Corrective Action 1323
Carondelet Division - CA / PA / RGA Database
Corrective Action Type NCR
Date 7/27/2005 **Revised 1/18/06**
CA Originator C. Ruud
Applies to: Coil castings C-1, C-2, C-3, C-4 and A-1 and C 1 shim and four C coil and six A coil shims

**Description of Defect / Non-Conformance**
Phosphorus levels in material produced to date exceed specification limits. Both phosphorus and sulfur readings reported erroneously in certifications.

Certification reports have shown phosphorus and sulfur levels in the <.01% range. Independent laboratory data confirmed phosphorus in the .018 to .033% range and sulfur in the .005 to .022% range. Actual levels of some tests are above those in PPPL Specification NCSX-CSPEC-141-03-07 Rev 7.

Nonconformance was first suspected as a result of analysis of zoned attached test specimens volunteered by MetalTek International as response to PPPL questions on weighted average chemical analysis and quality of blending in the gating system. Nonconformance was verified on the bars used in the study and has been extended to evaluation of previously poured products.

During this investigation it was discovered that the manganese results were also flawed. We were over reporting by approximately 0.5%.

**Root Cause**
Specification limits for phosphorus and sulfur were set below the levels achievable through use of available raw materials. Spectrometer did not properly calibrate for phosphorus and sulfur at levels of specification due to equipment malfunction.
The chemical specification of EIO heats uses alloy CF8MNMNMod which incorporates a type standard calibration with a certified reference material (CRM) BS180. This enables the operator of the spectrometer to match the elemental concentrations of this alloy with corrective factors. These factors are determined by analyzing the CRM and having them compared with the calibration curves for each element. The phosphorus and sulfur content have very low measured intensities due to low concentrations. Intermittent failure of the spectrometer intensity measuring card caused higher intensity readings for phosphorus and sulfur. Subsequent checks with the CRM resulted in low corrective factors that were not detected. This in turn resulted in low reported concentrations for the EIO samples.

Samples from A-1, C-4 and C-5 were sent to Wisconsin Centrifugal, our parent company, for independent analysis of all reported elements. The results indicated a discrepancy in the level of manganese in the results of the analyses performed by the two labs. Consistently, the Pevely lab measured Mn about 0.4 to 0.5% higher than WC measured. To confirm this information we sent three samples to an outside laboratory for wet chemistry analysis. The results correlated well with the results achieved at Wisconsin Centrifugal.

In follow-up, samples from C-1, C-2 and C-3 were also sent for verification, with similar outcome. We then located and tested a sample from a test heat #21424 of CF8MNMNMOD made in January 2004. Testing indicated similar results.

It can be stated that, for at least the period of time comprising the Prototype and the Production to the repair of the Spectrometer, that our analysis of Manganese levels has been higher than the level actually present in the alloy. Typically, this deviation is on the order of 0.4-0.5%.

The spectrometer received the preventive maintenance on August 29, 2005. The report was submitted on September 2, 2005. The repair made to the optical card was determined to have rectified the erroneous phosphorus and sulfur analysis. No other mechanical or software problem that would affect manganese was determined.

In follow up to the manganese discrepancy, the same samples were analyzed on the Pevely spectrometer. The levels reported after PM now correlate with the results from WC and the independent laboratory. Further investigation indicates that the BS180 standard used for type standardization was sufficiently outside the range of Mn and inducing error. No other root cause has been determined.

**Corrective Action**
Modification to specification for phosphorus and sulfur will be requested. Limits will be set based on process capability and consistent with other stainless steel grades.
Replacement of deficient card in spectrometer was completed on August 29, 2005.

In consideration of the erroneous Mn and other elemental readings, the following actions have been taken. Create a type standard that closely matches the Mn in CF8MNMNMOD. This type standard was implemented with A-4 coil.
Request a revision to the chemistry range for Mn. (propose widening of Manganese since it has been proven to be effective at much lower concentrations than previously thought).
Have each heat of CF8MNMNMOD verified independently for balance of program.

**Verification of Corrective Action**
All analysis of CF8MMNMMod will be verified by an outside laboratory. See attached reports comparing the results. Results correlate very well.

**Preventive Action**
In addition to spectrometer faults, we have identified that the specification ranges for sulfur and phosphorus is unattainable. Analysis and specifications for virgin charge materials predict sulfur at 0.040% maximum and phosphorus at 0.040% maximum. We have no way to remove phosphorus from the melt and do not intentionally add phosphorus. So, the confirmed coil analyses, along with analyses of virgin material heats, demonstrate sulfur in the range of 0.010% to 0.022% and phosphorus in the range of 0.018% to 0.033%. These results are consistent with our charge material analysis. We will request a deviation for phosphorus in the subject parts and also request a permanent specification change to 0.040% maximum for both phosphorus and sulfur, to allow us to provide non-discrepant material. This change will not affect, in any way, the physical properties or material performance because all coils and test material exhibited sulfur and phosphorus within the new ranges despite inaccurate reporting.

**Estimated Completion Date**
August 15, 2005

**Actual Completion Date**
Spectrometer preventive maintenance completed on August 29, 2005.
A new type standard has been created and put to use starting with Coil A-4.
The specification for phosphorus and sulfur were revised to 0.035% and 0.025%, respectively.

Signed: C. Ruud

CC: Jim Galaske, Barry Craig, Joe Edwards, E.J. Kubick, J. Markham

Chemistry Check with WISCO A Coils — Revised 12-13-05

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | A-3 I-1 | Button #1 | 0.04 | 0.3 | 2.8 | 18.1 | 13.4 | 2.2 | 0.26 | 0.034 | 0.012 | run after PM |
| CAF | A-3 I-1 | Button #2 | * | 0.3 | 2.7 | 18.1 | 13.4 | 2.3 | * | 0.034 | 0.012 | run after PM |
| WC | A-3 I-1 | Button #2 | * | 0.3 | 2.6 | 17.9 | 13.4 | 2.3 | * | 0.035 | 0.016 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | A-3 I-3 | Button #1 | 0.04 | 0.4 | 2.9 | 18.2 | 13.3 | 2.2 | 0.26 | 0.034 | 0.012 | run after PM |
| CAF | A-3 I-3 | Button #2 | * | 0.4 | 2.9 | 18.2 | 13.3 | 2.2 | * | 0.030 | 0.011 | run after PM |
| WC | A-3 I-3 | Button #2 | * | 0.4 | 2.7 | 18.1 | 13.4 | 2.2 | * | 0.032 | 0.016 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | A-3 I-6 | Button #1 | 0.04 | 0.4 | 3 | 18.3 | 13.2 | 2.2 | 0.25 | 0.034 | 0.012 | run after PM |
| CAF | A-3 I-6 | Button #2 | * | 0.4 | 2.9 | 18.3 | 13.2 | 2.2 | * | 0.031 | 0.012 | run after PM |
| WC | A-3 I-6 | Button #2 | * | 0.4 | 2.7 | 18.2 | 13.4 | 2.2 | * | 0.034 | 0.016 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | A-2 I-1 | Button #1 | 0.04 | 0.5 | 2.8 | 18.5 | 13.2 | 2.3 | 0.24 | 0.031 | 0.012 | run after PM |
| CAF | A-2 I-3 | Button #2 | 0.04 | 0.4 | 2.9 | 18.1 | 13.1 | 2.4 | 0.24 | 0.038 | 0.012 | run after PM |
| CAF | A-2 I-6 | Button #2 | 0.04 | 0.3 | 2.9 | 18.2 | 13.0 | 2.3 | 0.26 | 0.035 | 0.016 | run after PM |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | A-2 Z-1 | Cast on sample | * | 0.4 | 2.7 | 18.2 | 13.0 | 2.3 | * | 0.035 | 0.012 | run after PM |
| WC | A-2 Z-1 | Cast on sample | * | 0.4 | 2.5 | 18.0 | 13.2 | 2.3 | * | 0.034 | 0.026 | |
| CAF | A-2 Z-2 | Cast on sample | * | 0.6 | 2.5 | 18.3 | 13.1 | 2.3 | * | 0.032 | 0.012 | run after PM |
| WC | A-2 Z-2 | Cast on sample | * | 0.6 | 2.3 | 18.2 | 13.3 | 2.3 | * | 0.030 | 0.024 | |
| CAF | A-2 Z-3 | Cast on sample | * | 0.4 | 2.7 | 18.1 | 13.0 | 2.3 | * | 0.036 | 0.012 | run after PM |
| WC | A-2 Z-3 | Cast on sample | * | 0.4 | 2.5 | 18.1 | 13.2 | 2.3 | * | 0.036 | 0.029 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | A-1 | Reported | 0.04 | 0.4 | 2.4 | 18.2 | 13.3 | 2.4 | 0.26 | * | * | |
| CAF | A-1 | Cast on sample | * | 0.5 | 2.1 | 18.0 | 13.4 | 2.4 | * | 0.034 | 0.009 | |
| WC | A-1 | Cast on sample | 0.06 | 0.6 | 1.6 | 18.1 | 13.7 | 2.4 | 0.25 | 0.027 | 0.009 | |
| CAF | A-1 | Cast on sample | * | 0.6 | 1.6 | 18.2 | 13.5 | 2.4 | * | 0.028 | 0.009 | re-run after PM |

* not analyzed by spectrometer.

Chemistry Check with WISCO B Coils — Revised 12-13-05

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
| CAF | B-1 I-1 | Button #1 | 0.04 | 0.3 | 2.9 | 18.4 | 13.0 | 2.3 | 0.25 | 0.032 | 0.012 | run after PM |
| CAF | B-1 I-1 | Button #2 | * | 0.3 | 2.8 | 18.3 | 12.9 | 2.3 | * | 0.034 | 0.013 | run after PM |
| WC | B-1 I-1 | Button #2 | * | 0.3 | 2.6 | 18.2 | 13.0 | 2.3 | * | 0.031 | 0.019 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | B-1 I-3 | Button #1 | 0.04 | 0.4 | 2.7 | 18.3 | 13.1 | 2.2 | 0.25 | 0.035 | 0.012 | run after PM |
| CAF | B-1 I-3 | Button #2 | * | 0.4 | 2.8 | 18.3 | 13.2 | 2.2 | * | 0.038 | 0.013 | run after PM |
| WC | B-1 I-3 | Button #2 | * | 0.4 | 2.7 | 18.2 | 13.3 | 2.2 | * | 0.037 | 0.020 | |
| **Lab** | **I.D.** | **Sample** | **C** | **Si** | **Mn** | **Cr** | **Ni** | **Mo** | **N** | **P** | **S** | |
| CAF | B-1 I-6 | Button #1 | 0.04 | 0.4 | 2.9 | 18.3 | 13.1 | 2.2 | 0.25 | 0.040 | 0.012 | run after PM |
| CAF | B-1 I-6 | Button #2 | * | 0.4 | 2.9 | 18.3 | 13.1 | 2.3 | * | 0.032 | 0.012 | run after PM |
| WC | B-1 I-6 | Button #2 | * | 0.4 | 2.7 | 18.1 | 13.2 | 2.3 | * | 0.038 | 0.019 | |

* not analyzed by spectrometer.

Chemistry Check with WISCO
C Coils and Shims

Revised 12-13-05

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-6 I-1 | Button #1 | 0.04 | 0.3 | 2.9 | 18.1 | 13.0 | 2.4 | 0.25 | 0.026 | 0.012 | run after PM |
| CAF | C-6 I-1 | Button #2 | * | 0.3 | 2.9 | 18.1 | 13.3 | 2.3 | * | 0.028 | 0.011 | run after PM |
| WC | C-6 I-1 | Button #2 | * | 0.3 | 2.8 | 18.1 | 13.4 | 2.3 | * | 0.027 | 0.022 | |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-6 I-3 | Button #1 | 0.04 | 0.3 | 2.7 | 18.2 | 13.3 | 2.3 | 0.25 | 0.027 | 0.012 | run after PM |
| CAF | C-6 I-3 | Button #2 | * | 0.3 | 2.7 | 18.2 | 13.4 | 2.3 | * | 0.026 | 0.011 | run after PM |
| WC | C-6 I-3 | Button #2 | * | 0.3 | 2.6 | 18.1 | 13.4 | 2.3 | * | 0.025 | 0.018 | |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-6 I-6 | Button #1 | 0.04 | 0.4 | 2.9 | 18.1 | 13.2 | 2.3 | 0.25 | 0.034 | 0.013 | run after PM |
| CAF | C-6 I-6 | Button #2 | * | 0.4 | 2.9 | 18.1 | 13.3 | 2.3 | * | 0.034 | 0.011 | run after PM |
| WC | C-6 I-6 | Button #2 | * | 0.4 | 2.7 | 18.1 | 13.4 | 2.3 | * | 0.030 | 0.024 | |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-5,I-1 | Button #1 | 0.05 | 0.3 | 2.6 | 18.1 | 13.4 | 2.4 | 0.26 | 0.023 | 0.011 | |
| CAF | C-5,I-1 | Button #2 | 0.05 | 0.4 | 2.6 | 18.0 | 13.4 | 2.6 | 0.26 | 0.026 | 0.013 | |
| WC | C-5,I-1 | Button #2 | 0.02 | 0.3 | 2.2 | 18.2 | 13.5 | 2.4 | 0.25 | 0.025 | 0.010 | |
| STL Wet | C-5,I-1 | Button #1 | | | 2.2 | | | | | | | |
| CAF | C-5,I-1 | Button #1 | * | 0.3 | 2.3 | 18.3 | 13.4 | 2.4 | * | 0.029 | 0.012 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-5,I-3 | Button #1 | 0.05 | 0.4 | 2.2 | 17.9 | 13.4 | 2.5 | 0.24 | 0.033 | 0.012 | |
| CAF | C-5,I-3 | Button #2 | 0.05 | 0.4 | 2.2 | 17.9 | 13.2 | 2.4 | 0.24 | 0.033 | 0.012 | |
| WC | C-5,I-3 | Button #2 | 0.05 | 0.4 | 1.8 | 18.2 | 13.4 | 2.5 | 0.23 | 0.034 | 0.018 | |
| STL Wet | C-5,I-3 | Button #1 | | | 1.8 | | | | | | | |
| CAF | C-5,I-3 | Button #1 | * | 0.4 | 1.8 | 18.3 | 13.3 | 2.5 | * | 0.034 | 0.012 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-5,I-6 | Button #1 | 0.05 | 0.3 | 2.4 | 18.1 | 13.2 | 2.4 | 0.25 | 0.030 | 0.012 | |
| CAF | C-5,I-6 | Button #2 | 0.05 | 0.3 | 2.4 | 18.1 | 13.2 | 2.4 | 0.25 | 0.029 | 0.011 | |
| WC | C-5,I-6 | Button #2 | 0.04 | 0.3 | 2 | 18.3 | 13.3 | 2.4 | 0.24 | 0.031 | 0.018 | |
| STL Wet | C-5,I-6 | Button #1 | | | 1.9 | | | | | | | |
| CAF | C-5,I-6 | Button #1 | * | 0.3 | 2.0 | 18.4 | 13.3 | 2.4 | * | 0.033 | 0.012 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-4 | Reported | 0.04 | 0.4 | 2.5 | 18.2 | 13.2 | 2.2 | 0.26 | .030** | .014** | |
| CAF | C-4 | Cast on sample | * | 0.6 | 1.9 | 17.9 | 13.5 | 2.3 | * | 0.037 | 0.013 | |
| WC | C-4 | Cast on sample | 0.04 | 0.6 | 1.5 | 17.8 | 13.6 | 2.4 | 0.25 | 0.030 | 0.012 | |
| CAF | C-4 | Cast on sample | * | 0.6 | 1.4 | 18.2 | 13.6 | 2.4 | * | 0.031 | 0.009 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-3 | Reported | 0.04 | 0.4 | 2.5 | 18.2 | 13.3 | 2.3 | 0.25 | 0.023** | 0.013** | |
| CAF | C-3 | Cast on sample | * | 0.6 | 1.9 | 18.0 | 13.3 | 2.4 | * | 0.027 | 0.010 | |
| WC | C-3 | Cast on sample | 0.06 | 0.6 | 1.6 | 18.3 | 13.7 | 2.4 | 0.24 | 0.029 | 0.009 | |
| CAF | C-3 | Cast on sample | * | 0.6 | 1.6 | 18.1 | 13.5 | 2.4 | * | 0.028 | 0.011 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-2 | Reported | 0.06 | 0.5 | 2.8 | 18.0 | 13.2 | 2.3 | 0.26 | 0.023** | 0.018** | |
| CAF | C-2 | Cast on sample | * | 0.8 | 2.2 | 18.1 | 13.4 | 2.2 | * | 0.030 | 0.012 | |
| WC | C-2 | Cast on sample | 0.07 | 0.9 | 1.6 | 18.2 | 13.7 | 2.2 | 0.23 | 0.023 | 0.014 | |
| CAF | C-2 | Cast on sample | * | 0.8 | 1.6 | 18.2 | 13.5 | 2.3 | * | 0.024 | 0.012 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | C-1 | Reported | 0.06 | 0.5 | 2.7 | 18.1 | 13.1 | 2.2 | 0.27 | 0.018** | 0.014** | |
| CAF | C-1 | Cast on sample | * | 0.7 | 2.2 | 18.1 | 13.1 | 2.2 | * | 0.021 | 0.010 | |
| WC | C-1 | Cast on sample | 0.06 | 0.7 | 1.8 | 18.3 | 13.4 | 2.4 | 0.24 | 0.021 | 0.014 | |
| CAF | C-1 | Cast on sample | * | 0.7 | 1.9 | 18.3 | 13.2 | 2.4 | * | 0.024 | 0.013 | re-run after PM |

Heat #29198 for 5 C and 6 A shims

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | 29198 | Reported 9/24/05 | 0.07 | 0.7 | 2.97 | 18.1 | 13.12 | 2.45 | 0.255 | 0.013** | 0.01** | |
| CAF | 29198 | Separate Test bar | * | 0.8 | 2.7 | 18.2 | 13.2 | 2.4 | * | 0.025 | 0.011 | re-run after PM |

| Lab | I.D. | Sample | C | Si | Mn | Cr | Ni | Mo | N | P | S | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CAF | 24424 | Reported | 0.054 | 0.4 | 2.8 | 18.1 | 12.94 | 2.21 | 0.27 | 0.020 | 0.010 | |
| CAF | 24424 | Keel bar | * | 0.4 | 2.2 | 18.2 | 13.2 | 2.2 | * | 0.018 | 0.010 | re-run after PM |

* not analyzed by spectrometer.
** analyzed by wet chemistry.
For C-5 - C and N were analyzed at CAF and at WC by Leco Analyzer, P+S analyzed on spectrometer.

MetalTek INTERNATIONAL

**Carondelet Division**

8600 Commercial Blvd. - Pevely, MO 63070 USA
Phone: 636-479-4499 - Fax: 636-479-3399

August 16, 2005

Report on Alloy Specification Development of Contaminants Limits

MetalTek International was requested to comment on the limits set for the contaminants, specifically Sulfur and Phosphorus, in its specification recommendation to PPPL for the NCSX program. This is the result of that investigation.

In review of the data and efforts in the 2.1.2 Task (Alloy Selection) under the prototype contract, several items were of note relative to the alloy chemistry development:

1.) In the onset, Alloy#1, a less alloyed variant of 316ss, was considered; however, the concern within PPPL and MetalTek was the effects of water quenching on the alloy during solution anneal (e.g. dimensional control and residual stresses).
2.) The limits for P and S in the Alloy #1 were set to comply with standard CF8M (cast "316ss") limits of 0.04% maximum for both.
3.) In order to eliminate water quench, a second alloy was funded under the scope of the 2.1.2 Task. This alloy was successful and has been referred to as "Stellaloy."
4.) The limits for P and S in the Alloy #2 were set to comply with standard limits for CF8M, again 0.04% maximum.
5.) Heats were made for each alloy, with both P and S well below the 0.04% maximum limits; however, one heat showed P above the 0.015% ultimately recommended.
6.) Based on review of the testing, MetalTek International Research recommended a chemical composition range for the ultimate 2.1.2 task. This range incorporated restrictions on the P and S at 0.015% maximum limits. Insufficient review of this recommendation against historic chemical analyses and those reported in the task was performed, resulting in the recommendation to PPPL to use the lower limits.

In essence, insufficient review of available data outside the recommendation of the MetalTek International Research group resulted in the proposal of a specification beyond the limits of the planned production processes.

Joe Edwards/Chuck Ruud

MetalTek INTERNATIONAL

# Addendum to CA1323 8-17-05

Historical:
The proto type coil was poured on February 24, 2004. The chemistry specification at that time permitted a maximum of 0.04% for sulfur and phosphorus. The reported values for these elements were 0.01 and 0.02% respectively.

Prior to pouring the C-1 coil casting the specification was revised. MT failed to incorporate the revisions into our system. The contract review procedure did not detect the changes to the specification. Therefore normal change procedures were not implemented. This was reported in corrective action 1308 on June 13, 2005. The error was recognized when the material poured to cast C and A coil shims did not meet the revised specification.

An investigation was begun immediately to determine compliance of the C-1 and C-2 coils. It was determined that both the C-1 and C-2 met the revised chemistry, except for sulfur and phosphorus. To verify the analysis MT analyzed samples from the cast on bars taken from the coils. By this time the optical card had malfunctioned. This fact, in combination with the human error (believing that the type standard was also in the 0.002% range) led MT to believe that the sulfur and phosphorus were actually in the 0.002% range. As a result MT believed the coils to be compliant and no action was taken.

Current Activities:
Samples from A-1, C-4 and C-5 have been sent to Wisconsin Centrifugal, our parent company for independent analysis of all reported elements.

Repair to the spectrometer is scheduled for this week. In the mean time we continue our surveillance of the suspect elements during melt and chemistry analysis.

C. Ruud

CC: Jim Galaske, Barry Craig, Joe Edwards, E.J. Kubick