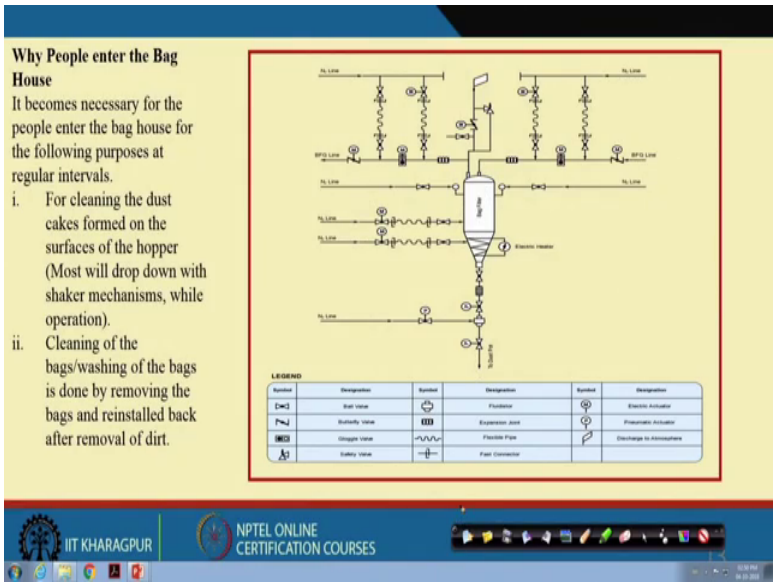

You all must be knowing by this time P and ID diagrams. The gases from the gas furnace blast line will come to a bag filter, or bag house where the gas will go to the bag filters and the dust is catched caught there something will go inside, something will go outside. And finally, the dust which it going outside taken out from these valves, inside the gas inside the filters whichever is whichever dust is contain periodically they have to be cleaned, washed. Those filters are to be taken out washed and put back.

How will you do that? People have to go inside takeout those filters wash it; clean all the hopper. So, people have to go inside a inside the bag house for cleaning the dust cakes, cleaning the bags all these things people have to work periodically in this. Can they go? Last one is gas is going. What you have to do? If a person is going there people are going there.

All the energies going inside this have to be made 0. What are the energies? Blast furnace gas blast furnace the input, gas blast furnace output, blast furnace input has to be made 0, blast furnace output valves also made 0. Why? Because in the reverse they should not any flow coming inside. There are lot of nitrogen lines all those lines are used once you take out the blast furnace gas you have to purge it.

So, that blast furnace traces of blast furnace gas also should not be there inside, you have to purge it, nitrogen purging we do. So, once the blast furnace gas is taken out close, then you have to purge it, then you close the gas furnish valves. Because nitrogen valves if

nitrogen valves are not close; if nitrogen is here then a process called as a fixation. People will not get the required amount of oxygen for the breathing.

So, all the nitrogen lines are to be stopped isolated; all the blast furnace gases are to be stop isolated that is the requirement for the people to go in to the bag filter.

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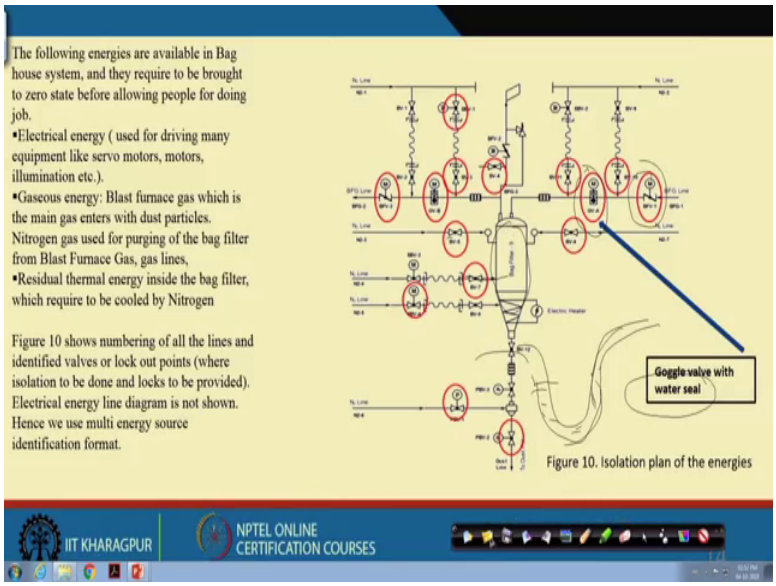

How it is done? First people have to isolate the electrical energies; there are powers all the valves are valves are operated with the power. So, those valves electrical energy also to be stopped; gasses energy also to be at seen and residual thermal energy also to be made 0. That means, once the blast furnace gas line this is the blast furnace gas line, this is better fly valve, this is the butter fly valve.

First people close the butterfly vale so that gas coming is become very very less. Butter fly valve a is not 0 leaf proof. Then this is the goggle valve then goggle valve mean they put up the goggle valve inside goggle valve normally now a days there is a water seal. Goggle valve closing is not isolations because you have to separate it for separation either you separate it or put the water seal if you put the water seal gas will go through the water seal.

So, if you put water here gas cannot go, it is almost like separation. So, put the goggle value off; again this goggle valve is put of delivery side, put of the butterfly valve. Then you put off the power to this they are made 0, then you purge it with all these nitrogen

valves. When thorough purging is done people check there what is the oxygen content? It is thorough purging is done then you isolate all these valves that is the process we have to see. Then this is totally isolated from all the energies, electrical energy, gaseous energy, nitrogen energy.

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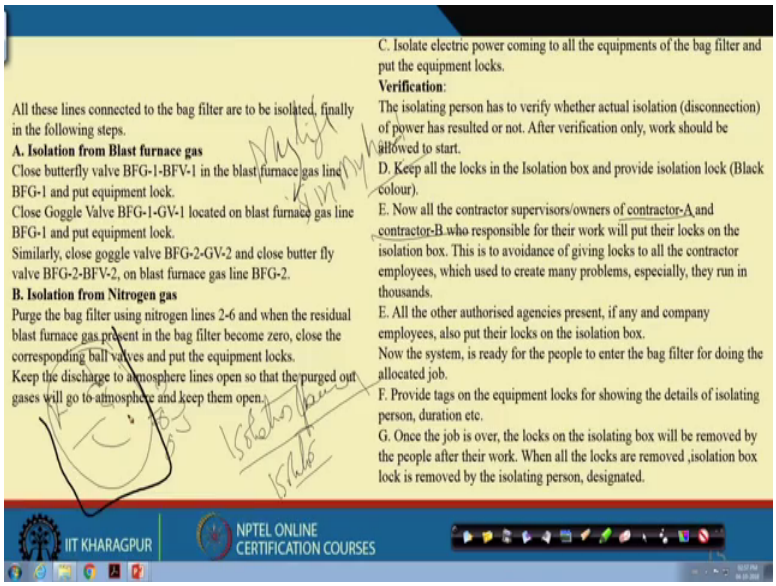

So, I written the sequence. How the valves are to be closed? Blast the lines have been given, names blast furnace gas line, blast furnace gas line one this valve you have to close blast furnace gas line goggle valve you have to close. Blast furnace gas line you have to close this then how to do the nitrogen line nitrogen closing? Then you have isolate the electric power, then you have to verify how do you do verification? By checking inside with a gas meters whether the gas is coming or not?

Then you put all the locks, the people whoever is working they have to put their locks. They have to takeout the keys. If the contractors are working say there are contractor A, contractor B. There are contractors working contactors say there are 10 people, 10 people contractor people are not so educated they do not know this locking and all these things.

So, the contractor supervisor he will put the lock. So, before contactor supervisors employees putting their lock. First lock has to be put by the equip the isolator the man who has got knowledge, isolating knowledge. See there are 3 activities; one is isolating planner, isolation planner that is those red circles where it is to be put? Locks all those things could be done by the man who has got total knowledge about the things, he is

called isolation planner. Then isolator, isolator is the person who will go and put the lock and the equipment.

So, first lock you will put in all the equipments you will put the locks nitrogen lines, blast furnace gas line, everywhere he will put the equipment locks. Those keys he will take and put it in a box put it in a box which is called isolations box. All the locks of the equipments you have put here, then you will put the isolations put his on lock, group lock. After putting this equipment locks; group lock then only others will put their on key, own locks and these on that particular lock.

The isolation box is closed and the one more lock isolation isolator will put. On that people will keep on putting the locks whatever people are working they will put the locks. If I complete my job, I will open out my job, if all the people open outs the lock isolator will come to know yes everybody has done their job, then he will open the lock. And he will open the equipment lock one by one.

If anybody has not open the lock then he isolator cannot open the lock. All the people you have put the locks then they open then only the isolation box can be opened, where the equipments, where the locks are provided the keys are inside that is why people say my life is in my hand.

Why? The person after isolation all the energies he has put it in the isolation box, he had put one lock; that means, all the energies isolated and this group isolation box is isolated it is there in these. Now if I to work, I am putting my lock here, if I and I keep my key inside my pocket, I keep do my work as long as I do not complete my job my key is inside my hand nobody can open the isolation box.

So, my life is in my hands, when all the people after doing the job when they open the their keys, when the isolator will open the isolation box, and one by one equipments he will open out. In this process do we think any time at any time a person can be effected by a energy. If I am a worker I am working on the equipment bag filter, I am very very comfortable. Because I feel nobody can open the open the gas as long as my keys in my pocket when I complete my job then I open then only others can the gas can come.

So, I am very very comfortable otherwise workers will have the fear. Anybody by mistake opens our management have the fear by mistake anybody opens the gases it will also like happened like that. So, in the positive isolation that is taken out.

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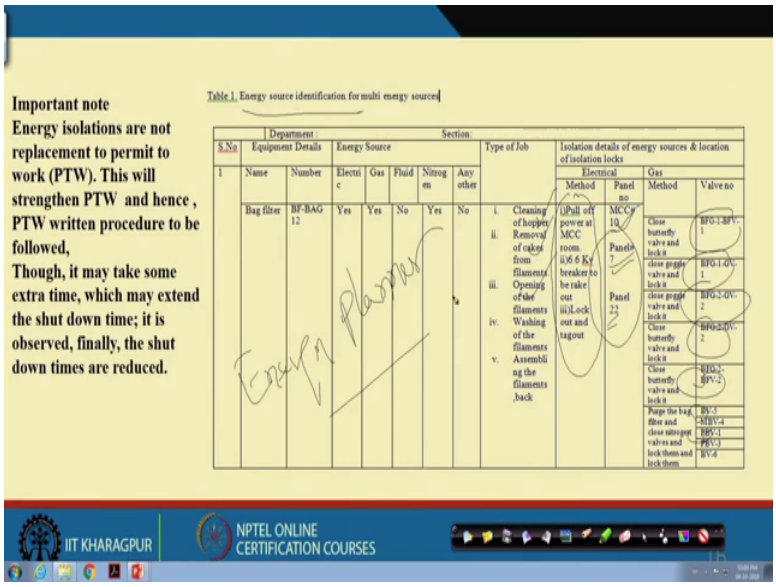

So, this is the energy isolation. So, what are the energy is coming? What are the activities we have to do? What is the method we will do? And how the locks are provided? Different locks, different valves.

If close the butterfly valves see people go inside and cleaning of the hopper, removal of the cakes, opening of the all the jobs. First he have to do the energy electrical isolations that is MCC 10, Panel 7, panel 22 you will put locks here. For a gas cleaning close the butterfly valve, close the goggle valve, close the all these valves people close then put the locks.

This is called energy source identification. Where you have to put the locks? Energy source identification it is done by a very very knowledgeable people, he is called energy planner, energy planner very important person. Lot of training is given to them. How to do this?

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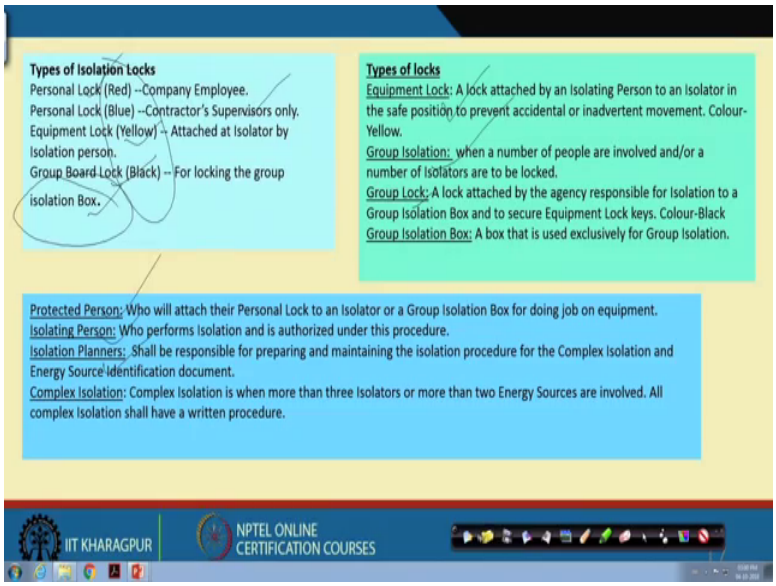

So, types of lock people use there are personal lock by employees, there are personal lock by the contractors, supervisors. There are equipment lock, there is group board lock, there is isolation box. So, these are the different locks 4 types of locks people use and isolation boxes.

So what is equipment lock, group isolations lock, group lock all those things put it here. So, here isolating planners, isolating persons, protected person all these things are the names of various people involved in this.

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What are the various things we use in these? This is the blank the gas line if you isolate, separate, and put the plan. These are these are the blocks, stoppers for hydraulic cylinder when they lifted. Stoppers when the hydraulic cylinder, you lifted then you put the stock these are the locks.

See one person puts the locks, others can put on these, unless these locks are opened these cannot be opened. A seizers one lock seizer he had put the isolator, and he had put seizer lock then all these wholes others can put the locks. There are different ways how the valves handles are locked? So, different handles how do you lock?

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This is isolation box, where the energy isolator he will put the equipment locks though the equipment locks keys are put inside. Then on this he will put this own lock, these are the seizer lock. Because if the people are more then he will put the seizer lock and all those people they put the locks here.

So, unless these things are opened if this cannot be opened, even if you open see cannot take it out. So, unless you open out these keys are inside they cannot be open. If you have more number of equipments, you put you used two isolating boxes and two are two are connected with the equipment lock. So, people will not put locks here, a equipment lock you put it here that key he will put it here and again equipments locks are there. So, they are connected two boxes are connected.

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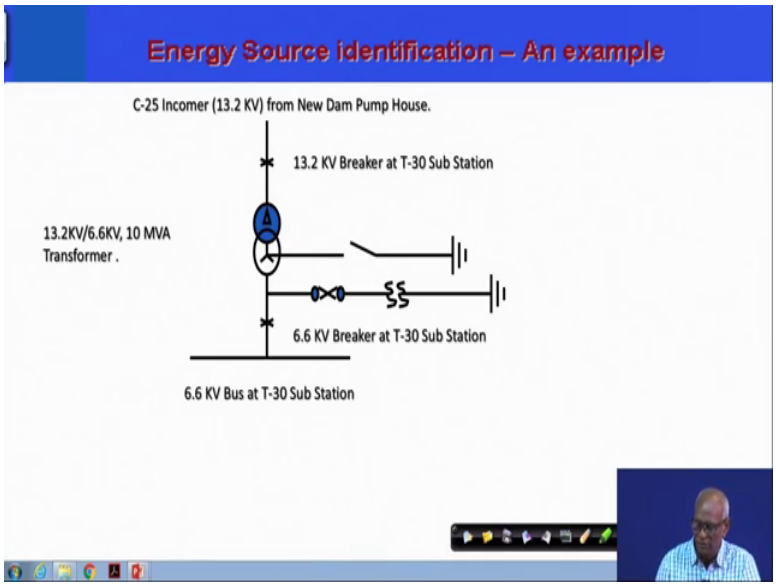

So, some examples, how the electrical energy is isolated? Electrical energy which is coming here, coming here, coming here, they are put off their energies if the people are working here.

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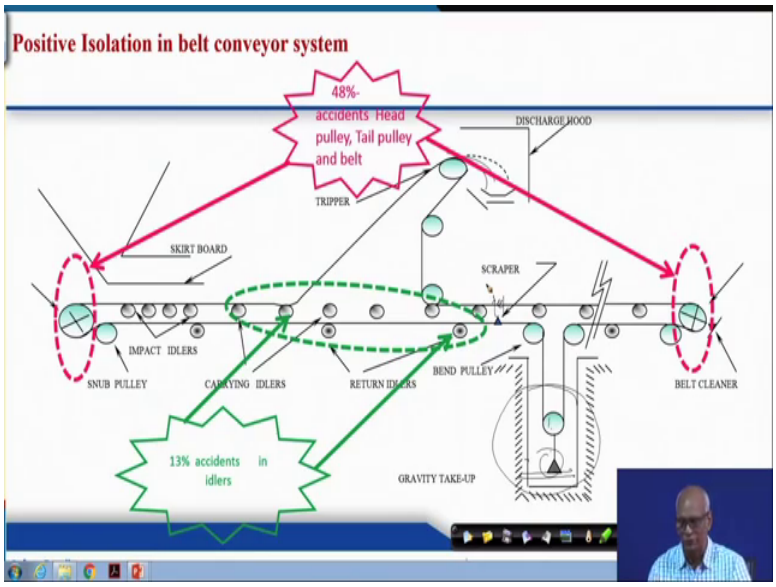

Very important belt conveyors: belt conveyor is used for transporting lot of materials bulk materials, continuous materials. Suppose if you have to the belts are joined if they are the length is more they are cut and joined here. If you have to join here there is a

gravity take of fully always in the bend conveyer. The purpose of this is to give tension on the belt always.

Tension so if the gravity pulley is here with the weight, if you cut it will come down it will fall down people are working there will be damaged. So, this gravity contour weight has to be locked here. So, that there is no load on this then you have to do the work which are suppose to do. This is called this is called gravity isolations.

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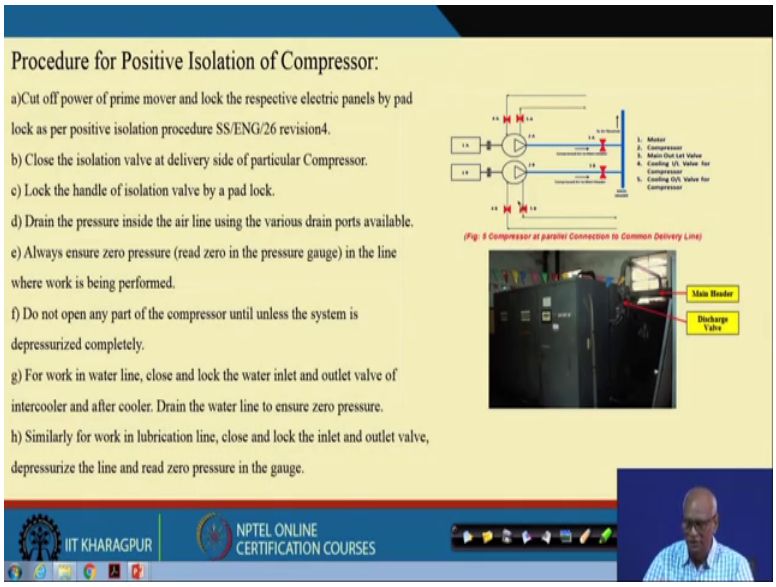

This is called compressor isolation.

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Railway tracks industries railway tracks are there. If somebody is working there people put the flags there not the energy isolation, they put the derailer, this is the derailer. When the when the any equipment comes it will come here and it will come get derailed. The equipment the railway engine will get derailed; on the derailer you put the lock.

So, that nobody can open it if I am working it working in this direction. Suppose if both the side rails come the two derailers in between I will be working. This is called minimax. In the hydraulic circuits this is put minimax is put. So, minimax by pressing this minimax, you can release the energy and finally, you can check whether the pressure is 0, or not with these connections.

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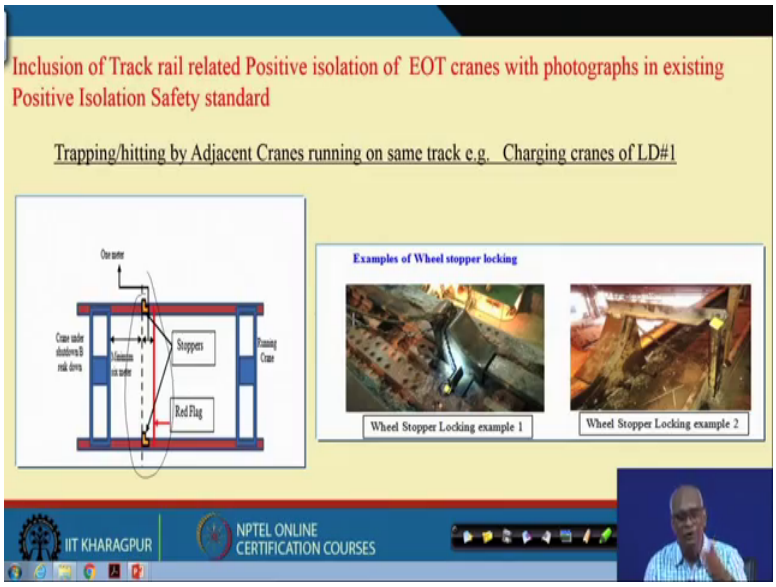

Cranes, EOT cranes; EOT cranes then they move, so they will have long travel. So, totally you need not block some length you will block other side people will be working.

So, people will put locks here. They put the stoppers and put the lock. Why lock? Otherwise stopper anybody can take out positive isolations. So, positive isolations for the EOT crane moment. What did we discuss? Why energy isolations is required when people are working on the machines? If you do not isolate the energies people will get killed that is what is to happened.

So, the energy isolations are separating energies and put in the blanks. Then you have to put the locks by putting by doing the energy isolation disconnecting, separating, putting

the lock. The people positively people are saved that is why these things are called positive isolations. The main motto of energy isolation is my life, my hand.

So, my life nobody can take out it is in my hand ok. So, this is how the energy isolations are ensured in the industries. And the industrious if you have put energy isolations in place, the safety performance has increased many force drastically and safety performance come by design, this also a part of safety by design.

Thank you.