Bulk Material Transport and Handling System

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Lecture - 20
Case Studies of Stacker and Reclaimers Applications

Welcome back, so today we are going to discuss few case studies, exactly we last to three classes we have talked about stacking, blending and reclaiming and in stacking we know that when the raw materials are coming from the mines or agricultural field, we get them and then we need to store it in some open storage. We knew that this storage can be either in chevron type or in windrow type or as oblique layers as strata type, we are storing them.

And sometimes we store them in under a shed or in a building or in many times it will be stacked in the open air. And then while stacking them we do it in such a pattern that when we reclaim, they get a blending and we discussed about that homogenization and blending these two activities are done while we are reclaiming so, that the targeted use or making the concentrate.

It can give a positive impact to the performance of the subsequent processing or also it should not adversely affect the machines and the systems. So, that is the whole purpose of stacking and blending. Now we also told that there are various industries where this stacking, blending and reclaiming is are used. So, one thing you know about that our raw material sectors in India, particularly in the mineral sector our major thing is the coal and iron ore in which we do a quite a good amount of them.

At the same time, we have got the stems stacking blending and reclaiming operations will be there in our limestone mines, in our cement plants, in our thermal power stations, in the ports were coming and everywhere there will be stacking. And then sometimes it may or may not be blending but reclaiming will be there. Now when we talk about a case studies that means in a in your process of learning you should know where how they are being deployed.

And what are the different problems are being faced and then how they are resolved. You will find if you make a internet search that many of the cases of India are not available in a written form in a good documents, good journals you do not find much of this studies.

Because there were certain things that we were not disclosing many of the things to the public but at the same time as a student you will have to make an effort to find out what is the present status.

Now for knowing that you will have to find out you will have to visit sites I hope that through the institutions or with your individual effort you will be able to see some of the sites for example in the iron ore raw material handling sections say if you are nearby Bokaro you can go to Bokaro steel plant or Rourkela steel plant or even in the Tata steel BSL that the angle steel plant.

Or if you go to the mines like Kiri Buru, Magmata Buru Bolani or Jodha mines or if you go to Panchpatmal area to the bauxite mines you will be able to see how exactly the raw materials are stopped. Now if you go to a steel plant there the raw materials are coming iron ore coming you can get that there will be dolomites, there will be this coke and they are stocked differently. Now while you are storing them then your first thing is what type of problems you face.

That is exactly sometimes you will find mostly the problem related to the maintenance of the machinery. That is that machines deployed if they are not properly maintained there will be breakdown there will be failure and those failures are there. Second thing sometimes you may have the problem due to the quality of the material which is coming. And then there may be big boulders coming.

There may be sometimes more fines and dust coming during the rainy season more moisture coming those are the things. Sometimes a problem may come that is say you are having a coal stock there is the demand side maybe in the boiler side in the power generation site there is a slag it is not required for a long time and thereby there will be a deterioration while storing so many issues may be there.

So, during the study of case studies of the stacker, reclaimer applications you will have to find out some of the history of these existing places. Then in absence of that what you will have to do? You will have to do a desktop research. Desktop research means you will have to find certain keywords and on that you will have to do a study and see that what type of cases they are reported.

And then two sources are there one is the application source other one is the manufacturer. So, you should remember that is what are the names on which you can make your search. First thing is say Taishan group they are manufacturing stacker and reclaimer there are say for example FL Smith there are say Takraf, these type of companies their websites that will be giving you lot of information.

Then other one is you will have to go through some of the conference reports because many of the things you may not be getting in a text book. The case studies will be normally they are presented in different conferences and that is technical seminars. So, like Apcom it is to be a one of the very good conferences where many of these studies were reported. Similarly, mining that equipment selections on that there is a conference which reports are there so those things you will have to study.

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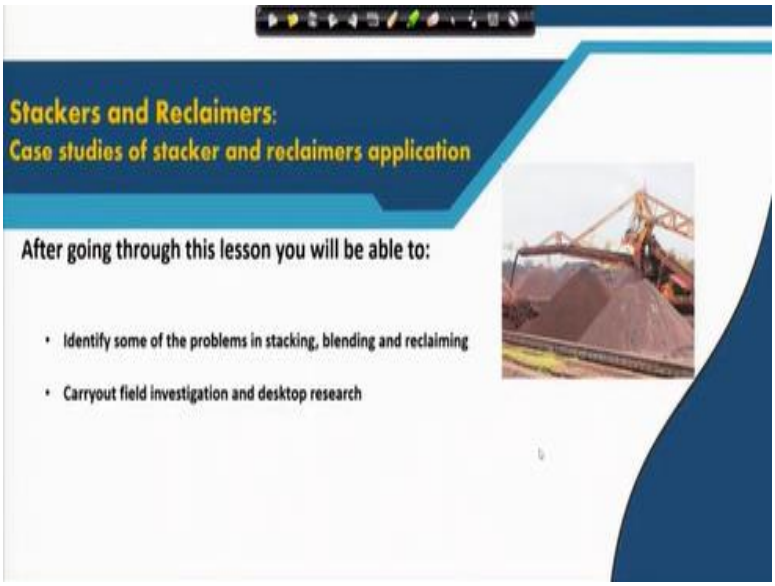

But today I will be introducing you very briefly what this case studies means. Now this, figure here you can see one of the figure in our Indian iron ore mines. So, they are forming the stockpiles from there they will be taken and they will be loaded to the wagons. Now we will be discussing today, so that you can identify some of the problems in this stacking, blending and reclaiming and then you should be able to carry out some field investigation and desktop research.

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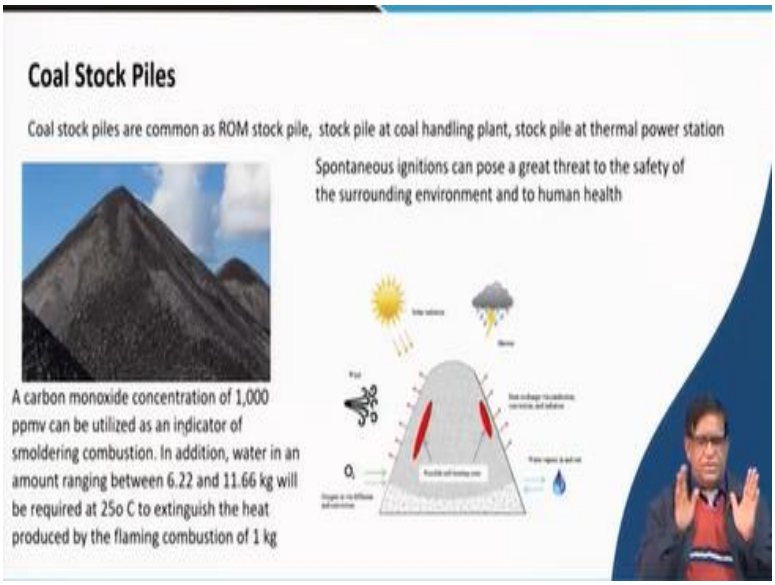

So, let us talk first about the coal stock pile. Now what is happening in a coal if you know certain properties that is it is subjected to spontaneous ignitions or spontaneous heating when it comes in contact with oxygen you can see that there will be with a oxygen there will be reactions and then there will be your heat generations will be there and sometimes you may find that even open flame comes out of it.

Now when there will be shower and with that humid conditions there will be another problem that your moisture content will go on increasing. These two are one of the main problems coming in because if in your stock you have got a lot of weight and moist material then when they will be taken and put into the boiler then a lot of heat will be lost in evaporating those things also.

So, that means and also if you think of a weight coal is taken from your mines to another 100 kilometre distance then the total weight of that moisture is also being carried. So, you are using fuel of the your strain that is your for locomotive you are using extra energy for carrying that material. So, how exactly you will be stocking it and then what type of actions you should take that you can think of.

Now for then monitoring it whether this is exactly that stock is in a proper condition or it is getting heated up or it is having a lot of moisture there will have to be certain monitoring system. That is why in particular cases in some of the areas you will find the word very common is stockpile management. This is a new area coming up many start-ups are these days being launched for developing a stock pile management system.

In which they will be having an instrumentations they will be having some of the devices that how they need to know few things, one is what is the volume remaining over there. So, they will have to measure the volume they will have to monitor how much is going and how much is there so that is the material balance at any time and online that is you will have to get there. And then second thing is you will have to find out that what is the heating condition.

There is a it may be spontaneous heating at the top itself you can say flame or there could be a smouldering that means inside there will be a heat generated. Now if there is that your spontaneous that is combustion has taken place that is your smouldering is taking place at the inside there will be some generation of carbon monoxide. So, now that is exactly if the carbon monoxide is increasing if you can have a sensor around these things around this stock pile.

And find out that this increasing that means there will be a heating taking place, so you should fasten that your evaporation process where the demands are there as early as possible you should dispatch your coal and then also that sometimes the water content that also is an indicator of the conditions. Because it will be also that means you are steaming it so those types of systems are there.

So, it is now your duty to find out what is the stock pile monitoring system and then how it can be implemented that will be a subject of your case study.

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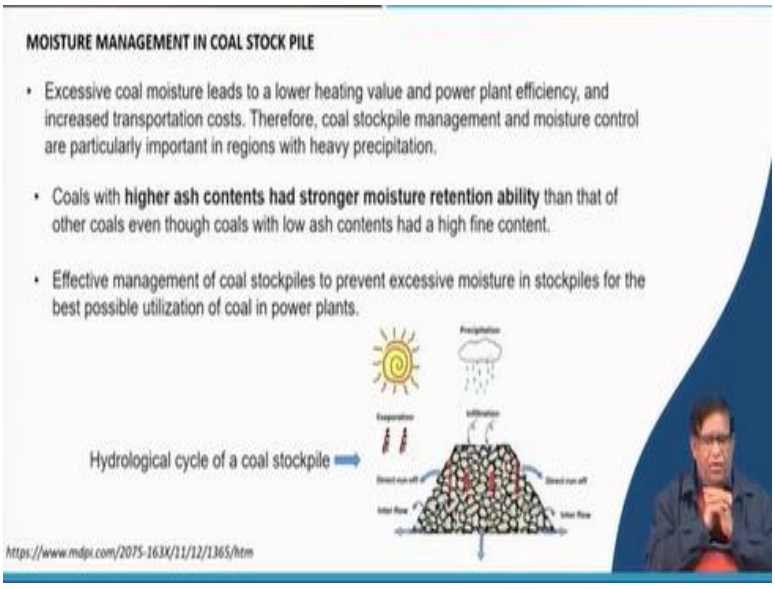

Now exactly what is happening when your rain water comes then where the water will be going how it will be there. So, for example there could be where you are stocking over there if there is a heavy rain there the water will be going. Now in that coal you need to know what is the quality of that coal. Do you have a high sulphur content or you are having high clay content very poor quality? Now if you are having high sulphur content.

For example, the coal of our northeast coal field now of course not his coal fields coal mines are now almost closed but when they used to keep on a pile because they have got a very high sulphur content the water which was percolating down as a your leachate. It was having full of that is your acidic property pH value sometime goes as low as 2.5. Same is with the Meghalaya coal if it is put over there because of heavy rainfall from there.

So, that stock if you are to manage there you will have to see that how you will be putting a liner around the area or how that leachate which will be going out you will have to control. So, that means maintaining the cold stock pile you will have to do additional arrangement also. So, depending on how much rain what is the rainfall rate and then how much exactly the water will be retained in the stock pile.

Now if you are having a poor quality coal where ash content is high there will be the more clay content will be there and they will be absorbing more water. So, that way exactly the leachates will become less because it will be holding some amount of water. So, that phenomena it need to be seen and many times these are this can be subjected to if it laboratory research.

If you see there are number of research has been done in different countries on the how in a cool stockpile hydro logical studies. So, you can this type of case studies also will be important for you to look into.

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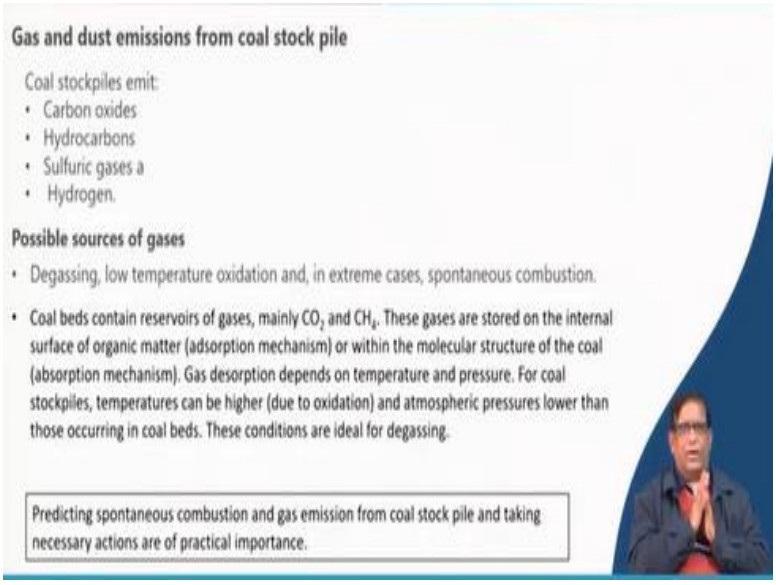

Now then when you are going to study particular coal stock pile say for example in the mines or in your coal washery or coal handling plant or in your thermal power stations. Now you need to see that anywhere if there they will be depending on the spontaneous heating and combustions it will be emitting carbon oxides and carbon dioxide if the burning has already started then you will be getting more carbon dioxide.

Then there would be sometimes that you know that when it is there in situ there are your meeting is trapped in the seam and there is a under certain pressure and temperature. Now the pressure and temperature condition is changed in the stock pile during that time many of those trapped meeting they will also get released and those release gas will be going out sometimes even sulphuric gases may also come if there is a sulphur contents are there.

Sometimes the pyrites they also get from the that your immediate strata it get mixed up. So, this even hydrogen may also get released over here so, these gases need to be monitored. So, whenever that is you try to find out you may find some of that coal stock management how they are using. Now there is another study that for the handling of coal that is on a spontaneous combustion study lot of studies have been done.

There you will find a lot of article to get but as such for the management of the stock piles for taking some short term measure so that the coal does not get deteriorate and you can dispatch it that type of such the report are very lessors.

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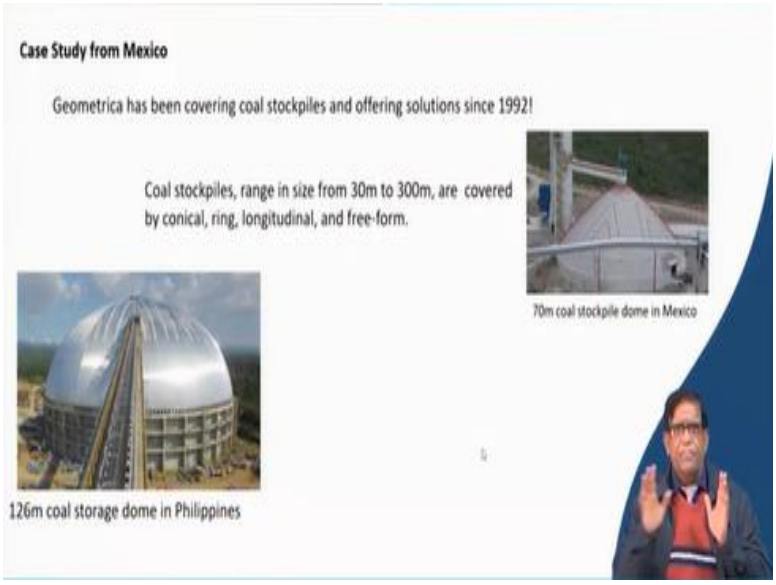

Now nonetheless this is your what can be done, if you as I told you earlier also that in our minds most of the cool stocks are open and then there are all the time the dusts are going out because wind blowing lot of dust coming out and then also lot of pill forest to stealing also takes place over there from the stockpiles. But if you see in Mexico this case study you can do there is a company called Geometrica.

That is a construction company but from 1992 they have been doing a marvellous job in this managing stock piles. You can see here they have got all sorts of covered stock pile which are sizes from 30 meter to 300 meter they have got a dome structure to longitudinal structure. Now this dome structure for covering stockpile has come to India particularly if you go and study some of the Birla groups limestone mine particularly in Chittorgarh area there is a dome shaped that is for the raw material of the cement plant they store over there.

Now in this you can see here there is a 126 meter cold storage dome in Philippines they have also used these things. Then there are sometimes the rectangular structures for storing the stock piles I could see that your inner one where there is the zinc mines in Ireland. They have got the cover is just a rectangular structures within which the whole materials are stored, so that the dust cannot go out.

So, this in Mexico's this you can see a dome structure within which everything is there. Now this company can manufacture such type of coverage when your systems are working. So, if you go to (()) (19:03) near (()) (19:08) where the stockpiles are there near the railway sidings very near the villagers the peoples are residential area is there all area is black and dusty. At

those things are very easily can be converted to a dome structure or under a covert structure only the mind-set will have to be developed.

So, you should study about those things the adverse environmental and safety impacts of our open storage you should reveal it because those studies are not available in our literature because nobody has published those things in India. So, you can find out that there is a good business for retrofitting.

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And then giving on the existing while the operations are continuing at that time also, we can have this type of cover for having a better that environmental and better management. In these ones how that company has done for the longitudinal stockpile you can see here along this those stacker and you can now that equipment which you can see here, I think is known to you these equipments your portal or that scraper reclaimer is being used for taking the stockpile out.

Similarly, they have covered on a that is a dome it is a twin dome, this twin dome is a very famous dome in Mexico they have made it over here. So, that is the way you can see that that there are already the work was there and on that they have structured this the dome and then they have covered this area and that whole area has become now environmentally safe. So, this type of cases you please study so that it will give you an idea that what are the things are yet to be drone or where you can put your no new innovative ideas to work.

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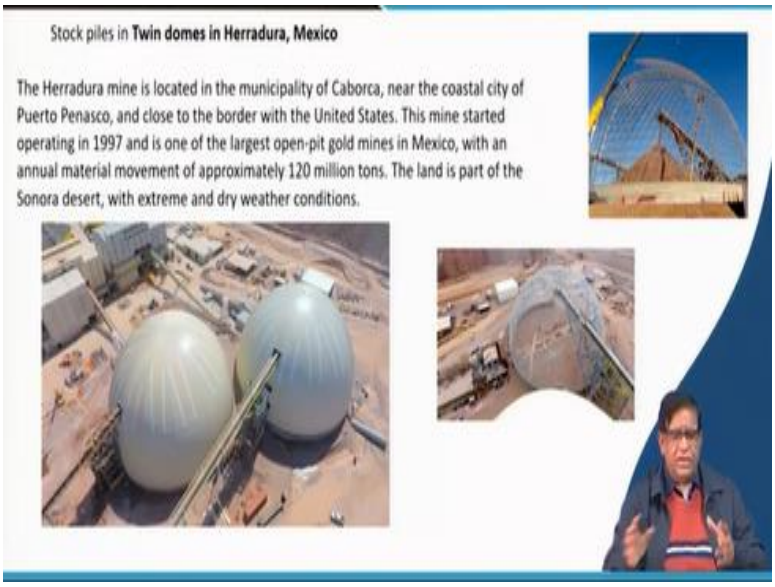

This twin dome of Herradura it is an in Mexico you can see here there this is a non-coal sector they have got a gold mine and then they say gold and this copper mines. From there raw materials are being covered over here just for environmental protection purposes only. So, this shows you that exactly how they started the constructing over an area and then the whole things have gone in and everything has got pretty.

So, now you can understand that is in bulk material handling we can develop a better practice that is a best practices are there in the world some of the thing need to be incorporated over here.

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So, if you see this, stock here that is how it can be made a smart stockyard. Say in our we are having our stockpile if you go to Vizag you can see how the stockpiles are there or if you go

to our some of this port where we are importing coal you can find that the life is not that very good because, these are still giving a lot of environmental emission. So, we need to do certain work in those I just request you to kindly find out collect the data that what is existing scenario over here.

And then you study from that what the industry is offering so, I asked you that to see about Thyssenkrupp. Thyssenkrupp has revolutionized in last about 10-15 years they have come out with a digital maintenance assistance system mass and a stockpile management system and dome based inspection system. Today the dome is coming up as a very good tool for managing the stockpiles.

Particularly when we talk about the managing stockpile you need to exactly do two things in case of a say a bigger stock year near port you will have to find out all the time that where is your free which is exactly next lot of material when it is coming where it should go. And then accordingly if you know that what will be the arrival term of prime of the next shape your which of the stockpiles need to be immediately evacuated.

So, then they need to study also that from the port area to take the material to the thermal power stations or steel plant if it is iron ore at that time the traffic there is a big bottleneck because in India particularly, when from the roads different roads are coming and then suddenly, they will have to cater over there the number of concentrations of the road carrier will be much more and the traffic will be always having a trouble.

Similarly, there will be a congestion in the railway evacuation also. So, considering that what is the rake coming and what is that ship coming and then where which stockpile is now free. This exactly a good allocation problem and that has been done by exactly getting the site data very quickly without depending on the that is your manual surveyor the drone does the surveying and then they calculate the volume online that is you can know.

That is exactly that this particular stockpile is going to be free by say in two days that is the rate it is being discussed. So, all the information and data they are captured and after that the management software that will be used. So, there is a requirement depending on our situations will have to develop such type of tools and devices. So, after that what will happen?

If we can have this properly collecting the data information by whether you are deploying drone or you are deploying some of the on-site. That is your monitoring sensors you have got a lot of your camera and laser scan that you can do the ground survey and all information come. Then your operation can be control from your control room by click of your mouse. And by that what they will have to make they will have to develop a total 3D image of the system.

This is what is now today's standard of the industry is your whole stockpile will be having a 3D model. And then most important for those data science people is; you will have to give the visualization of the stockpile conditions. Now for that visualization what is necessary, what in the previous class I told you how will you make that in what rate your stockpile is getting formed that is your stacker movement.

And your this stacker boom movement how much slewing, how much volume will be exactly getting accommodated. Similarly, when your reclaimer will be working how much volume at what rate it is coming. So, if that geometry drawing the basic geometry when you will be able to analyse and develop a mathematical model then only your this all the visualizations and optimizations will be possible.

Now this is another thing is their number of your stacker and reclaimer they will be working in a very close proximity and all are having boom. And then for their optimal operations they will have to clear the whole material over there. But while doing so there is always a chance that this boom may get touch each other. So, that collision of the boom also will have to be automatically controlled so that it does not happen.

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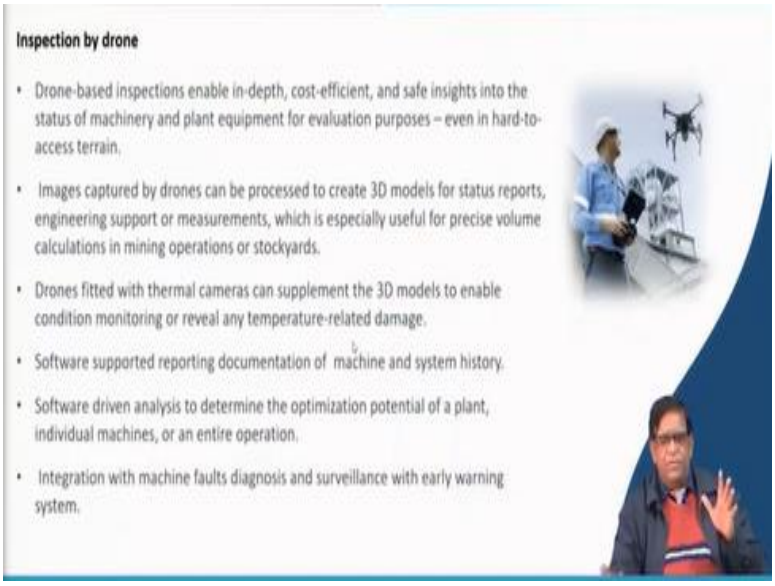

So, as I said this type of cases will have to be studied by you so that you can do it. Now this drone based inspections enable in-depth cost efficient and safe insight into the status of the machinery and plant equipment for evaluation purposes. So, wherever you are having a stock yet because in mining and in also in a stock yet it is a wide area and many a time some places are not very easy for going the surveyor to do a things there.

So, there your drone will be giving a very good solutions to you. Similarly, that what they do exactly they capture the images now from the image you just make a 3D model that is a terrain modelling that is a principle and that theory is very simple. Nowadays that already technology is available but what I request you please go through the basic principle how exactly with a stereo image how a 3D perspective is given this part is little bit necessary for you.

For that you may study little bit of the how photogrammetry was used earlier for knowing the depth of knowing the height of a building how with a photogrammetry you can do a survey and find it out. So, those applications are done over here in drone sciences.

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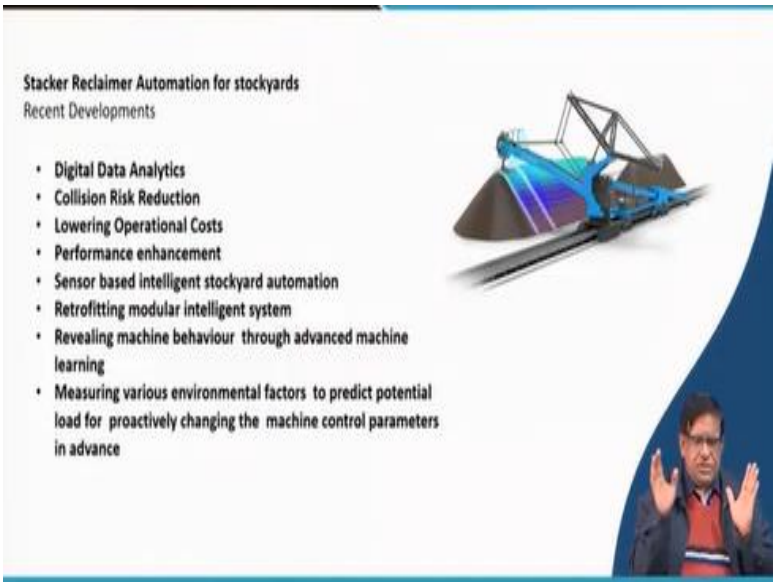

Then what are the recent developments in the industry in stacking, blending and reclamation is they do a digital data analytics. That has come in a very big way and then this collision risk reduction work has been done, lowering operational cost by all these things. Your optimize the system means your energy requirement will be less your addition unnecessary work will be eliminated.

And your that exact amount what is required at that exact time will be provided by that exactly the impact will be coming on the less energy consumptions which again will be giving you the less cost. And many of the time when you use this automated system you will be eliminating some of the unnecessary unskilled labour requirements. So, that we will get the opportunity of skilling our workforce who are unnecessarily we are doing without any productivity.

Those workers can be now put into better work for contributing to these things so, that operational cost and that our manpower cost will be reduced and then performance will be enhanced, sensor based intelligent stockyard automations that your whatever will be there this many of the things will be coming automatic. In that now the recent development with the machine learning and IoT is getting into these things like tucker of that this is your Thyssenkrupp.

And these companies FL Smith they are introducing those things over here then we will have to have retrofitting of modular intelligence system. This will be the business in the coming years if you can retrofit some intelligent system over there through the existing system that

will be exactly giving the benefit of this modern advancement and also a new business opportunity will be there.

Then, revealing machine behaviour through advanced machine learning. Now the one most important thing is that how the machine is responding that reading the machine's pulse is very important and for that the application of mechatronics are coming. Your the sensors they will be getting the information and then you will have to do it. Now here it is just I am giving you an introductory note here.

How to do it that requires a little bit of research and your time will have to be there you will have to work continuously for some days on that topic then only we can go into this.

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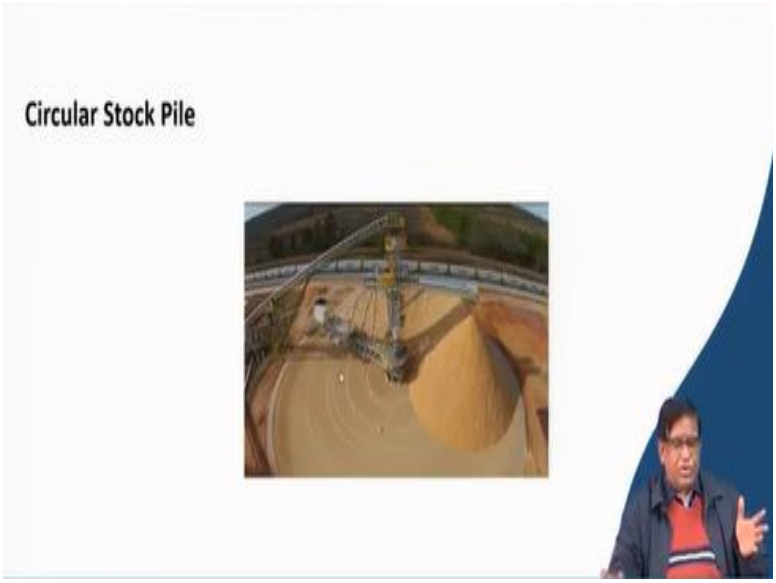

But as a various environmental factor and then predicting that what will be the emissions rates and things like that you can do it. Now there are you can see some of the case studies of because we told that about circular points that is your in a circular pile that means you are having an incoming material is coming over here and then it is going to this stacker and this stacker can give a slew like that and it is making a stock piles over here.

And then you can see there is a chain scraper here with this harrow when it is forming into this one from the back side it can be collected to this is another conveyor and then the material will be taken over there. So, these types of things are there in a many wood ships for the bio fuel area.

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These are used you can see over here that another you can see that how the stack this is strain scraper chain is collecting the material and here now this battery this space is now made and, on that space, it again starts dumping or putting the material over here.

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So, that means your this completed that as you can see here after completing the dumping over here this boom has come over here where your in this part the material was getting taken from taken by this change scrapper.

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And then on this space it is now this this will be going on that whole material will be now taken by this conveyor and will be released to the another conveyor belt and taking the material to the user and then whatever the material is coming from the other side it is getting dumped. So, like that things go over there.

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Then what I say as a case studies you should start studying the websites of different manufacturer and try to do certain calculations like calculation of the optimal sleeve angle for outer edge clearing that is how the slew angle should be there where you will be positioning. Then what will be the optimum or that where the reclaimer should start work where the stacker should start stacking, then how exactly from where it should take a turn.

What will be the this your cutting speed by when you are taking the bucket will reclaimer is taking the material what will be the cutting speed? Last class also I told you that what will be the depth of cut in which way it will be there, then these are the different parameter which will have to be studied separately if you are interested to develop your expertise in this field.

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So, as I said there are lot of references are there, please read some of these articles and also you will have to do some experimental work. If you really want to know that other day, I told you about that blending concentration of your rice and wheat you can mix and then you can find out then see the bendability. Develop some small household experiments and do it over there and if a good idea comes then you can do and do work in our laboratory bulk material learning laboratory or you can do the work.

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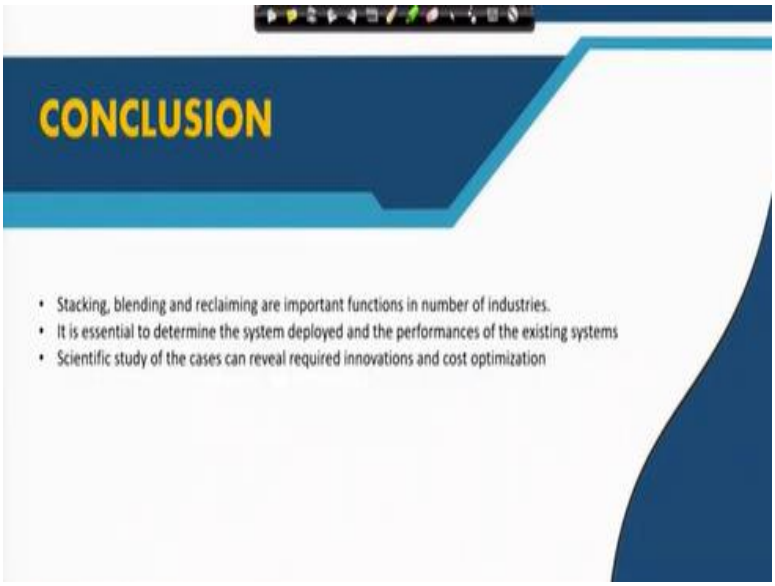

So, stacking, blending and reclaiming are important functions in a number of industries are known to you and it is essential to determine the system deployed and the performance of the existing system by doing the studying different cases what are the exactly what is the real life situations over there. And then this scientific study of the cases can reveal required innovation and cost optimizations where is the possibility.

Once you find that then only, we can go ahead in innovating and then finding out new way of doing it. Thank you very much.