Duke Power®
A Duke Energy Company

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June 8, 2007

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Duke Power Company LLC d.b.a.
Duke Energy Carolinas, LLC
McGuire Nuclear Station, Unit 1
Docket No. 50-369

Emergency License Amendment Request for One-Time Limited Duration Extension of Allowed Outage Time for the Unit 1A Emergency Diesel, Request for Additional Information

On June 7, 2007, Duke Power Company LLC d.b.a. Duke Energy Carolinas, LLC (Duke) submitted an emergency license amendment request for a one-time limited duration extension of the Technical Specification Required Action Completion Time associated with the Unit 1A Emergency Diesel Generator (EDG). The requested extension would allow continued operation of Unit 1 for an additional 168 hours while repairs and related testing of the 1A EDG are completed.

On June 7, 2007, the NRC Staff electronically requested additional information regarding several issues contained within that request. An additional request for information was received during a teleconference with the NRC Staff June 7 and 8, 2007. The Duke response to the request for additional information is attached.

The responses being provided are clarifications and do not represent any changes to the emergency license amendment request. Also, the conclusions reached in the original determination that the emergency license amendment request contains No Significant Hazards Considerations and the basis for the categorical exclusion from performing an Environmental/Impact Statement have not changed as a result of this request for additional information.

A001
NRR

Please direct any questions you may have in this matter to K. L. Ashe at (704) 875-4535.

Sincerely,

Gary R. Peterson

cc w/ Attachment:

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OATH AND AFFIRMATION

Gary R. Peterson affirms that he is the person who subscribed his name to the foregoing statement, and that all the matters and facts set forth herein are true and correct to the best of his knowledge.

[signature]

Gary R. Peterson, Site Vice President

Subscribed and sworn to me: June 8, 2007
Date

[signature] Kay L Crane, Notary Public

My commission expires: April 1, 2012
Date

KAY L. CRANE
NOTARY
PUBLIC
LINCOLN COUNTY, N.C.

Background Information:

On June 7, 2007, Duke Power Company LLC d.b.a. Duke Energy Carolinas, LLC (Duke) submitted an emergency license amendment request for a one-time limited duration extension of the Technical Specification Required Action Completion Time associated with the Unit 1A Emergency Diesel Generator (EDG). The requested extension would allow continued operation of Unit 1 for an additional 168 hours while repairs and related testing of the 1A EDG are completed.

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RAI Questions and Responses

Question 1:

The submittal identified administrative controls to assure plant changes are reflected in the PRA model, but has not stated whether there are outstanding plant changes not yet reflected in the model, and whether those would impact this analysis.

Response:

There are 4 plant changes that are not included in the current base PRA model (Rev. 3a). These changes were reviewed and evaluated. One was determined to potentially impact our base model for this application. Therefore we incorporated this change and created an adjusted base case. The issue of interest deals with the timing to manually throttle Auxiliary Feedwater flow when there is a loss of power. The probability of human error was increased in the adjusted base model to reflect this plant change.

Question 2:

The submittal did not address truncation levels per RG 1.177 2.3.3.4.

Response:

Truncation issues are not an issue with this risk calculation. The analysis with the diesel in the failed state was performed at the same truncation level as the base case (1E-9 for CDF and 1E-10 for LERF). A review of the cutsets shows that the diesel failure is in most of the top cutsets. There is adequate representation of the failure in the results that drive the answer so that there was no need to solve to any lower truncation levels. The issue identified in RG 1.177 (most of the failures appearing near the truncation cutoff) does not exist in this analysis.

Question 3:

The submittal needs to identify if credit is taken for the SSF in the risk calculations, and should also address if equipment repair is credited (i.e., for the 1B diesel).

Response:

Credit is taken for the SSF. It is identified in the submittal as a protected system that will not be taken out of service during the extended AOT. No equipment repair for the 1B diesel (or any other equipment) is credited.

Question 4:

The submittal did not address uncertainty or sensitivity issues per RG 1.177 2.3.5.

Response:

Duke agrees with the RG 1.177 statement that risk analyses of AOT extensions is relatively insensitive to uncertainties. We did not credit equipment repair so there are no uncertainties to be evaluated for that issue. We required important systems to remain in service during the AOT so no issues with mean downtimes should exist. We confirmed that common cause was not an issue for the other diesel. Therefore, for the typical issues related to uncertainties, there should be no effect on our analysis. However, we did do two sensitivity studies of key inputs to the analysis. Our base case looked at the 1A diesel out of service and concluded we could support up to an addition 34 day AOT. Sensitivity case #1 doubled the LOOP frequency and concluded that we could support up to an additional 20 day AOT. Sensitivity study #2 increased the common cause factor for the 1B diesel and concluded that we could support up to an additional 19 day AOT.

Question 5:

Provide clarification that the seismic contribution is negligible compared to the non-seismic results.

Response :

The frequency of seismic events at certain important levels is compared to the LOOP and tornado frequencies.

The insulators in the switchyard have a mean seismic fragility of approximately 0.3 g, Table 3-1 of the MCGuire IPEEE submittal report. The McGuire design basis earthquake is 0.1 g.

From Figure 3-1 of the McGuire IPEEE submittal, the frequency of exceedance for a 0.1 g (~100 cm/sec^2) event is approximately 3E-04/year. This is much smaller than the nominal LOOP frequency of 5.1E-02/year. It is also smaller than the tornado initiating event frequency of 7.1E-04/year.

The frequency of exceedance for a 0.3 g (~300 cm/sec^2) event is approximately 2E-05/year. This is much smaller than both the nominal LOOP frequency of 5.1E-02/year and the tornado initiating event frequency of 7.1E-04/year. This is a much better representation of the frequency of a seismic induced LOOP than is the comparison to the DBE.

Question 6:

Additional information is requested regarding the McGuire 1A Emergency Diesel Generator (EDG) jacket water and intercooler pump motor overload alarm of June 6, 2007, motor testing and inspections, and the results of Duke's investigations.

Response :

<u>Motor Preventive Maintenance</u>:

Motor periodic maintenance is based upon the Duke Energy Motor Program template prepared by the Duke three site Motor Working Group. The electrical testing for this motor, 1KDMR0009, is performed on a 3Y frequency. All preventive maintenance tasks are based upon EPRI guideline TR-106857-V8:

Low Voltage Electric Motors (600V and below), as well as benchmarking of other utilities.

The small motor/ intermittent duty template applies and recommends the following periodic maintenance:

- External visual inspection: Focus is mainly on visual indication of deterioration.
- Electrical testing including:
  - Winding resistance: Integrity of circuit and connections.
  - Insulation resistance (Megger): Machine dielectric resistance of ground wall insulation.
  - Polarization Index: Indicates moisture or conductive contamination of the winding or lead cables.
- Thermographic data: The main application is to provide an indication of a loose connection.
- Vibration spectra: Very effective in addressing or finding bearing defects, balance, or rotor bar defects.
- DC stepped Hi-pot and Surge testing are typically performed at McGuire on small motors when troubleshooting.

Motor testing and motor inspections are performed under procedure IP/0/A/3190/0005, Rev 21. Per this procedure, the winding resistance must be balanced within 5%. The acceptance criterion for the Megger test is based upon IEEE 43, Recommended Practice for Testing Insulation Resistance of Rotating Machinery. The minimum acceptable reading is 100 Mohms (MΩ).

Typical Data for the KD motors:

EDG jacket water and intercooler pump motors. Manufactured by Louis Allis, type Pacemaker CJ5B, 20 HP, 550 V, 3 phase, 1800 RPM, Type F insulation, frame size 256T.

Motor 1A: 1KDMR0009, Motor 1B: 1KDMR0010, Motor 2A: 2KDMR0009, Motor 2B: 2KDMR0010

Lubrication:

Motors are greased semi-annually on preventive maintenance model work order 510294 using procedure MP/0/A/7300/010. Each motor bearing grease port receives 2 strokes of grease, total per bearing is 4 grams, a volume of 4 cc's.

Unit 1 KD motor lubrication: Both Unit 1 motors were lubricated on 05/30/2007 on work order 01724486.

Unit 2 KD motor lubrication: Both Unit 2 motors were lubricated on 02/06/2007 on work order 01708008.

Pump to motor alignment: The two pumps attached to each KD motor are aligned on a 36 month interval. The 1A KD motor/pump assembly that overheated was aligned within procedural tolerances each time.

09/03/2002 on work order 510514
10/02/2005 on work order 562554

Vibration:

All KD motors have quarterly vibration data taken on 5 positions: H1, V1, H2, V2, A2 from 0-2000 Hertz (H=Horizontal, V=Vertical, A=Axial direction). No degrading trends were identified. All values were at least 50% below the first alert value used for fault identification. The present overall values are low.

Motor 1A: Last monitored 05/08/2007 at 11:55: Maximum spectral peak amplitude 0.059"/sec,

Motor 1B: Last monitored 03/28/2007 at 08:13: Maximum spectral peak amplitude 0.095"/sec,

Motor 2A: Last monitored 04/03/2007 at 13:24: Maximum spectral peak amplitude 0.073"/sec,

Motor 2B: Last monitored 03/20/2007 at 14:05: Maximum spectral peak amplitude 0.034"/sec

Electrical Tests:

Preventive maintenance electrical testing is performed on a 3 year interval, consisting of winding resistance, insulation resistance, and Polarization Index, using a calibrated Baker test instrument Advanced Winding Analyzer Series II. If a problem is indicated, more testing is performed for diagnosis with Engineering concurrence. The phase to phase winding resistance is calculated within the Baker software, not shown below. The Baker maximum resistance is 20,000 MΩ and is considered infinity.

Review of the 1A KD motor electrical test data of 4/2/07, 9/2/03, and 11/28/00 shows stable data and no degrading trend. Testing was performed following the motor breaker trip on 6/6/2007. Results:

06/06/07: Phase A-B: 0.718; Phase B-C: 0.721; Phase A-C: 0.715 Ω; Megged 5,200 MΩ corrected to 4,851 MΩ; PI = 1 at >5,000 MΩ. Testing stopped before

1500 volts DC of the hi-pot performed by the Baker test set. The motor was disconnected at the motor lead box with similar diagnostic test results.

Motor 1A: Last performed on work order 00590722 on 4/2/2007.

04/02/07: Phase A-B: 0.656; Phase B-C: 0.658; Phase A-C: 0.655 Ω; Megged 20,000 MΩ corrected to 6,155 MΩ; PI = 1 at > 5,000 MΩ.

09/02/03: Phase A-B: 0.683; Phase B-C: 0.675; Phase A-C: 0.655 Ω; Megged 20,000 MΩ corrected to 11,486 MΩ; PI = 1 at 20,000 MΩ.

11/28/00: Phase A-B: 0.624; Phase B-C: 0.621; Phase A-C: 0.629 Ω; Megged 20,000 MΩ corrected to 9,330 MΩ; PI = 1 at 20,000 MΩ.

Motor 1B: Last performed on work order 00587434 on 7/18/2006.

Phase to phase balanced within spec; Megged 5,000 MΩ and corrected to 4,061 MΩ; PI = 1 at > 5,000 MΩ.

Motor 2A: Last performed on work order 00551344 on 8/24/2004.

Phase to phase balanced within spec; Megged 5,100 MΩ and corrected to 3,865 MΩ; PI = 1 at > 5,000 MΩ.

Motor 2B: Last performed on work order 01698439 on 1/23/2007

Phase to phase balanced within spec; Megged 5,100 MΩ and corrected to 2,219 MΩ; PI = 1 at > 5,000 MΩ.

<u>Pump data</u>:

Review of the 8 driven pumps (2 per motor) identified two different pump designs:

Pumps 1A and 2A are Goulds pumps, 3410 3X4-10S and 3410 4X6-11H.

Pumps 1B and 2B are Peerless pumps, 30S08-B and 50S09.

Each skid consists of a single motor driving two pumps, one on each end of the motor. For the Goulds pumps, the intercooler water pump is rated at 320 gpm and the jacket water pump rated at 730 gpm. For the Peerless pumps, the intercooler water pump rated at 300 gpm and the jacket water pump rated at 700 gpm.

The A Train pumps on both Unit 1 and 2 were changed via the modification process to Goulds pumps in 1997. Unit 2 pumps were replaced under Work Order number 416420. Unit 1 pumps were replaced under work order number 365977.

Motor data:

All four motors in service on 6/5/07 are manufactured by Louis Allis. They are a Pacemaker Type CJ5B, rated at 20 HP at 1800 synchronous speed on a 256T frame, having a KVA code G. The following summarizes the differences in the motor characteristics, and thus different build dates:

Motor 1A:

Model Number: 9145852002E
Speed at rated load: 1745
Full Load Amps: 19.5

Motor 1B:

Model Number: 9145852001E
Speed at rated load: 1745
Full Load Amps: 19.5

Motor 2A:

Model Number: 4J06335002
Speed at rated load: 1750
Full Load Amps: 21

Motor 2B:

Model Number: 3406320001
Speed at rated load: 1755
Full Load Amps: 21

To summarize motor build age, the difference in model numbers between the 1A and 1B motors indicates that the motors were built at approximately the same time, and are expected to be the original motors installed for the McGuire diesel dedication in 1975. The 2A and 2B motors have very different model numbers, rated load speed and full load current, as compared to the original 1975 vintage motors. The 2A and 2B motors were replaced as supported by historical work order documentation. Motor 2B was replaced on an emergent basis in 1983, work order number 0094017. Motor 2A was replaced in conjunction with a pump modification in 1997, work order number 416420.

Because the Unit 2 motors are more recently installed, they have fewer cycles and less operational wear.

McGuire relies on periodic maintenance and predictive maintenance to prevent failures of these components. The vibration data for all of these motor and pump skids indicates that there are no adverse trend in condition monitoring, and this is also supported by the non-intrusive motor testing that is performed.

Diesel generator and approximate KD motor run time data since 10/2003:

Motor	Monthly Average (hrs)	Total (hrs)
1A	9.10	282
1B	9.82	304
2A	9.04	280
2B	8.96	277

<u>1A Motor Analysis</u>:

At 18:20:03, approximately 23 minutes after the 1A Diesel Generator was shutdown, the McGuire Control Room received a non-tripping computer alarm indicating an administrative current overload condition on the 1A KD Jacket Water Cooling Pump Motor, simultaneous with the motor stopping. There were no problems noted during the run. Maintenance was asked to troubleshoot the motor and performed several electrical tests including a Megger, winding resistance, and Polarization Index test. The tests indicated no problem with the motor. Maintenance then performed a stepped DC voltage Hi-Pot and Surge test of the motor. Both tests gave repeatable data and indicated a potential problem with the windings. The motor was removed and sent to an offsite vendor for inspection and attempted repair.

The vendor disassembled the motor and provided photographs of an apparent hard rub between the stator and rotor (Figure 1, 2, and 3). There were also numerous pieces of metal particles inside the end-bell and in the end turn windings of the stator (Figure 2, 3, and 4). Since an apparent rub was in several places around the circumference of the stator winding, the initial cause investigation (based on vendor supplied photos only) suggested a bearing failure. However, this was later refuted as discussed below.

A rub would explain why the overload alarm was received. Since the computer overload alarm device is sized one standard size smaller than the expected full load current, any drag or rub would cause additional current. This additional current would cause the overload alarm to be picked up as it did. If the motor had continued to run with a degrading rub, then the three phase overload, set at 150% of full load current, would have tripped the motor.

Since the motor was not run after the initial indication of an overload condition, there are insufficient data (vibration, bearing temperatures, running amps, alignment verification) available to determine the actual cause. However, on motor disassembly and preliminary visual inspection of the bearings on 6/7/07 by the experienced Duke motor representative at the motor shop, there were no immediately apparent bearing problems such as cage failures or looseness.

Records indicate that the motor had been lubricated on 5/30/07 and previous quarterly vibration readings associated with diesel testing, performed on 5/08/2007, were also reviewed and found to be within tolerance. No increasing trend of the overall vibration data was identified over the previous 7 years.

Again, based on pictures provided by Shultz Electric earlier on 6/7/07 of the disassembled motor, there appeared to be an indication of a hard rub between the rotor and the stator. However, the apparent rub was actually aluminum that flowed out of the rotor due to heat, that smeared onto the stator. Given that the bearings did not indicate degraded condition, this supports the conclusion that the rotor did not come into contact with the stator.

The pictures, specifically of the bracket, show loose aluminum particles. Any aluminum imbedded in the windings or the slot can provide a tracking path to ground, resulting in degraded indications from the DC HI-POT test and surge test performed at McGuire prior to shipping the motor to the repair facility. The degraded core due to the melted aluminum would lead to higher current draw, causing the overload alarm that was received, and would be expected for this condition.

When the remaining in-service motors were run for common cause failure with process fluid temperatures less than would be present with an operating diesel engine, the absence of overload alarms is sufficient indication that a degraded condition of the rotor is not present on those motors.

At this preliminary point of the causal evaluation, the initiating mechanism causing the rub/smear could be any of the following: excessive heat on the rotor from numerous start attempts or starter relay chattering, a locked rotor condition, a slow start with additional heating from the additional current while accelerating, and unusually heavy load applied from the pump(s). Once the motor was overheated, local hot spots of the aluminum bars could melt, drip down into the small, approximately 0.025" air gap, and smearing would rapidly progress throughout the air gap interface. Vibration analysis can find broken rotor bars, but not this particular type of rotor damage. Rapid degradation of this nature are difficult to detect.

Data:

2A Motor issued: 11/17/97, Motor Stock Code 127784, Material Request number 398843
Work Order number 416420, No Purchase Order number available

2B Motor: Replaced 7/29/1983; Work Order number 0094017; Manufacturer Louis Allis

Extent of Condition:

Review of all 4 KD motor data prior to the failure was performed on 6/6/2007 for degrading vibration trends or high amplitudes, and changing electrical test results. No issues were identified. The remaining three KD motors were run to verify operability on 6/6/2007. 1B was started at 11:47 for 5 minutes, 2A at 12:00 for 3 minutes, 2B at 12:05 for 3 minutes. Therefore, based on the available testing, and successful previous quarterly diesel testing, the remaining 3 KD motors are fully operable.

Figure 1

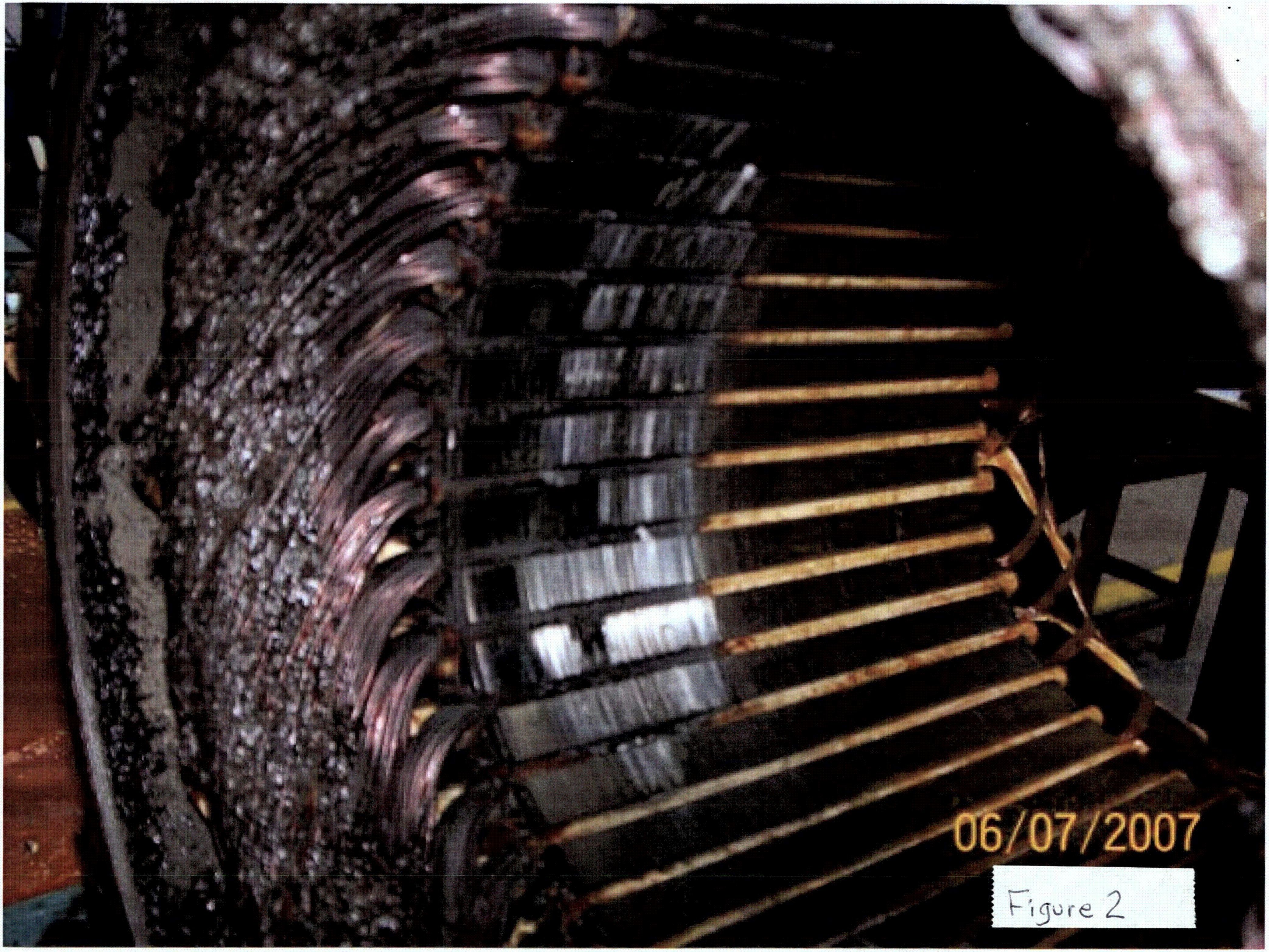

Figure 2

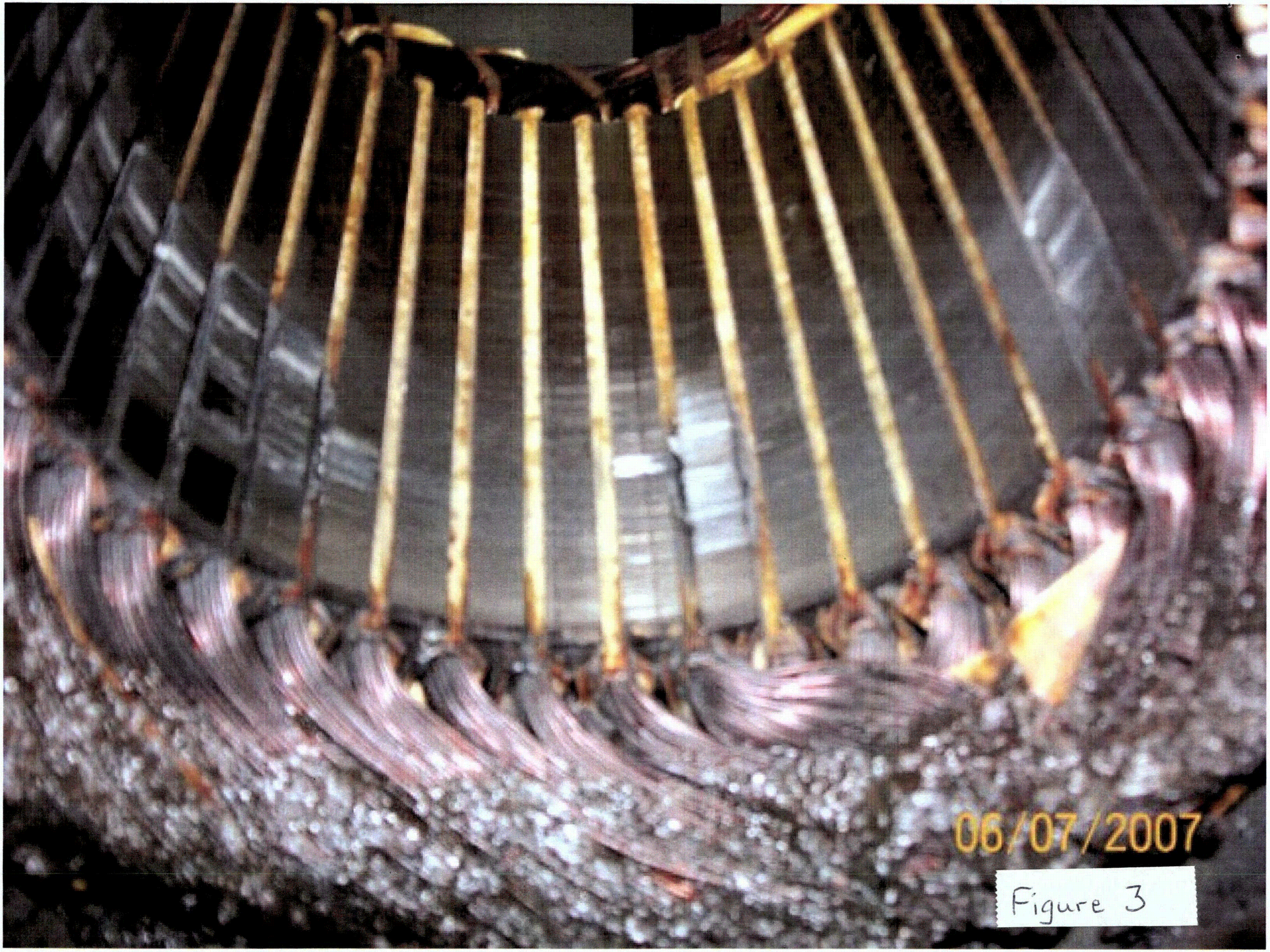

Figure 3

Figure 4