Glass Processing Technology
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Lecture - 68
Root Cause Analysis

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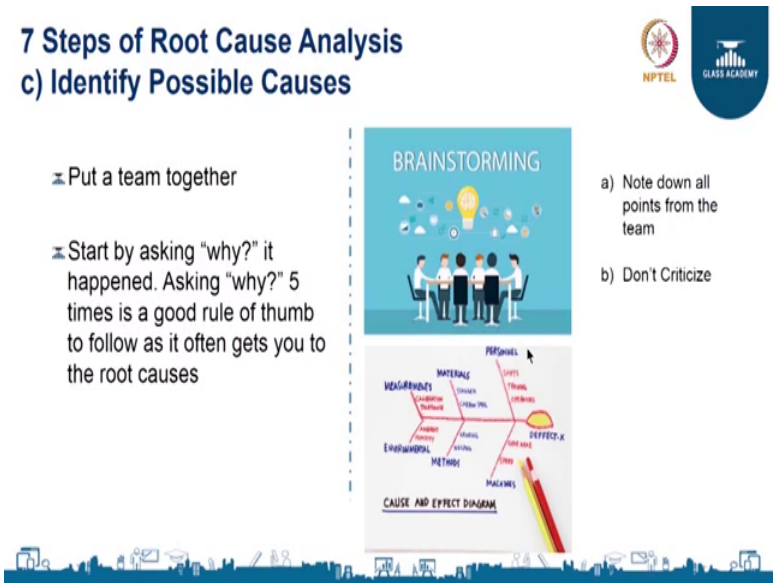

And identify the possible causes is the next step. See once the problem is been these thing as a team, we will have to involve all the team members like if we see we will not select a team which is only on the production team. See how do we select a team is a key role again the any problem analysis. For example, as a if you want to work on any problem or any project team from all the different function has to be involved; in the sense one from production, one from the operation, one from the maintenance, one from the quality, one from the HR, if it is a any skilled related issue for that HR needs to be involved.

And once if team form, then we will have to ask why, why, why, it is happen like it is a general thumb rule says if we ask 5 times why for a any possible causes that will take tell down into what is the actual cause of the problem. And the one tool which is very key, and the powerful tool for identifying the possible cause is brainstorming. Brainstorming is what it means is as a group of people, all can be gathered at either offline or online process. What do I mainly prefer and the effective method is in the online process that is

in the collecting the information or analyzing the any problem, when you do at the Genba you will be gives a really good output. In the sense that will throw a say good ideas that can generate good ideas, when you analyze the problem at the Genba that is the where the actually the process is taken place.

Example brainstorming, what is the process involved in brainstorming is whatever the team identified all can be assembled, whatever the ideas coming from all of them irrespective of any department all can be capture. In the sense do not neglect any of the ideas coming out from the any of them in the team that is the key this thing of the brainstorm. Note down all points from the team, do not criticize anybody in the sense what if I example if one of them says, man power has not come to this thing that mainly cause the problem because of that we had put one new man power.

You just take that point, because that also could be the final cause of that what the problem is reported from the customer or any problem what you are analyzing. See in the main thing which we note able thing on the brainstorming analysis, do not criticize anybody. Whatever the points coming come out from the team, we need to take and the what are the what we are going to see in the subsequent slides will tell us, how to eliminate wh[at] the unwanted points comes out from the brainstorm.

See, the as a team from the different teams can have each own as their own knowledge on their process. So, whatever the points come, it need to be taken. And the next powerful tool is on the, how do we got the around let say 50 numbers of causes for this set problem. How do you stratify into a different process like means here we see cause and effect diagram.

This is the like stratification, what are the possible causes what we got from the brainstorming that can be stratified here under six categories; one is the man, second is method, and third is measurement, fourth is material, fifth is environment, and see here environment also plays a role, and the last one is the man. See if you see here, why the environmental and measurement are taken is see previously there were only 4 M; Man, Machine, Material, Method. See that time the method measurement and environment not focused here, because that comes under previously under the special focus been not given for the measurement and environment.

Later on many of the problem analyst and find out this also could cause the defect generation, so that later on this 2 M addition may be introduced in the cost and effect. In some of the companies, they call it as a 6 M methodology that is the cost and effect diagram that different name of some of the other companies proposed it as 6 M methodology.

Let us talk about one by one case in this thing. For example, we see a measurement, it comes under calibration status; if the calibration of the measuring instrument is not done properly that also can give wrong output. Example if you see here, the what is the problem taken as example here dimension oversees, dimension oversees is not it is it leads it comes under some measurement, where the dimension of the customer specified is been measured. In the sense if the calibration is not done properly, when the operator or whoever is measuring in the process that will give non-conformity data.

So, what will happen as for whoever is measuring that was actual, but in reality the calibration is expired or not done properly whatever not to give products, which is giving as a ok. And whatever the products that can also can there is a chance, where as a product also can give not in that case there will be a huge non-conforms during production, so that also not good. See that is the one key thing which we captured here, for the measurement calibration is very important this thing.

And for the material, yes for any dimension oversees material also it can contribute. For example, there is a if there are 10 process where there will be 1 input, 1 output; 1 input, 1 output ok. For example, in a machining process the machine as a set and capability can capable to remove only 1 millimeter on them as a thickness; for example, in the step b the output should be 10 millimeter plus or minus 0.5 that should be the input for the step 4.

Assume if the step 4, the input from step 3 would be 10.5 means 9 point 10 to 11 is the ideal limit. Example: If the step 4 if getting 11.5, which is 0.5 millimeter higher than the specified limit. What is happened then the set parameter in the step 4 was plus or minus 0.5 only. If the input is more, the machine would cannot able to remove the 1.5 mm millimeter, against the 1 millimeter tolerance is been set at the step 4. And parallel for the what will happen the machine can remove only 1 millimeter, instead of 10 at the step 3; what will be the final output will be produced 11 11.5, where the input itself is wrong the

output also obviously, it will be wrong only. So, the material also plays a key role in this any this thing problem analysis.

And the fourth, third is on the personal that is the man power man. The man can definitely play a role for example, if you regulate time man power is not there, unfortunate the day has not come; what will happen now any of this people will swap the, the next man power to the critical this thing. For example, if the man power is not known the what and all things; to do and not to do process if and that particular step 4 or whatever the process, you will do definitely some wrong way, what will happen that will definitely leaves to the rejection.

And fourth thing is on the environment, yes environment also definitely place a role. For example, if the measurement or any this thing as to be checked under controlled temperature that has to be done, because if the temperature of any measurement what the standard says is it should be under 22 plus or minus 2 degree centigrade. See for example, if you check the any measurement of the metal parts or any instruments at 30 degree what will be definitely, it will be wrong reading.

So, the measurement or under environment condition it is a mainly contributing parameters of any measurement related activity. And the fourth is on the methods. Methods means tools, jigs, fixtures, what process and what stage those are all comes under the methods. And machine when you come to the machine, there are many parameters also contributing on the any output of the machining industry; like machine speed, feed, run rate, speed rate, tool life, everything comes under on the machines.

So, on the right hand side if you see, there is a whatever you are focusing on the defects that is a problem customer or anything that is that we call it is effect in the cause and effect diagram that is fish bone diagram, so that can be mentioned on the effect column. And whatever we are talking about the 6 M's; Man, Matter, Material, Machine, environment those are all what are the possible causes, those are all branched into sub branched into this 6 category, and those are all the causes called as a causes. So, what are the causes possible causes comes from the brainstorming that is plotted on the left hand side of the this 6 this thing, 6 categories on the right hand side we call it as a effect.

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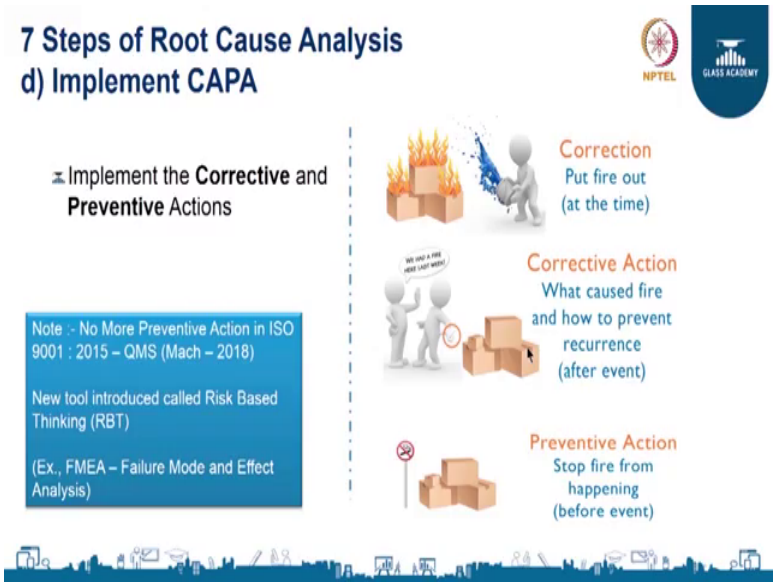

The next take is on the corrective action. So, once this I will go back to the previous slide, all what are the causes been identified in the cause and effect diagram on point comes out from the brainstorm, those we call it as a possible causes. So, possible cause the next step is the identify the probable cause. In the sense I told you early there are some 50 this thing, points comes out from the brainstorming session. And some of the would be the really actual cause for the to generate that effect that is a defect what we call, what we call here it is a dimension oversize.

So, how do we deselect the remaining unwanted causes? See what we what will have to take is example if we let us let us take this calibration, that is calibration status one of the cause comes from the team once the calibration status is not as per the requirement, which means that calibration could be the error for this cause. So, when we go and check the what you have to do here is will have to check the calibration status of the particular instrument being used for this dimension oversees problem.

So, what here is we know the problem, what is the part number when it is been produced everything we have the data. What will have to do is, we have to go to the shop floor and see on that set date who is the co (Refer Time: 10:54) quality person and what was the instrument being used on that defect that in the sense for the process of grinding or whatever it may be, where the dimension of oversees been checked.

So, here the cross verification how the cross been validation is we have to see the calibration certificate for the instrument. Let us take here the; we can take as example of Vernier caliper. The Vernier caliper is being used for the dimension oversees. What will have to check here is, we will have to check the calibration status of that Vernier and see what was the when it was run and when is the calibration due. Is the calibration due date is within the, I mean within the period then this cause could not be the problem for that defect.

So, will here it clearly says it is insignificant Indian significant. So, we can deselect that this is not the cause of the problem, in such a way we need to validate all the causes whatever comes out from the brainstorming session. Like the one more example, what we can take is machine speed; let us take machine one example in the machine. What here the points come out comes out from the team is high speed, like here there could be a chance because of high speed, the material is not removed properly ok.

So, what will have to do is, we will have to go to the SOP and see what is the speed mentioned in the SOP. And see what was the actually which was produced and stored in the system. This data we can see either in the default feeded program or we can see the process monitoring, process data monitoring sheet. Like every shift the process critical parameters been monitoring in some of the cases, like every shift, the autonomous check, speed should be this, high level should be this, machine turning rate should be this, we will check the (Refer Time: 12:40) sometimes the program, it is been automatically saved.

So, in this case if you see the machine for example, if you see the SOP, the machine speed says 1 meter per minute, we will have to see the what is the program feeded data. So, if we see, if you observe it is 1, yes; it is SOP says 1, the actual also says 1. So, this is (Refer Time: 12:57). So such a way, we need to validate all the possible causes comes out from the team. Let us take one more example for the from the personal that is (Refer Time: 13:06), this is training skill.

See again if we see the training, we will ask will check the who was produced on that shift, and will take that person name and will check with the HR, what is there this person is skilled enough to do the job, there whether you have the skill matrix. And whether this person been trained in this process or not, so this will tell us the skill record

will tell us all this history of this person been qualified for what and all process; this is so in such a way this can be verified and material, stainless steel, carbon steel.

For example, material mix up also can create this issue in the sense, for saying place of stainless steel, if you use carbon steel. The machine parameter been set for the stainless steel to (Refer Time: 13:54), but the actual material would be carbon steel that also can be done. So, what we need to verify is the what are the problem reporter from the customer, either we will be sending somebody there; check whether the material is correct or not.

If possible will get the sample, and give it to the lab; and see whether the metallurgical part, whether the material is as per requirement or not. Because few of them under stainless steel there are many categories; one is the major category of stainless steel and carbon steel, and another stainless steel there will be a different category, this percentage of magnesium, silicon kind of thing. So, what will have to do is will have to give that material to the laboratory for the further analysis, because by visual is by visually we cannot able to identify this kind of defects; whether the change in the material or not.

So, one this is been report from the lab, will have to cross check that with the SOP that is this says this percent of nickel, this percent of carbon, SOP also says. So, if it is qualifies, then that also been can be neglected. So, in such a way we need to validate all the 50 causes, and see what is significant. Significant in the sense example, let us see one more example method, method says grinding; grinding is the method and grinding should be will should be like 1000 RPM per minute.

When you validate this cause at the machine, example if you see the actual process parameter record or what are the program in case of program, the machine parameter is feeded as a data of 1150, the SOP says thousand plus or minus 50; which means there is a gap between the SOP and actual production. So, in such a way it is clearly says that there is a gap between SOP, and the actual it is clearly says this is a significant, in such a way we need to validate all the (Refer Time: 15:44) and find out, what and all the in significant causes and what are the insignificant causes. Those significant causes are identify called as root cause.

So, out of this brainstorming points what are the points come on, all things needs to be taken into consideration, all points to be get stratified into 6 category and validation has

to be done and find out the what are all the probable root cause, this can be called as the another way. Once this probable root cause been find out, so the next step is identifying the corrective action and preventive action for the causes identified.

So, what is mean by corrective and preventive action? And this is very key topic to understand. What is the difference between corrective action and preventive action? See assume if there is let see the example, assume there is a fire at the (Refer Time: 16:37) been stored. There is the boxes wooden corrugated sheet box been stored at warehouse. So, the correction is put the fire out at that time means, at the point of time I am eliminating the or vanishing the problem reported problem. Here in this case the fire is happen, what the immediate action to be taken; we need to shutoff the fire, so that is the correction.

And corrective action if somebody is smoking near that wooden or paper material area, we need to tell them to stop that it should not be done at this area that is the corrective action; means what caused fire and how to prevent, in this case if we see, what would have cause for the fire this thing happen. See somebody as smoked there, and some or some could have been the thrown away the fire material or this any electrical leak happen. So, what cause the fire and how to prevent the recurrence, recurrence in the sense that should not happen after that event? So, for that some action we what are the action taking for that, that is called as a corrective action.

And the preventive action, preventive action is stop fire from the happening that is if stop the recurrence in the sense, it should not happen again, like a (Refer Time: 18:02) kind of thing. Here if you see we have put the banner called, this is this is the non-smoking area. And the next can be we can all this material should be stored under the covered room or fins area, where nobody can enter into that premises.

So, in the sense what preventive action here for the fire case is stop fire from the happening that for that what and all action taking. And I just I want to add one more point here, which is away from this topic that is the ISO 9000 that is the quality management system of the 2015 version, which was released on March; what it says is, there is a no more word of preventive action because, what were really you were doing is, all this action preventive actions or corrective actions what we are doing here is on the post occurrence of any problem.

So, what the new version of standard says is, there should not be any this thing of preventive action. The in place of that they have introduced a new tool called risk based thinking that is RBT. Risk based thinking in the sense as a process from the process what we need to will have to do is, we need to identify what are all the possible risk which can happen in our process, those risks should be identified. And for all the risk based on our past experience or from the experts, we need to identify the causes, and probability, severity, and what are the recommended action if the severe RB number is RB number is greater than 100, those number has to be fixed based on that business perspective.

For example if you see the automotive industry, it is already the technology called FMEA. FMEA means Failure Mode and Effect Analysis, see you see the words it failure mode and effect analysis. Whatever the failure can happen in my process, those can be identified as a failure mode. What could be the effect for this failure modes that need to be analyzed, for that effects what are all the causes, for that causes proposed action need to be derived for all this failure modes.

In the what the failure mode the other this things are talks about is what for example, let us take one failure mode of what we have analyzing this dimension oversees oversized. The dimension oversize is the failure mode, what causes for the failure mode which we identified on the cause and effect diagram. Let us take machine speed that over machine speed is not as per SOP that is spender speed is more that is the cause. And what is the effect for that is rejection at customer end, my customer line stops this is the effect.

See for this effect cause and failure mode, it would derive the probability occurrence reduction. Probability means what is the probable condition of this failure mode, there will be rating of 1 to 10; which is 1 is slow, and 10 is high we need to rate from 1 to 10 different scale. And next is the severity, how severe is the problem; how severe in the sense in my customer line stops very high or it should can be detected at my place it is very low medium, kind of thing we need to identify the severity conditions.

Detection, detection in the sense the again there are some categories low medium high, in the sense what detection means is how much we can able to or how we easily we can able to identify this defects at process; or customer end or before dispatch. If it is a customer end, then will not be having any control at the process it means like that. So, the detection under categories under low medium high. Otherwise, if you calculate all

this 3 numbers RPM that RPM equal to probability, occurrence, detection. So, we need to multiply all these thing to get the RPM value.

And if any what as general standard what it says if the RPM is greater than 100, which is alarming in the sense we need to take any action to avoid that products which is generating on conform and skipping to customer end. So, we need to reduce the RPM number of all the failure modes, and that has to come under below 60 category which means if it is all the RPM numbers of like between 52 and 75 or whatever the RPM listen 80 which means at very good, and we are in the control levels and the effectiveness.

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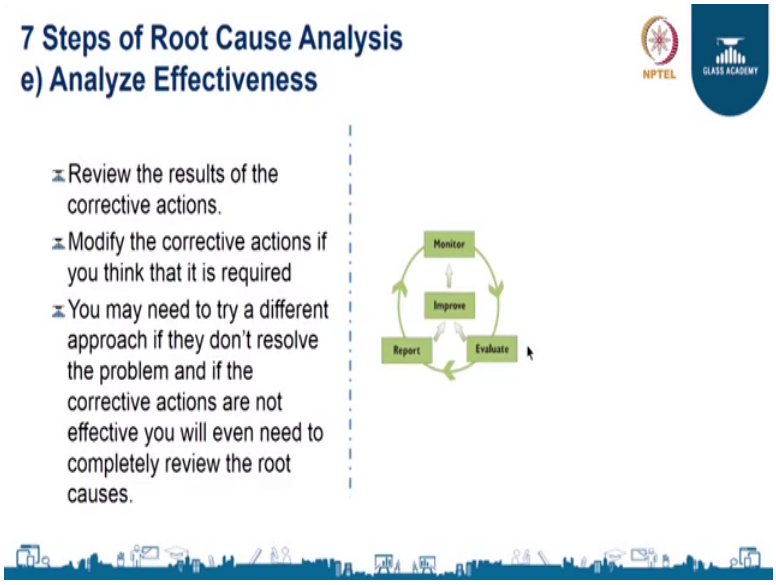

So, once the action been taken and which is implemented we need to review the results of the corrective actions been taken. So, what we need to do is will have to modify the corrective actions. If you think, whatever the action taken is not giving the proper result that also we can take it as a team. And will have to try for different approach and if the being problem is resolved. So, will have to take a different approach to get the required output.

So, how do we analyze the effectiveness of the any action being taken? So, first will have to monitor the desired output is achieved or not with the action revised action taken we need to evaluate, and if the report says, we have targeted 1 percent and if the actual is 1.5 let us take as a numbers if we it is greater than the what we targeted. So, what we have to notice, definitely will have to improve and will have to revisit the correction has been

taken, whatever taken is in place or there is some gap. So, we need to improve and will have to again take different action, again monitor, again evaluate, and this cycle has to be repeated until we achieve the desired output and once this been update.

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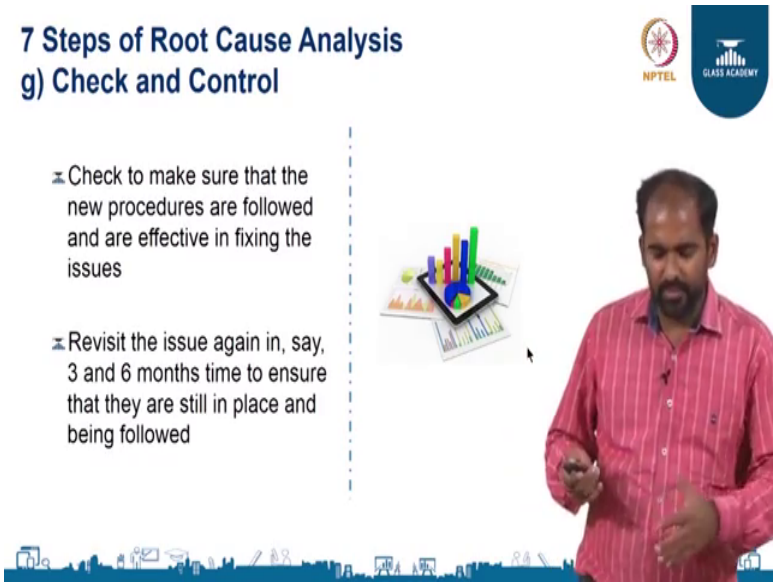

Action been taken monitor for like short term period, let us take one month or kind of thing and if the everything whatever the desired output is been achieved. So, we will have to update the revised procedure and the documents. Here what are the documents in the operation or any processing industry? One is SOP and OPL control plan, and for the drawings if any jigs or change in the designs involved, and all this has to be changed, because if will have to as a system this all needs to be changed; because if any new man power or any other people you are coming tomorrow to work on the place.

Then they need to know that this is to be followed. If it is let us take example if you are not updated this revised information, the SOPs. Assume if tomorrow a new man per come to that some of the (Refer Time: 25:02), if the old SOP available in the sense what he will do? He will do he will just change that new parameter to the old parameter, which is already changed in the system which will take into the again the old earlier mode of the defect generation mode.

So, whatever the changes we those all need to be definitely update in the relevant documents. Some can be some can be updated only in the control panel or some can be updated in both the place, there are many things we need to identify where it is relevant,

I identify those documents and update in the relevant this thing. Example, in most of that in some of the cases drawing may not be apply applicable, because if there is no change in the machine tools being used or jigs being used, if there is no change in that components, then there will not be any change in the drawings.

If for example, if you say if you take only there isa the root cause for this problem any problem is if you identify the machine speed as a there are some gap in the machine speed then the drawing would not be applicable. Then the applicable parameters only is on the document is on the sops and this thing. And the other step is on the check and control once all this been updated in the documents we need to monitor the effectiveness of the action been taken for this problem for a period of at least 6 months.

If you if you do not monitor this thing, what will happen over a period of time, again this will go back to the problem stage that we do not know, because we are short term monitor mode we done was only the period of 3 weeks or 1 month say. With that time we should have come ok, but we need to monitor whether this is been sustained in the long period. For that what we have to do is we will have to monitor this in at least for a next 6 months to see whether there the results are consistently. If the results are consist running, then it is very what all we updated in the system there is been followed for the upcoming days.

If something major fall or some dip happen in the process for example, the first 3 month whatever we targeted for 1 percent is achieved, and suddenly the 4th and 5th month if the rejection rate is gone to 1.5 percent been something problem on that 4th and 5th we need to analyze. See for the first three months has come ok, if suddenly 4th and 5th is not ok, then something could have happen either new manpower or again you need to analyze the (Refer Time: 27:33) and see what would have gone wrong. The monitoring effectiveness is very important for any project completion once the short term is been over.

Normally typically 6 months would be this minimum 6 months we need to monitor the effectiveness of any action been taken. Then we need to see whether plot into different whatever the applicable like train chart or whatever the thing we use that is it on the today's you see. I think what we have covered majorly on the root cause analysis, one is on the what is root cause and what all the tools used in the root cause method and seven

steps of root cause method analysis. And the main key thing one more thing I want to tell here is this root cause analysis not only for the our official or business perspective, this can be applied in anywhere in the business as well as our personal this thing like brainstorming points whatever we discussed here, we discussed today all are applicable for both our official and personal this things.

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