DURATION TESTING

March 27, 2012

Coordinator: Welcome and thank you for standing by. For the duration of today's call all participants will be in a listen-only mode.

At this time I would like to inform all parties that today's call is being recorded. If you have any objections you may disconnect at this time.

I would now like to turn the call over to Tony Jimenez National Renewable Energy Laboratory. Thank you. You may begin.

Tony Jimenez: Hello everybody welcome to the third of the pre-conference Web - of pre-conference Webinars for the Small Wind Association Testers Conference. These Webinars are basically an introduction to small wind turbine certification testing and provide those who are new to the field a chance to basically bone up on the - on the topic before attending the conference. You do not have to be a conference attendee to download or participate in these Webinars.

At this point I would like introduce Ismael Mendoza who is our speaker today and he's going to talk about duration testing one of the four tests that's commonly done as part of the small wind certification testing. Ismael is a test engineer at NREL at the National Technology Center. He's been with NREL since 2010. He has been involved with IEC accredited testing of wind turbine - of wind turbines in the areas of power performance, power quality, duration and safety and function.

His background is electrical engineering and has a degree from the Colorado School of Mines.

And with that it's all yours Mendo - it's all Ismael.

Ismael Mendoza: Thank you Tony. (As) we'll -Tony mentioned we're going to base our presentation today on duration testing that's one of the main tests that we do here at the National Wind Technology Center in Boulder. The purpose of - the objective of - the purpose of the duration testing is to investigate and see that you have a reliable turbine and have - it shows structural integrity, quality and environment protection of the wind turbine complies with the safety standards as well as it be - the behavior and the dynamic of the turbine is not harmful or harmful to the environment or the people.

I highlighted the dynamic behavior because no two small wind turbines are created equal. A lot of them are (engineered) to do furling some of them have tip brakes, some of them have cut out wind speeds, some of them don't. So each wind turbine is very different from one another so that's why I highlighted those from the definitions of the requirements for the duration testing are defined on the IEC 61400-2 Edition 2 the Final Requirements for Small Wind Turbines Section 9.4 and the AWEA the Small Wind Turbine Performance and Safety Standards.

Before I jump into the (present) criteria I would like to explain a little bit more of the small wind turbine class classifications. The turbines are classified in four sections Class 1 to 4 depending on what type of area and you're trying to (unintelligible) or plan this type of wind turbines. All of this wind speeds are defined to (unintelligible) or you design the turbine to say a Class 2 saying that you're excited that I have an average wind speed and annual average wind speeds of 8.5.

The other criteria that falls into that are the mass wind gust or a 50 year wind - (extreme) wind of 70 meters per second for the Class 1, 59.5 for the Class 2, 52.5 for the Class 3 and 42 meters per second at Class 4. So depending on what type of size your turbine - your (unintelligible) to plan your turbine that's where the type of wind criteria that you have to design your system to be able to survive those wind speeds.

Going back to the IEC requirements it says, that the turbine has to be - have a reliable operation during the test period at least six months of operation. Here on our wind site it can take between six to 12 months to actually finish with other requirements. So we don't - we see an elongated time of turbine running in our site to actually complete with a 2,500 hours of power production, at least 250 hours of power production greater than or equal 1.2 wind average and 25 hours of power production at wind speeds greater than or equal to 1.8 wind average depending on the turbine class.

You know, we have standard calls for all of the same IEC's and requirement plus at least 25 hours of power production and the - at 15 meters greater than or equal to 15 meters per second. All of this is defined to actually verify that you have a safe and reliable product that has been tested on actual wind conditions or it's actually up in the air is not lab tested that's part of the main purpose of this duration testing.

Going back on the definition of reliable operation the standard defines a method to define what and calculate what's an actual operation time and the standard recalls for 90% or above that the turbine has to be available to produce power, that the turbine has - doesn't have to have major failures so the turbine components such as inverter, failure that the turbine cannot even produce power, generator problems, rotor failure such as, you know, failures on the wells of the rotor and the blades or fractures on the actual blades.

Those are - may be considered major failures anything that will stop the turbine from producing power had no significant wear, corrosion or damage of the turbine component just to verify that there's no safety hazards or power degradation in the system. So - because if there is any tear or wear then the turbine has a insufficient strength or reliability that it was designed for especially it's going to be continued we've seen those type of high winds throughout the duration period.

So here's the actual equation that defines the operational and time fraction. TT is the total time under consideration see for the month of March we're going to see 744 total hours and we subtract what hours the turbine didn't actually produce power or there was some maintenance or instrumentation period that gets subtracted from that period. So TT is the total time as I explained. TN is the time during which the turbine is known to be non-operational.

Then the turbine has faults and it's labeled TN. Also TN can be stretch out say that the turbine had a failure of inverter so the time - the clock starts ticking so that TN doesn't stop until the manufacturer sends a error replacement for that particular portion of the turbine that malfunctioned.

If there was a situation that the - that manufactured standards of instrumentation and our - either our techs or they weren't available then that stops the clock for the non-operational function because it wasn't their fault that this is (ones) in repair it was because our dimensions weren't available then TU is the time which the turbine's status is unknown (unintelligible) in our instrumentation or we did a - we had to shut down the turbine because the part - our transistor had to be recalibrated and things like that.

And TE is the time that it needs to be excluded from the analysis from being a failure or a system that outside of the turbine systems caused a fault such as the grade failure, a grade over frequency or under frequency or any of those events.

So here's an example of a non-operational time such as like I mentioned before (if) the turbine has a (Vove) it over speeds and it releases its tip brakes and the tips brakes don't get re-engaged then that's considered a fault. Until those tip brakes are fixed then the turbine can be actually saved and be able to produce power again.

The generator - a manual was shut down due to maintenance or a fault say that you need to replace the oil in the gear box that counts as a TN or that you have to do an actual inspection of the blades because of the - on the manual it states there that it (if you see) winds above x amount of meters per second you have to actually stop the turbine and inspect the wells or the rotor conditions after such event or at the end just unwrapping the droop cable and that time need to be considered because the turbine has been turned off and it's not operating or able - capable of producing power.

TE for excluded time it's time that institutes instrumentation or independent we do at an (inspector) or we do a manual stop that is not caused by a fault or as you can see on the top right there was a nest on one of our towers that the birds decided to go in and create their own little home. We were - we found this and we were - we contacted our biology group and they came in and accessed the situation and they advised us to turn off the turbine and wait until the birds actually hatch and fly away.

So all that time wasn't the fault of the turbine it was just the conditions of the environment. All that time was labeled as TE and (excluding) what is supposed to count again the actual turbine because it wasn't a fault from the turbine or a change in power production, (unintelligible) such as the great over frequency, under frequency, over voltage, under voltage and things like that. There's an example on the bottom right hand corner of a - an inverter that capture an actual under frequency event and as you can see the system has a red light that a manual reset has to be done to actually clear that fault.

So all that time that the system was under this type of fault was classified as TE and again there was an actual fault or a great outage and will also be classified under the same category.

TU is (unintelligible) maintenance on the Test Institute Instrumentation or data acquisition system such as a icing event, the anemometers are not spinning that we had - the turbine has been operating for more than a year and the instrumentation has run out of calibration so we need to completely stop the turbine, take the instruments out then replace them or recalibrate them to be compliant with our quality standards (block) or resolvable records of turbine conditions such as there was a power outage and we lost to our computer so we couldn't continue recording any more information.

Overall we're going to give you a breakdown of how we access and do our test procedure. So we all will sit down with our clients or manufacturer and explain to them what our expectations and requirements from the standard and during those conversations we try to identify what are some of the parameters that the turbine or the system requires such as maintenance, observations or different behavior that the wind has - that the turbine has a kind of wind speed or if it doesn't if it furls what is governing speed?

(Whether come) - what type of other instrumentations we're going to play if the turbine has an actual turbine status or if it doesn't how we - do we monitor other - include - how can we better characterize the turbine behavior and actually understand how the turbine dynamically behaves when it's actually producing power or not producing power. Then we do a instrumentation of the turbine to calculate if the power production, wind speed, other optional sensors that we put here that help us identify and help us label the different events or what direction, pressure, temperature and precipitation.

So once everything - all of that is been clear we demand fracture senses the turbine, we do a pre-test inspection to try to have a baseline of how the turbine went up before we installed and actually start producing power. We take pictures of the rotor, of the nacelle, of the tower, of the foundation and things like that just to be able to compare once we finish with the actual test period and see if there is any actual degradation or issues with the system.

We do our data collection the standard calls to do 10 minutes averages. NREL assumes that the turbine is producing power for the entire 10 minutes whenever the average power of that period is positive. We know that that method overestimates time for power production and wind speeds between 4 to 6 minutes per second and at this wind speeds the turbine may have been producing power for about half of the time recorded.

At higher wind speeds this method will provide less of an overestimate and we do asserting the analysis and we believe that overall the time period that we tested it will comply with a relay distribution and we will actually comply with the total time of power production and time requirement that the standard calls for. And we try to work with the manufacturer as well with our internal QA system to do the scheduled maintenance and inspections of the turbine.

And like I stressed on the previous slides that observe how the turbine behaves with - on different wind speeds they have higher wind speeds you see a resonance or vibration of the nacelle (the thing is that) considered harmful then you need to note it or is that susceptible, is the tower is robust enough and to handle those types of fluctuations or maybe that's the original design of the tower that every turbine is different.

So the dynamic behaviors at different wind speeds are - have to be captured, be - able to understand and be able to report it on the final report failure of the turbine, oscillate of the turbine furls and creates some resonance on the tower. All of that needs to be recorded and understood.

Then after a while you do periodic checks of the data just to verify that there's not any information lost or that the turbine has been - had a fault and you didn't know about it because nobody's going to be able to be observing the turbine 24/7 so that's why we rely on the data and we do this periodic checks.

Then we do the monthly processing of data and labeling and try to identify and find the total operating of the turbine doing that particular month. After we have completed and concluded what the requirements IEC standards that at 2,500 hours of overall power production then we can move on and do the big commissioning of the turbine and do a post test inspection and see if there's any actual degradation or issues with the system.

Later on in the - towards the end I will show you some of the pictures that we have found on some of the turbines that we have tested here on the site. After we do all that everything gets compiled and we create a test report that gets published or given to the manufacturer that can - and then over to their certifying body.

Going back on the description of the analysis we have a log book that we try to record any event that we were able to capture just like icing events, under frequency, create faults, maintenance on the system that will help us identify and if we label each time period which is right allocations such as excluded, unknown and non-operational then we rely on the data to do time series of average min and max of wind speed, power production, wind directions and things like that to help us identify something that we didn't actually capture on the log book.

Do anemometer comparison then wind speed versus power, have preliminary power curve to try to identify there was a fault in the system that we weren't able to capture. Then process the data after identifying some of the periods that were - where the turbine had a fault of any of the system itself had some issues and we were able to calculate power production for each wind speeds that the standard called for, identify the turbulence intensity at 15 meters per second what was the maximum gust that the turbine actually saw during that period and then that monthly power curve.

I will give you some further examples later on that better illustrates what I'm - what this slides trying to say.

Here's an example of our log book entries for the month of February of last year. On February 1 we saw that the anemometer was not spinning there was some freezing temperatures ranging to negative 19 degrees Fahrenheit. On February 4 warmer temperatures were seen on site so we were able to see on our data acquisition system that the system seemed to be working properly. It was - the wind speed was being tracked and compare - compared to other anemometers that were on site.

On February 7 there was - the turbine wasn't spinning it was found that the turbine had identified that the grid had an under frequency event so it had a fault. A manual reset had to be done to bring the turbine back on line. On the

21st the turbine had a fault. On the 19th we were - that was the weekend so nobody was here to actually identify what happened but it reset itself after then (unintelligible) did a routine check. This particular turbine had a routine check - a daily routine check that actually identified and see all of the system and reset itself if it required to.

The system itself wasn't smart enough to record what type of fault it was so we concluded that it wasn't a turbine fault.

On February 22 the turbine was on to a side grid outage. On the 23rd the power was restored on site both the turbine and that acquisition system were restarted and where we're able to capture the turbine or dis-empower.

Last one, one of things I - how we reveal a log book and try to - okay how do we label our data because we have (unintelligible) months of data like I mentioned just for the month of February we have 744 hours that we have to go in computer data and try to label each 10 minute period. So any observations, anything that will help us identify the data will try to help us expedite the - that the analysis of each month.

So then we move on to do - specialize the data and try to identify when the system actually produced power or didn't produce power and help us further label the data.

Here's a times series winds - times series plot of the wind speed as I have highlighted on the graph. You can see that at the beginning of the month the (unintelligible) there was an (unintelligible) an icing event on the anemometers and both of them flat line and towards the right hand of the graph you see that gap on our data acquisition system that's when we actually had a grid outage.

Unfortunately here on our site we don't have a robust UPS system or generators to keep our data acquisition system running. So and you'll collect wind speed, temperature, other parameters that are on our site. So for over all that time wasn't recorded or should be labeled accordingly.

Here's another time series of the different turbine signals that we capture such as wind speed, temperature, turbine availability and power production just to emphasize and correlate to what we actually saw at lower temperatures at the beginning of the month causing the icing event on the anemometer, the different turbine faults because of the turbine availability and then again the gap in our data acquisition system due to the grid outage.

We can correlate what we wrote on our log book and zoom in into actually define the 10 minute that the turbine transition between being on a false state to a power producing state.

Here's a zoom in on the actual power in-availability time series where you can see the turbine had a grid fault on the 15th and then the - another fault on the 19th. Wind (unintelligible) the turbine brake signal (unintelligible) if it was a high (unintelligible) that the turbine didn't put the brakes on and the turbine went to a low state and it said that the turbine actually had an issue and forced the system to put its brake on.

Here's a scattered plot of the power versus wind speed. As I highlighted on the bottom the turbine flat line on the power producing see the turbine is supposed to produce power at 10 minutes per second and there the turbine then producing (unintelligible) so all that time the turbine had an issue. So further investigation was required to identify what happened and if it was a turbine fault or an instrumentation fault to connect (unintelligible) label the data.

Here's another way we visualize the data it's a anemometer comparison. We have a primary anemometer versus the reference anemometer you can see on the bottom the - that the system emphasizes and showcase when the (ane) - not both anemometers came back after that freezing event

At the same time the anemom- the primary anemometer started spinning before the reference anemometer with all that data still would have to be classified as TU because the anemometer or instrumentation wasn't available. And there wasn't a way to correlate at that particular site the wind speed for - that the turbine was actually seen.

So after we have identified everything we go into the process data and start labeling each 10 minute period within its proper (unintelligible) available that those 10 minute periods or the turbine wasn't known, excluded or non-operating.

Here's another zoom in on the time series like I mentioned before the Blue line is the primary anemometer and the Red line is reference anemometer. You can see - and it correlates the previous anemometer comparison (unintelligible) block but the primary anemometer starts spinning first then the reference anemometer. So we label all that period until the second anemometer started spinning at TE - TU because the instrumentation wasn't available.

And our conclusion was that February 1 the anemometer wasn't spinning freezing temperatures ranging below 17 degrees Fahrenheit and secondary was found that the secondary anemometer wasn't spinning as well.

Precipitation was observed on the - on site and we were able to correlate with our plots so all that time was classified as TU because of the failure of the acquisition system for that - all that month of February would have resulted in about 54.3 hours of unavailable time.

Let's move on to another grid - another event which is the grid fault. On February 7 the turbine was found at a fault it was observed on the inverter that the system had recorded an under frequency event. So it required a manual reset to clear that fault. On the 22nd the (DAP) was down to a side grid fault. On the 23rd the power was restored on site so that (DAP) and the turbine were restored and we were able to plot as you can see on the previous graphs the gaps on - at the end of the month and then the availability of the turbine went to 0 on February 7.

So that correlates with this particular fault. So all that time was classified as TE because it was outside the system that caused the fault. It was in the system fault that automatically added to the - about 19 hours that the - for the month of February that was labeled as TE. All that time was excluded from the operational time fraction.

Again here's that graph showcasing the great outage from the gap on our (unintelligible) on our data acquisition system.

The other great events didn't affect the whole system that's why we don't see that other gaps.

Here's a turbine fault and an actual grid fault because we were instrumenting the turbine brake signal we couldn't actually - system which - so further investigation had to be done to be able to label each fault or each event accordingly.

So here's a - the examples of those over screen shots over data analysis spreadsheets. So each 10 minute period it gets labeled with our different columns as you can see on the far top right there's the column's TA TE TN and TU view. If it has a 1 that means that like on this one the turbine was available. TE and all the other ones have to be labeled as 0. If TE has a 1 then all the other - three other columns have to be labeled as 0 just to be able to filter the data and identify when the turbine actually faulted or the data has been labeled differently.

Again the overall classification for the month of February accumulated to about 19 hours of time excluded.

Here's a actual turbine fault classification. Again the turbine faulted on the 19th but reset itself after the routine invertor check. The evidence was on the data the system put its brakes on for the system. We were unable to identify what actually caused the failure but evidence showcase that there was an actual turbine fault. So that particular event was classified as TN came that the turbine controller had driven the turbine from operating and producing power.

That resulted in about 7 hours of turbine non-operating.

Okay again here (unintelligible) on the actual events (you see the) - on the 19th both accumulated 7 hours that the turbine was down and wasn't producing any power. So from the calculations for the particular month of February, February contained 672 hours out of those 93.7 hours were labeled as TU or unknown, 19 were labeled as time excluded and 11.7 were - 11.7 hours were labeled because the turbine had either a fault or it wasn't operating due to a fault.

So we put all those numbers in our operation time fraction formula and we came up with a 97.7% - 97.9% (failed) operating time fraction for the month of February. So that means that the turbine was available to produce power 97.9% of the whole month of February which is pretty good. Like I said, the standard call of the turbine has to be - have an operating time fraction of about 90%.

So now that we have analyzed the power protections and we have labeled the - each 10 minute period for that month we move on to gather requirements of the standard which is identified accumulated time for the 2,500 hours. So power production the 250 hours of 1.2 times of V average and the 25 hours above greater than or equal to 1.8 V average.

So here in our system we do either have a macro or a auto filtering spreadsheet or a (Madlock) program depending on how you do your data analysis to - and filter the data for the (time that) the turbine actually started producing power and sorted by the average power production that is greater than 0 and wind speeds greater than whatever is required by the standards.

Like I said, those three requirements whenever the turbines actually producing power at 1.2 times the V average and 1.8 times the V average this particular turbine was a Class 2 so it gives us a value of 10.2 minutes per second for the 1.2 V average and 15.3 minutes per second for the 1.8 V average. But for the particular month of February we were - we accumulated 246 hours - 146.5 hours of power - of actual power production, 69 hours of 10 meters - 10.2 meters and above and only 9.2 hours of 15.3 meters per second.

That's why the standard is reasonable to say that you only want 150 hours for the 1.2 and above B average and only 25 hours. So 1.8 times greater than B average because those higher wind speeds are not as common as of the (rest) of the other ones.

So the other requirement was to identify what the actual turbine intensity for. Our data acquisition so we sorted our data and (did it) on the actual 15 so we look at 14.5 to 15.5 to center our data at the actual 15.0 period. The turbine's intensity is the standard deviation of the wind speed over the wind speed average times 100. Then we take the actual average of all the data points that are between the - that 15 minutes per second range.

Again when we calculated that previous value we move on to calculating the math what was the actual max wind speed that determined the actual view - experience for that particular month so we sorted data that's not classified for TU, TN and TE. So whenever the turbine was actually operating or available and may only check for the main maximum average values for the primary anemometer signals and depending on what type of functions or systems that you're using to analyze your data use the maximum function to find the maximum value.

Later on I will show you one of our test turbine graphs that indicates and gives all the information regarding the conditions here at our site for that particular turbine.

So finally you - for each month you do your power degradation investigation analysis to - so you filter the data for the (bell admission) sector and just to verify that the turbine doesn't have any obstruction and is producing power whenever. The wind speed has been correlated and been assessed to be accurate and there's no obstructions, the date and then we exclude the data that has been labeled non-operating, exclude it or unknown.

Com - bend the power and the wind speed which had been omitted plus series of power and reach wind speed for each month and look if there's any power degradation or power loss other than the actual seasonal variances because you know that during the winter months when the area sensors they're going to be producing more power compared to the summer months where the air is less dense.

So here's an actual graph of one of our turbines. It was rated at a 1201 machine and it was furling - had a furling mechanism to regulate its rotor speed. It didn't have any cut out to where we'll capture data up to 26 meters per second. So you can see the governing speed was around 14 meters per second anything greater than 14 meters per second the rotor speed was - has been governed and regulated and producing less power.

As you can see the trends that the turbine itself can have many variances but the variability that because of the dynamics of the turbine you couldn't tell if there was an actual power degradation because you can see big spikes like say on the 15 meters per second when the turbine is really engaged on the furling mechanism you can see that it trends. Then on July there's a really low point than the - that doesn't indicate that the turbine actually had an issue and was just that the furling mechanism reacted in a certain manner to reduce the wind - the rotor speed and produce less power for that particular month.

In order to simplify it and get a better view and have filtered the data to just between 0 to 14 meters per second just before or just about the turbine engages its furling mechanism and see the multiple power lines are pretty even, straight and you can definitely tell the seasonal variances between the months of - the winter months compared to the summer months like June and July, August that the summer months here in our site. But overall the turbine didn't showcase or indicate that there was any issues with the power productions or was any power degradation.

After we do all that we do the analysis, the turbulence, intensities to (unintelligible) the monthly (unintelligible) for each month until we have accumulated and finalized all the different requirements for the standards that six - at least the minimum of six months of operations, the 2,500 hours of any power productions, the 250 hours of 1.2 times the V average and the 25 hours of 1.8 times the V average just to verify that the turbine is actually reliable and it was designed to withstand its - withstand higher wind speeds or depending on how robust the system actually behaves to our particular sites.

Each site is very different like here on site we experience a lot of turbulence. Like here is our - a monthly NREL results for one of our particular tests the same 1 kilowatt machine. We were able to capture 2,500 18 hours at power producing, 488 hours at 1.2 V average and 1 - 106 hours of 1.8 average.

But you can see we were able to record a mass gust of 42 meters per second on March of 2011 but look at the turbulence intensity at 50 meters per second we never went down 17% where we average a 19.4% for our site indicating that we had the variability of the wind speeds here on our site our very extreme.

So it makes that a very unique testing center to see the robustness and the design that the turbines can withstand of such high turbulence intensity. Overall the turbine was operating for 12 months a total of 8,760 total hours and it came out with a total operating time fraction of 96.2% understand it only requires 90% or above. There's definitely - this particular turbine actually built the requirement standards of the operating time fractions of 90% or above.

So once we finish with our calculations we were able to do the post (unintelligible) inspection and verify that the dynamic behavior of the turbine being enhanced or actually in ways hurting itself or making it a hazard environment for the system to be operating for either the owner or the people on the ground have showcased.

Here a couple of the pictures are different post (unintelligible) inspections that we have done here on our site when you can see the tear down of the ARE 442 on the left center and the tear - the commissioning of the EW 50 on the center right that one's a 10 kilowatt machine and a 50 kilowatt machine.

And want to showcase more of the different findings that we have done we have (unintelligible) here and the different turbines. You can see on the top right there's the oil inspections. I don't know how thoroughly you can see but there's some black spots indicating that there was some actual tear and wear on the gears and degradation of the oil in the system. So then we take into consideration and we put it on the system. We do oil sample testing to verify how many parts per million are loading on the oil after degradation testing.

We tear down the turbine completely like on the center part you can see the slip ring, the power slip ring that the turbine can transmit power from the (free yaw) machine all the way to the inverter. On the top right you can see the insides of a gear box. When we did that gear box inspection we had an - sculpt it all out and figure out if there was any grinding, oil levels, leakage or we were able to identify if there was any chips or damage to the gears.

On the bottom left hand corner there's - that's a break in a solenoid of a system. And now you can see it's supposed to be an intact solid one piece but it was connected through a rubber ring that got deteriorated due to the weather and it broke apart. So the brake itself brake solenoid wasn't aligned properly so it wasn't applying the brakes correctly when the turbine needed to apply the brakes. And you can tell because of the caliper on the far bottom right you can see the brake pads one of them is on the bottom is worn more than the one from the one on the top.

So the uneven wear was caused because of the misalignment of the solenoid in the system. And then on the middle portion of the bottom middle is the blade close up. You can see the crack on the blade and some of the actual - some rubbing or scraping of the actual blade on the bottom corner of the picture. So those pictures are taken to verify the dynamic behavior and the dynamic - how robust the system was designed to actually fall under that - those particular - that small wind turbine classifications.

So that concludes my presentation. Is there any questions?

Tony Jimenez: Yes I do have a question.

Ismael Mendoza: Go ahead yes.

Tony Jimenez: I guess going back to the last slide would those, you know, where you have like the brakes like braking or they're braking to be misaligned would that - does that mean the turbine failed the duration test or how did you - what determination did the team make on whether that was enough of a wear and tear to say, no the turbine didn't pass or how did you deal with that?

Ismael Mendoza: No the major failure sometimes consider the turbine is unsafe or it doesn't produce any power. On this particular situation we didn't see any issue with the system until we actually tore it all down and we saw that the brakes weren’t being applied correctly. Overall the system wasn’t unsafe when it was still up in the air and...

Tony Jimenez: Okay.

Ismael Mendoza: ...(need to note) for the manufacturer to be more aware that this could happen out in the field and included in their maintenance schedule.

Tony Jimenez: Okay but you wouldn’t consider this to be a, you know, you think enough of those failures to withhold certification and I know that’s not our role but?

Ismael Mendoza: Correct no I don’t think so.

Tony Jimenez: Okay. Anybody else have any questions? All right well thank you Ismael.

Ismael Mendoza: You’re welcome.

END