



United States  
Enrichment Corporation

**George P. Rifakes**  
**Executive VICE PRESIDENT, Operations**

United States  
Enrichment Corporation

2 Democracy Center  
6903 Rockledge Drive  
Bethesda, MD 20817

Tel: (301) 564-3200  
Fax: (301) 564-3201

Dir: (301) 564-3301  
Fax: (301) 571-8279

April 11, 1997

SERIAL: GDP 97-0063

U.S. Nuclear Regulatory Commission  
Attention: Document Control Desk  
Washington, D.C. 20555-0001

**Paducah Gaseous Diffusion Plant (PGDP)**  
**Docket No. 70-7001**  
**Written Notification of 10 CFR 21 Report**

The purpose of this letter is to provide Written Notification to satisfy the requirements of 10 CFR 21.21(d)(3)(ii) of a reportable defect that was discovered at the Paducah Gaseous Diffusion Plant (PGDP). This Written Notification is a follow up to the Initial Notification sent to the NRC by letter GDP 97-0036, dated March 14, 1997.

The defect is associated with the packing nuts on 1 inch valves used on UF<sub>6</sub> cylinders. The firm supplying the items is Hunt Valve Co, Inc., 1913 E. State Street, Salem, Ohio, 44460. The defect was initially discovered on January 19, 1997.

The nature of the defect was cracking of the valve packing nut. Metallurgical analysis of the cracked nuts has shown intergranular cracking to be the degradation mechanism. Packing nuts with intergranular cracks were found in cylinder valves which had been used in various stages of the enrichment process. In addition, intergranular cracking was found in the packing nuts of cylinder valves removed from new cylinders to allow internal inspection of the cylinders. The removed cylinder valves were in storage and had not been exposed to the plant process chemicals or handling practices which affect the packing nut. This indicates that the problem is probably a material or manufacturing problem with the nuts. Three valve packing nut materials are currently used: monel, ASTM B150 613 alloy, and CDA 636 alloy. An inspection of valves from other suppliers that are manufactured from all three materials indicate that the cracking problem is observed only in the 636 alloy nuts on valves supplied by Hunt Valve Co., Inc.

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PDR ADOCK 07007001  
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*Tezo*  
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Failure of the stem packing nut during plant operations to fill or empty a  $UF_6$  cylinder could allow the stem packing rings to be forcefully ejected from the valve, resulting in a  $UF_6$  release, a hazard to plant personnel, and a challenge to plant safety systems. Failure of a cylinder valve packing nut and ejection of the valve packing with an open valve on a full cylinder would constitute a failure of a  $UF_6$  confinement system, and, therefore, could create a substantial safety hazard. Cracking of the stem packing nut on closed cylinder valves does not pose a hazard since the packing gland is isolated from the  $UF_6$  cylinder contents.

The 1 inch cylinder valves are used in the 30B Portsmouth Gaseous Diffusion Plant (PORTS) cylinders and the 48X, 48Y, 48G, and 48H PGDP cylinders. The 1 inch cylinder valves are procured by PGDP for use on all of the cylinders identified above at both PGDP and PORTS. The valves are provided by PGDP to the cylinder vendors for installation on new cylinders supplied to PGDP and PORTS. The 1 inch cylinder valves are supplied by PGDP to PORTS for any replacements required on the 30B cylinders. The total number of applications is bounded by the number of valves supplied with CDA 636 packing nuts by Hunt Valve Co. The total number of valves provided was 4500. The number of valves with CDA 636 packing nuts currently in service is less than 4500 due to valves removed for cylinder inspections, repairs, replacements, etc. The exact number in service is currently unknown. The 1 inch cylinder valves are not used on any of the other cylinder designs.

The corrective action that has been taken at PGDP is to prohibit feed and withdrawal operations for cylinders equipped with 1 inch Hunt Valve Co. valves equipped with CDA 636 packing nuts. CDA 636 packing nuts are replaced with monel or ASTM B150 613 packing nuts prior to use of a valve in feed or withdrawal operations. Long Term Orders have been established in accordance with the governing procedure to ensure compliance with the prohibition. The Long Term Orders require checking of the cylinder valve prior to use to identify any Hunt valves equipped with CDA 636 packing nuts and prohibit their use. The valve body is clearly marked with the name of the manufacturer and the nut is marked with the material designator. Therefore, Hunt valves equipped with CDA 636 packing nuts can be readily identified and excluded from use.

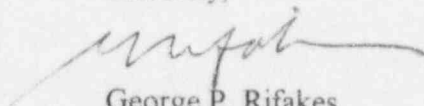
PORTS has been notified of the Hunt Valve Co packing nut defect. A PORTS Daily Operating Instruction was issued for the X-342, X-343, and X-344 facilities to implement stop work notices which require inspection of all cylinder valves prior to heating, filling, and transferring of cylinders. Any cylinder found to have a 1 inch Hunt cylinder valve with a CDA 636 packing nut installed will not be heated, filled, or transferred. Caution tags are installed on all prohibited valves, and operations may not continue until the valve packing nuts have been replaced with approved replacements (i.e., non-CDA 636 material). A procedure containing guidelines for inspection and rejection of cylinders was revised to include the requirement to immediately replace any packing nuts on Hunt cylinder valves stamped with "636", or hang a caution tag on the subject valve and reject the cylinder. Hunt cylinder valves with the CDA 636 packing nuts were removed from stock. The valves will not be put back into stock until the packing nuts are replaced with another material.

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PGDP efforts to determine the root cause of the failure mechanism are continuing. These efforts are focused on the nut fabrication methods and the raw material production. The suspect population of 1 inch cylinder valves may be narrowed to a subset of the current 4500 valves as a result of the continuing investigation. In the event that some number of the 4500 valves can be excluded from the potentially defective population, the corrective actions may be revised at that time to allow the use of Hunt Valve Co. 1 inch cylinder valves with CDA 636 packing nuts from the population excluded from being potentially defective. The prohibition on the use of valves with nuts from the suspect population for withdrawal or feed will be maintained. This corrective action is adequate to preclude a  $UF_6$  release due to the identified defect.

The associated PGDP 10 CFR 21 evaluation checklist and a copy of pertinent PGDP problem reports are enclosed. New commitments made in this letter are to continue the ongoing corrective actions described above to prohibit the use of cylinders with 1 inch Hunt Valve Co. valves with CDA 636 packing nuts at both PGDP and PORTS. Any questions related to this subject should be directed to Mark Lombard at (301) 564-3248.

Sincerely,



George P. Rifakes  
Executive Vice President, Operations

Enclosures: as stated

cc: NRC Region III Office  
NRC Resident Inspector - PGDP  
NRC Resident Inspector - PORTS  
Mr. Randall M. DeVault (DOE)

ENCLOSURES

PGDP PART 21 CHECKLIST AND RELATED PROBLEM REPORTS

## 10 CFR PART 21 EVALUATION CHECKLIST

Page 1 of 3 4/1/97

Following questions provide the criteria for evaluation of 10 CFR Part 21 reportability:

- A.1 No ☒ Yes ☐ Has the NRC already been informed of this condition pursuant to 10 CFR 21 (for example, by a supplier)?
- A.2 No ☐ Yes ☐ If yes, has USEC or LMUS been named as a recipient of the defective item?
- A.3 No ☒ Yes ☐ Has this condition already been reported to NRC in accordance with procedure UE2-MC-RE1030?

If the answer to Questions A.1 and A.2 are "Yes", or the answer to Question A.3 is "Yes", the condition need not be reported under 10 CFR 21. Attach objective evidence of notification of the NRC and complete Part #.

If the answers to Questions A.1, A.2, and A.3 are "No", continue with the evaluation.

- B.1 No ☐ Yes ☒ Is the identified condition a deviation or failure to comply associated with a basic component (including design, analysis, inspection, testing, fabrication, replacement parts, or consulting services)?

If the answer to Question B.1 is "No", the condition is not reportable under 10 CFR 21; attach basis for conclusions and proceed to Section E. If the answer to Question B.1 is "Yes", continue the evaluation.

- No ☐ Yes ☒ If the answer to Question B.1 is "Yes", has the basic component been delivered to USEC/LMUS and accepted for use in the plant or an activity (includes USEC-dedicated commercial grade items)?

If the answer to Question B.2 is "No", the condition is not reportable under 10 CFR 21; attach basis for conclusions and proceed to Section E. If the answer to Question B.2 is "Yes", condition is potentially reportable. Continue with the evaluation.

- C. Further, does the activity or basic component contain any of the following types of conditions? (Deviation means a departure from the technical requirements included in a procurement document.)

- No ☐ Yes ☒ 1) The installation, use, or operation of a basic component containing a deviation?
- No ☒ Yes ☐ 2) A condition or circumstance involving a basic component that could contribute to exceeding a safety limit as defined in the GDPs Technical Safety Requirements (TSRs)?
- No ☒ Yes ☐ 3) A failure to comply with any applicable regulation, order, or certificate issued by the NRC?

If all of the answers in this section are "No", the condition is not reportable; attach basis for conclusion and proceed to Section E. If any answers are "Yes", continue with the evaluation.

UE2-EG-GE1039, Rev. 1

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UE-141 (11-22-96)

Page 2 of 2 3

3/18/97

Could the deviation or failure to comply create a substantial safety hazard resulting in any of the following (assume the no redundant or back-up systems):

- No ☒ Yes ☐ 1) Exposure in excess of 10 CFR 20.1201 limits
- No ☒ Yes ☐ 2) Exposure of an individual in an unrestricted area to more than 0.5 rem in one calendar year (10 CFR 20.1301(c))
- No ☒ Yes ☐ 3) Release of radioactive material to an unrestricted area in excess of the limits in 10 CFR 20, Appendix B, Table 2
- No ☐ Yes ☒ 4) A deficiency which seriously compromised the ability of a UF<sub>6</sub> confinement system to perform its designated function
- No ☒ Yes ☐ 5) Other (explain) \_\_\_\_\_

If all answers in this section are "No", the condition is not reportable; complete Part E. If any answer is "Yes", condition is reportable. Continue with evaluation.

E. Evaluation results and recommendation. Recommend condition be reported?

No ☐ Yes ☒

If answer is "Yes", sign this part and continue to follow procedure UE2-EG-GE1039. Sign the evaluation checklist and forward to the Manager, NRA. If answer is "No", evaluation is complete. Sign the evaluation checklist and forward to Commitment Management for closure of Problem Report.

Attach written summary of evaluation and basis for conclusions.

SEE ATTACHED ~~PAGES 3 AND 4~~ <sup>PAGE 3</sup> 3/18/97

Investigator	<u>E. V. PRINE</u>	<u>[Signature]</u>	<u>3/18/97</u>
	Name	Signature	Date
Independent Reviewer	<u>Doyle J. WARRNER</u>	<u>[Signature]</u>	<u>3/18/97</u>
	Name	Signature	Date
NRA:	<u>Stephen Cowne</u>	<u>[Signature]</u>	<u>3/18/97</u>
	Name	Signature	Date



## 10 CFR PART 21 EVALUATION CHECKLIST

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## SUMMARY OF EVALUATION AND BASIS FOR CONCLUSIONS

The 1 inch cylinder valve used on UF<sub>6</sub> cylinders is equipped with a packing nut which retains the packing gland follower and packing rings. USEC-651, Rev 7, Uranium Hexafluoride, A Manual of Good Handling Practices, section 5.4.6, discusses past defects in 1 inch cylinder valves and the potential adverse effects. One past defect was packing nuts which have split during service. It is identified that this condition could allow the stem packing rings to be forcefully ejected from the valve, resulting in a UF<sub>6</sub> release.

Failure of a cylinder valve packing nut and ejection of the valve packing with an open valve on a full cylinder would constitute a failure of a UF<sub>6</sub> confinement system. Therefore, the cylinder valve packing nut is a basic component for which failure could create a substantial safety hazard.

The cylinder valves were procured by the Paducah Gaseous Diffusion Plant as commercial grade items and were dedicated for use on the UF<sub>6</sub> cylinders. The dedication process has been completed for any valves installed on UF<sub>6</sub> cylinders thereby establishing the applicability of 10-CFR 21 to these components.

On 1/19/97, a UF<sub>6</sub> release was detected during pigtail purging operations on a full cylinder. The release was visible as a small wisp of smoke after the pigtail was pressurized above atmospheric. The cylinder valve was closed and the release was terminated. Inspection of the valve revealed a visible crack in the valve packing nut. An investigation was initiated to determine the cause of the valve nut failure. A similar failure occurred on 2/7/97 and was included in the investigation.

The 2 failed nuts were examined metallurgically and were found to exhibit intergranular cracking. Both of these nuts are from Hunt valves and are CDA 636 material.

Valve packing nut inspections were performed as part of the investigation in order to determine the extent of the problem. Eddy current inspection techniques were used in addition to visual inspections to help identify potentially degraded valve packing nuts. As a result of the inspections additional cracked valve packing nuts were identified. The following is a summary of the additional nut inspection:

- 136 Hunt CDA 636 nuts from valves from Paducah Gaseous Diffusion Plant cylinders have been inspected by eddy current. 13 of these have exhibited cracks. One of these was on a cylinder stored in the E yard and the cracks were detected visually. Another, detected by eddy current, was on a "new" valve in storage following removal to allow inspection of a new UF<sub>6</sub> cylinder. Metallurgical analysis was performed on the "new" nut and confirmed the presence of intergranular cracks.
- 25 Hunt B150 613 nuts were eddy current tested and no eddy current indications were detected. One of these was subjected to metallurgical analysis and no cracking was detected.
- 28 Superior valve nuts of CDA 636 were eddy current tested and no indications were detected.
- 20 Hunt 636 nuts were examined from customer cylinders. 3 showed indications including 1 with a visible crack. 2 of these were metallurgically examined and the indications confirmed. Three nuts that showed no indications were examined metallurgically and only one showed very slight indications that would not be picked up by eddy current.

Three valve packing nut materials are currently used, monel, ASTM B150 613 alloy, and CDA 636 alloy. The cracking problem has been observed only in the 636 alloy nuts on valves supplied by Hunt Valve Co., Inc. The intergranular cracking has been detected in Hunt CDA 636 cylinder valve packing nuts which have been used in various stages of the enrichment process and in the packing nuts of "new" cylinder valves removed from new cylinders to allow receipt inspections. The removed valves were placed in storage and were not exposed to plant process chemicals or handling practices affecting the packing nut. This indicates that the problem is a material or manufacturing problem with the nuts. No defects or failures have been identified in nuts of CDA 636 material on other vendors valves or in nuts of alternate materials on Hunt valves.

A total of 4500 valves were supplied by Hunt Valve Co. with CDA 636 packing nuts. Investigation and analysis is continuing to determine if the entire population is susceptible to the intergranular cracking problem or if the affected population is a subset of the 4500. Until further analysis determines otherwise, it will be assumed that the entire 4500 is affected.

UC9710318

Business Prioritization System  
Problem Report Response Sheet

Page 1

ISSUE TITLE... SMOKE RELEASED FROM CYLINDER VALVE ON PP-2549  
ASSESSMENT... PROBLEM REPORTS JANUARY - DECEMBER 1997 (UC97A0001)

Response Due: / /

ISSUE ID..... UC9710318  
FINDING NO.... PR-CO-97-0289  
STATUS..... CANC  
TYPE..... PR - Problem Report  
SUB-TYPE..... NW - NotificationANALYST..... PENROD SR  
FUNC. ORG..... 12 - Operations  
GROUP..... (Unassigned)  
ORIGINATING FUNC. ORG.: 12 - Operations  
ORIGINATING GROUP..... 793 - UF6 Handling Shifts  
INITIATED BY..... 28539  
DISCOVERY DATE..... 01/19/1997 2200PRIORITY..... 0  
LOCATION.....  
BUILDING..... C-310  
MAIL STOP..... C-331

PROCEDURE/SPEC./DRAW..

## ROOT CAUSE DETERMINATION

TapRoot Code(s):

## FLAGS

## DESCRIPTION

UPGRADED TO EVENT REPORT PAD-ER-1997-001

A small wisp of smoke was released from the cylinder valve on cylinder PP-2549. PGD YE-75 over the #4 withdrawal position pigtail was actuated. The operators were in the process of evacuating/purging the pigtail on a full product cylinder. The wisp was observed after the pigtail was pressured above atmosphere. A noticeable crack circumvents the packing nut. The operators exited the area and donned additional PPE. The pigtail was purged using subatmospheric doubling purges and the cylinder valve confirmed closed. Cylinder was disconnected with no further incident and defective valve tag and caution tag was placed on the cylinder. HP and uranium samples were pulled with negative results. The ARP was followed and the PSS notified.

## ACTIONS TAKEN

NONE

## RECOMMENDED ACTIONS

Replace cylinder valve on PP-2549. Analyze failure of valve cap

## PSS JUSTIFICATION/COMMENTS

Urine samples were obtained. UF6 detection safety system was actuated and operated as designed. 24 hour event report PAD-1997-002 issued. Criteria met Appendix E 1(a) unusual and Appendix F, J (2) 24 hour. Small wisp released from cracked packing nut when pigtail pressured up. HP smears were negative. This PR should be evaluated for 10CFR21 reportability.

## REMARKS

## MANAGEMENT RESPONSE



UC9710699

Business Prioritization System  
Problem Report Response Sheet

Page 1

ISSUE TITLE... C-310 RELEASE FROM CYLINDER VALVE PK-591  
ASSESSMENT... PROBLEM REPORTS JANUARY - DECEMBER 1997 [UC97AD001]

Response Due: 04/04/1997

ISSUE ID... UC9710699  
FINDING NO... PR-CO-97-0640  
STATUS... PART  
TYPE... PR - Problem Report  
SUB-TYPE... [Unassigned]MANAGER... PERROD SR  
FUNC. ORG... 12 - Operations  
GROUP... 070 - Operations ManagementPRIORITY... 0  
LOCATION...  
BUILDING... C-310  
MAIL STOP... C-331ORIGINATING FUNC. ORG... 12 - Operations  
ORIGINATING GROUP... 793 - UP6 Handling Shifts  
INITIATED BY... 13945  
DISCOVERY DATE... 02/07/1997 0827

PROCEDURE/SPEC./DRAW... CP4-CO-CN2010 Rev. 0

## ROOT CAUSE DETERMINATION

TapRoot Code(s):

## PLACE

		CAQ			
--	--	-----	--	--	--

## DESCRIPTION

A small wisp of smoke was released from the cylinder valve on cylinder PK-591 during purging operations. This activated POLD Y8-73 in the #3 withdrawal position ventilation duct. The wisp was observed after the pigtail was pressurized above atmosphere. A noticeable crack circumvents the packing nut.

## ACTIONS TAKEN

Operations immediately exited the area. Alarm was responded to per procedure. HF samples and wipes were negative. The pigtail was purged using subatmospheric doubling purges. Cylinder was disconnected with no further incident.

## RECOMMENDED ACTIONS

Replace cylinder valve packing nut on PK-591. Investigate failure of packing nut.

## PSS JUSTIFICATION/COMMENTS

24 Hour Event Report per US2-MC-RE1030, Appendix E criteria 1. J. unusual (e), and Appendix F criteria J. 3. Appropriate response was made. HF and HP surveys were negative. Precautionary urine samples were obtained from the two workers who were present.

## REMARKS

03/06/97: Per PREC, assign to Operations for disposition. This PR will be closed to PR-CO-97-0640 which is a SCAQ.  
03/05/97: DOE reportable events due to DOE on/after 03/03/97 (date HRC assumed regulatory oversight) have been downgraded to problem reports. PR-CO-97-0640 has been placed back in PART status and will be taken back to the Screening Committee for SCAQ determination, action plan due date, etc. Event Report PAD-ER-1997-004D (UC9710610) has been cancelled.

## MANAGEMENT RESPONSE

UC9711002

Business Prioritization System  
Problem Report Response Sheet  
"31" PROBLEM REPORTS

Page:1

ISSUE TITLE... PACKING NUT ON CYLINDER PP-2520 IN E YARD CRACKED  
ASSESSMENT... PROBLEM REPORTS JANUARY - DECEMBER 1997 (UC97A0001)

Response Due: 03/20/1997

ISSUE ID... UC9711002  
FINDING NO... PR-SU-97-08588  
STATUS... PART  
TYPE... PR - Problem Report  
SUB-TYPE... (Unassigned)MANAGER... BROWN JM  
FUNC. ORG... 31 - Engineering  
GROUP... 814 - Mechanical & ProcessPRIORITY... 2  
LOCATION...  
BUILDING... C-745-E  
MAIL STOP... C-710ORIGINATING FUNC. ORG... 38 - Production Support  
ORIGINATING GROUP... 340 - Process Technical & NDA  
INITIATED BY... 32454  
DISCOVERY DATE... 02/18/1997 1445

PROCEDURE/SPEC./DRAW...

## ROOT CAUSE DETERMINATION

TapRoot Code(s):

## FLAGS

CAO

## DESCRIPTION

The packing nut on cylinder PP-2520 in the E yard was found cracked around the circumference (at approximately the top thread) through approximately 80% of the section. This is a "Munt" valve alloy "6-36" nut. (Lot #390795-8). This packing nut failure was found while inspecting Paducah Plant cylinders with an eddy current probe for indications of cracked nuts, but was clearly visible with crack opening of approximately 1/8". The cylinder appeared to be empty.

## ACTIONS TAKEN

NONE

## RECOMMENDED ACTIONS

NONE

## P's JUSTIFICATION/COMMENTS

Found during a random sampling of Munt valves with the "6-36" packing nut. No sign of any leakage. 10 ton cylinder. Per NMCA records, is an empty cylinder with notation requiring a valve change. This should be evaluated for 10 CFR 21 and 71.95 applicability.

## REMARKS

02/20/97: Part A is assigned to Operations and Management response provided at PRSC. No further action required. Part B is assigned to Engineering to evaluate for 10 CFR applicability.

## MANAGEMENT RESPONSE

Name of person providing response:

FUEL CYCLE FACILITY

EVENT NUMBER: 31954

FACILITY: PADUCAH GASEOUS DIFFUSION PLANT  
RXTYPE: URANIUM ENRICHMENT FACILITY  
COMMENTS: 2 DEMOCRACY CENTER  
6903 ROCKLEDGE DRIVE  
BETHESDA, MD 20817 (301)564-3200  
CITY: PADUCAH REGION: 3  
COUNTY: McCRACKEN STATE: KY  
LICENSE#: GDP-1 AGREEMENT: Y  
DOCKET: 0707001

NOTIFICATION DATE: 03/14/97  
NOTIFICATION TIME: 13:30 [ET]  
EVENT DATE: 03/14/97  
EVENT TIME: 00:00 [CST]  
LAST UPDATE DATE: 04/11/97

NOTIFICATIONS

WAYNE KROPP	RDO
JOSEPHINE PICCONE	EO
KEVIN RAMSEY (FAX)	NMSS

NRC NOTIFIED BY: MARK LOMBARD  
HQ OPS OFFICER: STEVE SANDIN

EMERGENCY CLASS: NOT APPLICABLE  
10 CFR SECTION:  
CDEG 21.21(c)(3)(i) DEFECTS/NONCOMPLIANCE

EVENT TEXT

10 CFR PART 21 NOTIFICATION REGARDING STRESS CORROSION CRACKING OF CYLINDER VALVE PACKING NUTS

IT HAS BEEN DETERMINED THAT STRESS CORROSION CRACKING OF THE 1-INCH CYLINDER VALVE PACKING NUTS USED IN VARIOUS STAGES OF THE ENRICHMENT PROCESS HAS, IN ONE CASE, RESULTED IN A REPORTABLE RELEASE OF UF<sub>6</sub>. THIS PROBLEM HAS ONLY BEEN OBSERVED IN THE 636-ALLOY NUTS ON VALVES SUPPLIED BY HUNT VALVE CO., INC.

\* \* \* UPDATE 1740EDT 4/11/97 FROM MARK LOMBARD TO S. SANDIN \* \* \*

THE LICENSEE SUBMITTED AN UPDATE VIA FAX. NOTIFIED R3DO(MADERA) AND FORWARDED TO NMSS(RAMSEY).

# UNITED STATES ENRICHMENT CORPORATION

Two Democracy Center • 4th Floor • 6903 Rockledge Drive • Bethesda, MD 20817

## *Fax Memorandum*

DATE: April 11, 1997

TIME: 5:39 pm

TO: NRC Operations Center

FAX:

PHONE:

FROM: Mark Lombard

FAX: 301 564 3210

PHONE: 301 564 3248

NUMBER OF PAGES (including cover sheet): 40 //

SUBJECT: Part 21 written report attached. for concurrence. Please call me if you have any questions. The hard copy will follow by mail.