BALTIMORE GAS AND ELECTRIC COMPANY
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ARTHUR E. LUNDVALL, JR.
VICE PRESIDENT
SUPPLY

March 18, 1980

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attn: Mr. D. G. Eisenhut
Acting Director
Division of Operating Reactors

Subject: Calvert Cliffs Nuclear Power Plant
Unit No. 2, Docket No. 50-318
Westinghouse Low Pressure Turbine Disc Inspection

Reference: NRC letter dated 2/25/80 from D. G. Eisenhut
to A. E. Lundvall, Jr., same subject.

Gentlemen:

The referenced letter informed us of an increased probability of crack formation in the low pressure turbine discs of Westinghouse-supplied turbines. We were requested to supply, pursuant to 10 CFR 50.54 (f), justification for continued operation of Calvert Cliffs Unit No. 2, pending a full ultrasonic inspection of the LP rotor discs, including certain plant-specific information and generic information. In subsequent discussions with NRC Staff, we were informed that our generic information submittal may be deferred until March 24, 1980 and the remaining information until March 19, 1980.

Attachment 1 to this letter provides the justification for continued operation of Calvert Cliffs Unit No. 2. Attachment 2 contains our responses to the Site Specific General Questions found in Enclosure 2 to th[illegible] referenced letter. The format for the responses is the same as that for the questions. The response to Question I.D contains Westinghouse-Proprietary information. Accordingly, the proprietary portion of that response is presented separately in Attachment 3. Attachment 4 (20 copies) is the non-proprietary version of Attachment 3.

Our responses to the Generic Questions found in Enclosure 2 to the referenced letter will be provided by March 24, 1980 as discussed above. At that time we will also forward a signed affidavit executed by Westinghouse Electric Corporation in support of the following request for proprietary treatment.

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Pursuant to the provisions of 10 CFR Part 2.790 it is requested that the information contained in Attachment 3 to this letter be treated as proprietary information and be withheld from public disclosure.

BALTIMORE GAS AND ELECTRIC COMPANY

BY: ______________________
A. E. Lundvall, Jr.
Vice President - Supply

STATE OF MARYLAND:
TO WIT:
CITY OF BALTIMORE:

A. E. Lundvall, Jr. being duly sworn states that he is Vice President of the Baltimore Gas and Electric Company, a corporation of the State of Maryland, that he executed the foregoing Response for the purposes therein set forth, that the statements made in said Response are true and correct to the best of his knowledge, information and belief: and that he was authorized to execute the Response on behalf of said corporation.

WITNESS My Hand and Notarial Seal:

____

My Commission Expires:

____

Attachments (4)

cc: J. A. Biddison, Esquire
G. F. Trowbridge, Esquire
Mr. E. L. Conner, Jr. - NRC

ATTACHMENT 1

The analysis of turbine-generated missiles during a destructive overspeed incident is detailed in Section 14.8 of the FSAR, a copy of which is included in this Attachment. Several assumptions were made concerning missile characteristics. After careful consideration of the recent information from the turbine manufacturer concerning cracking, we have determined that the adequacy of protection of vital areas from such missiles has not been compromised in any way. A summary of our determination follows.

I. Missile Energy

1. From the Westinghouse "Report Covering the Effects of a Turbine Accelerating to Destructive Overspeed" it is shown that if the turbine were to accelerate to 189% of its normal operating speed, destruction of disc #2 will occur and not allow further acceleration.

2. The assumption is then made that all discs burst at this 189% of rated speed.

3. Disc number 6 is postulated to have the highest exit energy of any missile which will penetra e the turbine casing under the conditions assumed.

4. The energies of the missile during this incident under the assumed conditions are:

   a. Prior to impact with casing: 17.0×10^6 ft-lb.

   b. Following penetration of the casing: 9.0×10^6 ft-lb.

II. Penetration of the Missile Into the Protective Barrier

1. Low Trajectory Missiles

   In the results outlined in table 14.8.2 of the FSAR two cases are calculated and their effects shown. The first, Case I, utilizes the postulated exit energy from the turbine and the second, Case II, uses the postulated energy of the fragment before its impact with the turbine casing and assumes no energy loss during the penetration of the casing. It is clearly shown that even with these extremely conservative assumptions, the barrier is not penetrated.

2. High Trajectory Missiles

   The same assumptions are made as in 1 above and the results are shown in table 14.8.2 to indicate penetration of the barrier under the least conservative conditions.

Conclusions

Using the most conservative assumptions it is apparent that the turbine fragments will not penetrate the protective barrier during the 189% overspeed failure. The current concern involves damage incurred during a 120% overspeed condition with attendant fragment ejection. The energy of these fragments will clearly be significantly below that calculated for the 189% overspeed condition and thus will be incapable of penetrating the protective barrier and will present no hazard to the protected vital areas.

For the above reasons, postulated failure of a low pressure turbine disc as a result of disc or keyway cracking does not reduce overall nuclear safety in the plant and, thus, does not result in any increased risk to the public health and safety. Consequently, we have concluded that continued unrestricted operation of Calvert Cliffs Unit No. 2 is justified until such time as a ultrasonic inspection of the discs is performed.

14.8 TURBINE-GENERATOR OVERSPEED INCIDENT

14.8.1 GENERAL

The purpose of this section is to evaluate the potential damage which would result from a structural failure or malfunction of the redundant control system resulting in missile like pieces leaving the turbine casing. The manufacturers of both units have conservatively designed the turbine-generators to eliminate any stress concentration points which could give rise to crack propagation. Manufacturing and inspection techniques for turbine rotor and disc forgings make the possibility of an undetected flaw extremely remote. Nevertheless, both turbine-generator manufacturers have conducted tests to determine the effects of a turbine control system failure resulting in a turbine runaway. The consequences of this occurrence and the protection afforded vital plant compartments and equipment areas are analyzed in this section.

14.8.2 TURBINE STEAM FLOW

The turbines for Units No. 1 and 2 are essentially the same. They are 1800 rpm, two stage reheat, tandem compound, six flow exhaust machines with a last row blade of 38 and 40 inches, respectively. The turbines are designed for 815 psia saturated steam inlet pressure and 2.0 inches Hg absolute exhaust pressure. There are six stages of feedwater heaters.

Dry saturated steam from the two steam generators enters the high pressure turbine through four sets of stop-throttle and control valves. The steam expands in the high pressure turbine and then flows to the moisture separator reheat units. After the moisture separator reheat unit, the steam flows through either combined intermediate valves (Unit 1) or reheat stop and intercept valves (Unit 2), to the low pressure turbine where the steam expands and then exhausts to the condenser.

A bypass system is provided in order to allow excess steam generator energy to be bypassed into the condenser whenever the turbine cannot accept all of the generated steam, e.g., during startup or a sudden change in load. Positive closing nonreturn valves are provided in all extraction lines, except those located in the condenser neck, to limit flow of stored energy (which could cause the turbine to overspeed) from the heaters to the turbine on a turbine trip. These valves are actuated by the Electro-Hydraulic Control Trip System.

14.8.3 TURBINE-GENERATOR GOVERNING DEVICES

Both units have an Electro-Hydraulic Control System. The Unit 1 turbine-generator (1) uses only electro-hydraulic control (EHC) fluid for all turbine tripping functions. The Unit 2 turbine-generator uses the high pressure bearing lubrication oil for its overspeed trip valve and EHC fluid for all other valves. Both units are equipped with the following steam valves:

1. Stop-throttle valves
2. Control valves
3. Combined intermediate valves for Unit 1;
   Reheat stop and intercept valves for Unit 2

The speed governor will start to close the control, combined intermediate (Unit No. 1) or reheat stop and intercept valves (Unit No. 2) at 101 percent of rated speed. At 110 percent of rated speed the mechanical overspeed trip will operate and close all steam valves. The backup overspeed trip system will actuate the master trip solenoid valve at 112 percent of rated speed. Two independent speed signals are used permitting speed control with either one of the signals incapacitated.

14.8.4 METHOD OF ANALYSIS 10

14.8.4.1 General

Despite the unlikelihood of a turbine runaway to destructive overspeed, the following conditions have been analyzed to arrive at a conservative estimate of the missile penetration ability and to evaluate the potential damage which would result.

14.8.4.2 Unit No. 1 Analysis

The General Electric Company, manufacturer of the Calvert Cliffs Unit 1 turbine-generator, determined their most severe turbine missile by assuming the instantaneous loss of load from a full load operating condition[2,3]. In addition, it was postulated that the normal speed governing system and independent overspeed governing system fail to close the emergency stop valves. The turbine can then accelerate to from 150 to 170 percent of rated speed before severe generator damage due to thrown windings and probable retaining ring failure will decelerate the turbine. The last stage low pressure turbine wheel is postulated to fail when the turbine reaches 169 percent of rated speed, resulting in three 120 degree disc fragments. These fragments were determined to be the most dangerous of those which could be formed. High pressure turbine rotors are not expected to fail at destructive overspeed, but even if failure did occur, the fragments should be retained by the heavy section, bolted high pressure shells. Generator field and retaining ring parts are expected to be retained by the generator housing, which, by its construction, is an ideal energy absorber.

14.8.4.3 Unit No. 2 Analysis

The Westinghouse Electric Corporation, manufacturer of the Calvert Cliffs Unit 2 Turbine-Generator, determined their most serious turbine missile by assuming both the stop-throttle and control valves fail to close following the opening of the main generator circuit breaker at full load [4]. Proven control system reliability and equipment redundancy makes such a turbine runaway highly improbable.

The criterion used is that the disc will fail when the average tangential stress equals the maximum specified yield strength of the disc material. Disc No. 2 on the low pressure element is the most highly stressed disc with a calculated failure speed of 189 percent of rated speed. Upon failure the disc fragments will damage the turbine to the extent that additional overspeed will not be possible. For the purpose of the analysis which was performed, all other discs were assumed to fail at 189 percent of rated speed.

Due to the very large margin between the high pressure spindle bursting speed of 270 percent of rated speed and the maximum speed that the unit may run, i.e., 189 percent, the probability of spindle failure is practically zero. Therefore, no missiles from the high pressure section will develop during turbine runaway. Generator field and retaining ring parts are expected to be retained by the generator housing, which, by its construction, is an ideal energy absorber.

Calculations by Westinghouse considered fractures of discs into 90, 120, and 180 degree segments. It was determined that the 90 degree segment posed the most severe missile threat.

14.8.4.4 Missile Characteristics

The worst missile characteristics (3,4) which will penetrate the turbine casings for both Units No. 1 and 2 are presented in Table 14.8-1.

TABLE 14.8-1

TURBINE MISSILE CHARACTERISTICS

	Unit 1	Unit 2
Length of bucket (in.)	38	40
Arc (degrees)	120	90
Weight (lb)	5944	2431
Initial Translation Velocity (ft/sec)	666.8	671
Initial Translation Kinetic Energy (10^6ft-lb)	41	17.0
Exit Velocity (ft/sec)	480	488
Exit Energy (10^6ft-lb)	20.5	9
Minimum Impact Area (ft^2)	3.66	2.2
Maximum Impact Area (ft^2)	8.4	3.3

14.8.4.5 Penetration Ability of a Turbine Missile

Penetration Formulas

As indicated by Amirikian (4), the Petry formula is most suitable for determining missile penetration into an infinite slab:

$$D_i = KA_p \left[\log_{10} \left(1 + \frac{V^2}{215,000}\right) \right],$$

Where: D_i = penetration depth into an infinitely thick slab (ft),

A_p = sectional pressure = missile weight/representative sectional area (lbs/ft^2),

V = striking velocity (ft/sec),

K = experimentally obtained material coefficient for penetration (ft^3/lb).

The following formula, which is related to the one above, can be used to determine missile penetration into a finite slab:

$$D_f = D_i \left\{ 1 + e^{-4\left[(T/D)-2\right]} \right\},$$

Where:

D_i = penetration depth into an infinitely thick slab (ft)

D_f = penetration depth into a finite slab (ft)

T = slab thickness (ft)

For the case where $D_i = T/2$, the above formula can be stated as follows:

$$D_c = KA_p \log_{10}\left[\left(1 + \frac{V^2}{215,000}\right)\right],$$

Where: D_c can be interpreted as a conservative estimate of the penetration depth. The exponential relationship is not valid for $D_i < T/2$. In this study, missile penetration depths were calculated on the basis of D_c.

As indicated by Zwicky[(3)], the effect of air drag on missile velocity can be determined by using the following formula:

$$V^2 = \frac{V_i^2}{1 + \frac{BV_i^2}{g}},$$

Where:

V = striking velocity (ft/sec),

V_i = initial velocity (ft/sec),

g = acceleration of gravity (ft/sec^2), and

B = sACd/2W (ft),

Where:

s = air density (lbs/ft^3)

A = representative sectional area (ft^2)

Cd = drag coefficient (dimentionless), and

W = missile weight (lbs).

The translational velocity on impact was estimated for the low trajectory missile (LTM) and the high trajectory missile (HTM). In the case of the LTM, air drag was neglected while full credit was taken for air drag in computing the striking velocity of the HTM.

The air density, s, was taken as 0.0809 lbs/ft^3, which is the air density at STP.

The drag coefficient, Cd, was taken as 1.0, which is a representative valve for an irregularly shaped object.

After penetrating the casing, the missile can be expected to be deformed. Thus, the body will be aerodynamically unstable and tumble erratically as it passes through the air. Because of this expected erratic motion, the sectional area was computed as the average of the maximum and minimum areas (in a plane perpendicular to the shaft axis). These areas are given in Table 14.8-1.

In this study, the value of K for the auxiliary building missile barrier at elevation 69'-0" was chosen to be 0.00476 ft^3/lb corresponding to 3000 psi compressive strength [5] and a value of 0.0023 ft^3/lb (5000 psi compressive strength) was used for the containment structure and missile barrier protecting the spent fuel pool [5].

14.8.4.6 Results

A 2'-6" thick concrete missile barrier located at elevation 69'-0" protects the control room, switch gear room, and waste processing area from a high trajectory missile (see Figures 1-8, 1-12, and 1-16). A 2'-0" thick concrete missile barrier positioned at elevation 118'-0" protects the spent fuel pool from a high trajectory missile.

Protection against a low trajectory missile is provided by a 3'-0" thick concrete wall located between the turbine building and the auxiliary building (see Figure 1-16).

The missile penetration depths for the above barriers are given in Table 14.8-2 for two cases; Case I, in which half of the initial kinetic energy of the potential missile was assumed to be available for penetration, and Case II (conservative) wherein it was assumed that no loss of kinetic energy occurred upon penetration of the turbine casing. The containment structure, its dome and cylinder, provide adequate protection against turbine missiles. (See Section 5.1.3.2.h.)

TABLE 14.8-2

TURBINE MISSILE PENETRATION DEPTHS

	Depth of Penetration (inches)			
	Unit No. 1		Unit No. 2	
Protection from H.T.M.	Case I	Case II	Case I	Case II
Control Room, Switchgear Room & Waste Processing Area	17.00	23.0	7.60	10.88
Spent Fuel Pool	10.44	15.48	7.48	10.88
Protection from L.T.M.				
Wall between Auxiliary and Turbine Building	20.46	32.47	19.44	29.16

14.8.5 CONCLUSION

Based on the above results it is concluded that the Calvert Cliffs Nuclear Plant Units No. 1 and 2 are adequately protected against turbine missiles.

14.8.6 REFERENCES

(1) General Electric Co., Description of Control Mechanism for Calvert Cliffs Station, January 1969.

(2) General Electric Report, Failure of Rotating Elements of Steam Turbines and Generators, March 29, 1968.

(3) Zwicky, E. E., An Analysis of Turbine Missiles Resulting from Last-Stage Wheel Failure, General Electric, Schenectady, New York, TR675L211; October 3, 1967.

(4) Westinghouse Report Covering the Effects of a Turbine Accelerating to Destructive Overspeed.

(5) Amirikian, H., Design of Protective Structures, Bureau of Yards and Docks, Department of the Navy, Washington, D. C., NavDocks P-51, August 1950.

ANSWERS TO QUESTIONS RELATED TO CALVERT CLIFFS U-2 TURBINE DISCS

SITE SPECIFIC GENERAL

I. A. Subject unit is a tandem-compound sextuple flow, 1800 rpm steam turbine-generator rated nominally at 878 Mw. utilizing 40 inch last row blades. The LP element is designated as a Building Block 80.

B. Each LP turbine has 23,253 hours of parallel operation as of March 4, 1980. Projected hours of additional parallel operation until 1-1-81 planned inspection equals 6110 hours. Total time of operation until inspection equals 29,363 hours.

C. This unit has been subjected to three (3) intentional over-speed trip tests and no un-intentional over-speeds.

D. See Attachment 3.
Notes for items 1 to 11.

1. Type of material is Ni-Cr-Mo-V alloy steel similar to ASTM A-471.

2. Tensile properties data of tests taken from the disc hub are given in Section B. Data obtained from rim material are presented in Section C.

3. Toughness properties are also presented in Sections B and C. As described above, Section B contains hub properties and Section C contains rim properties. Upper shelf energy is not presented when it is the same as the room temperature energy.

4. The keyway temperature is presented in Section G. This is the calculated temperature two inches from the exhaust face of the disc at the bore during full load operation with all moisture separator reheaters functioning (where applicable).

5. The maximum expected keyway crack size has been calculated and is included in Section G. This is done by multiplying the crack growth rate by the time the unit was in operation prior to the disc bore/keyway inspection. For units not yet inspected, the time used should be the expected operating time when the unit will be inspected.

6. The critical crack size at 1800 rpm and at design overspeed is presented in Section F.

7. This is the ratio of Item 5 to Item 6. It has been calculated and included in Section G.

8. The crack growth rate is given in Section G. These crack growth rates are the maximum expected rates based upon known cracks to date. Westinghouse has changed the basis for determining these rates to utilize the NRC gray book operating hours. It is believed this agrees with the way the NRC staff determines crack growth rates. The crack growth rate of the number six disc and number one disc of BB 80 turbines is assumed to be zero since these discs operate dry under normal conditions.

9. The bore tangential stress at 1800 rpm and at design overspeed are presented in Section E. The values presented include the stresses due to shrink fit and centrifugal force loads only. Additional analyses to include thermal stresses and pressure stresses are being made, but are not presently available.

10. The fracture toughness, K_{IC}, of each disc is calculated from the Charpy v-notch and tensile data. The values, presented in Sections B and C, are calculated at the upper shelf temperature or room temperature, whichever gives the lower result.

11. The minimum yield strength specified for each disc is presented in Section B.

II. As of this writing none of the three (3) LP rotors have recieved either disc bore or disc keyway inspections (other than during manufacturing).

III. The following parameters and values represent the nominal water chemistry of Calvert Cliffs U-2 and are considered representative of the LP turbine environment.

PARAMETER	NOMINAL VALUE
1. Sodium (Na^+)	1 ppb
2. pH ($-\log(H_3O^+)$)	8.5-9.0
3. Cation Conductivity	(.10-.15) μmhos/cm
4. Specific Conductivity	(2.0-2.5) μmhos/cm
5. Silica	10 ppb
6. Chloride	10 ppb

Significant changes in secondary water chemistry are subject to control as described below in "Table of Operational Steam Generator Chemistry". Deviations in normal values are promptly examined/evaluated so that necessary corrective action can be taken to preclude significant disturbances to the LP turbine chemical environment.

TABLE OF OPERATIONAL STEAM GENERATOR CHEMISTRY

	ANALYSIS PROCEDURES/METHOD	NORMAL SPECIFICATION (2)	ABNORMAL LIMITS (3)	FREQUENCY (1)
1.	Specific Conductivity/901 (μmhos/cm. max)	4	15	1/24 hrs.

	ANALYSIS PROCEDURES/METHOD	NORMAL SPECIFICATION (2)	ABNORMAL LIMITS (3)	FREQUENCY (1)
2.	pH @ 25° C/902	8.2 - 9.2	7.5 - 8.2(4) 9.2 - 9.5	1/24 hrs.
3.	Sodium/908 (ppm, max)	0.1	-	7/W
4.	Suspended Solids/911 (ppm, max)	1.0	10.0	2/W
5.	SiO_2/916 (ppm, max)	1.0	10	1/W
6.	Cl/906 (ppm, max)	0.1	-	7/W

N.S = Not Specified

(1) Frequency noted is minimum. These may be adjusted upward if conditions warrant. If normal specs are exceeded, the out of spec parameter(s) must be analyzed at least daily. If abnormal limits are exceeded, the out-of-spec parameter(s) must be analyzed at least once per shift. If blowdown is secured, a grab sample must be drawn and analyzed for spec. cond. and pH at least 1/24 hours.

(2) Normal specifications are those which should be maintained during proper operation of secondary systems.

(3) Abnormal limits indicate a fault condition exists and plant shutdown should be commenced if abnormal limits are exceeded for four (4) hours.

(4) The unit should be immediately shut down when pH exceeds 10.5.

"UK Experience of Stress Corosion Cracking in Steam Turbine Discs"; J. M. Hodge; IL Mooford, I Mech E 1979. This paper concludes there appears to be no presently known correlation between disc cracking and secondary water chemistry.

IV. It is our intention to inspect all three (3) LP rotors during the planned re-fueling outage commencing on or about January 1, 1981. Plans are currently being drawn which include both keyway and disc bore inspections as per Westinghouse recommendation. Inspection is subject to availability of qualified inspection teams of Westinghouse personnel.

V. Not Applicable.

VI. Please refer to Attachment 1.

ID # : 0080103901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK #C
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GOV
6. DISC# 1
7. TEST NO. TN1513

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] TB
(MIN. Y.S. (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]
[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes. b,c,e,

[ ]b,c,e,

2 OF 36

ID # : 0080100901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK# BC
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GOV
6. DISC# 2
7. TEST NO. TN1568

B. MATERIAL PROPERTIES (HUB)
1. TYPE TB
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT (FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT (FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

C [ ] MN [ ] SI [ ] P [ ] CR [ ] MO [ ] V [ ]
NI [ ] AS [ ] SB [ ] SN [ ] AL [ ] CU [ ] S [ ]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 0C80100901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK FC
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GOV
6. DISC# 3
7. TEST NO. TK1515

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] (KSI)) TB
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

C [ ] MN [ ] SI [ ] P [ ] CR [ ] MO [ ]

NI [ ] AS [ ] [ ] SN [ ] AL [ ] CU [ ] S [ ]

E. BORE STRESS

SPEED (RPM) STRESS

1. 1800 (KSI)
2. 2160 (120%) (KSI)

[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DT/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 0080100901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK — EC
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 1
5. LOCATION — GOV
6. DISC# — 4
7. TEST NO. — TN1579

B. MATERIAL PROPERTIES (HUB)
1. TYPE — T6
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: — MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

C [ ] MN [ ] SI [ ] P [ ] CR [ ] MO [ ] [ ]

NI [ ] AS [ ] SB [ ] SN [ ] AL [ ] CU [ ] S [ ]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes a, b,c,e

[ ] b,c,e

ID # : 0080IC0901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 5C
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GOV
6. DISC# 5
7. TEST NO. TN1511

B. MATERIAL PROPERTIES (HUB)
1. TYPE TB
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e,

[ ]b,c,e,

ID # : 0080100901

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK — 5C
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 1
5. LOCATION — GOV
6. DISC# — 6
7. TEST NO. — TN1513

B. MATERIAL PROPERTIES (HUB) — TC
1. TYPE (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: — BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ]b,c,e,

ID # : DD80100902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK# BC
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GEN
6. DISC# 1
7. TEST NO. TN1507

B. MATERIAL PROPERTIES (HUB)
1. TYPE T3
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT-LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e,

[ ]b,c,e,

ID # : DPBUI00902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK -G
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GEN
6. DISC# 2
7. TEST NO. TN1506

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] (KSI)) T2
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C]	[MN]	[SI]	[P]	[CR]	[MO]	[V]
[NI]	[AS]	[SB]	[SN]	[AL]	[CU]	[S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (12%?)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

Ⓦ All Bracketed Data Subject to Proprietary Codes, b,c,e,

[ ]b,c,e,

ID # : DG80100902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK [illegible]
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GEN
6. DISC# 3
7. TEST NO. TN1509

B. MATERIAL PROPERTIES (HUB)

1. TYPE TB
   (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to [illegible]

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ]b,c,e

ID # : D080100902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK FD
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GEN
6. DISC# 4
7. TEST NO. TN1510

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] TB
(MIN. Y.S. (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to
(W) Proprietary Codes, b,c,e
[ ] b,c,e

ID # : 0080100902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK — PG
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 1
5. LOCATION — GEN
6. DISC# — 5
7. TEST NO. — TN151b

B. MATERIAL PROPERTIES (HUB)

1. TYPE [ ] TB
   (MIN. Y.S. (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [L]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

Data for this disc will be
supplied by Westinghouse
at a later date.

ID # : 0080100902

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK   FO
2. UNIT   CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP#   1
5. LOCATION   GEN
6. DISC#   6
7. TEST NO.   TN1900

B. MATERIAL PROPERTIES (HUB)
1. TYPE
   (MIN. Y.S. [ ] (KSI))
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP.
   (DEG.F)
10. U.S. IMPACT ENG.
   (FT.LB.)
11. U.S. KIC
   (KSI*SQRT(IN.))

[.00]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP.
   (DEG.F)
8. U.S. IMPACT ENG.
   (FT.LB.)
9. U.S. KIC
   (KSI*SQRT(IN.))

[.00]

D. CHEMISTRY

C	MN	SI	P	CR	MO	V
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
NI	**AS**	**SB**	**SN**	**AL**	**CU**	**S**
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI) [ ]
2. 2160 (120%)	(KSI) [ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.) [ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F) [ ]
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size. [ ]

All Bracketed Data Subject to
(W) Proprietary Codes, b,c,e,

[ ] b,c,e,

ID # : 0080100903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK — BG
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 2
5. LOCATION — GOV
6. DISC# — 1
7. TEST NO. — T.1524

B. MATERIAL PROPERTIES (HUB)

1. TYPE — [ ] (KSI) — TB
   (MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e,

ID # : 0080100903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 6C
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 2
5. LOCATION GOV
6. DISC# 2
7. TEST NO. TN1525

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] (KSI) T3
(MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY
[C] [MN] [SI] [P] [CR] [MO] [V]
[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inpsection time.
4. Ratio of calculated crack to critical crack size.
[ ]

(W) All Bracketed Data Subject to Proprietary Codes, b,c,e,
[ ] b,c,e,

ID # : 0080100903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GOV
6. DISC# [illegible]
7. TEST NO. TN1526

B. MATERIAL PROPERTIES (HUB) TE

1. TYPE (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROP[illegible] (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [ ]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

(W) All Bracketed Data Subject to Proprietary Codes, b,c,e,

[ ] b,c,e,

ID # : 0C80100903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 8C
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GOV
6. DISC# 4
7. TEST NO. TN1527

B. MATERIAL PROPERTIES (HUB) T3
1. TYPE [ ] (KSI)
(MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C]	[MN]	[SI]	[P]	[CR]	[MO]	[ ]
[ ]				[AL]	[CU]	[S]
[NI]	[AS]	[SB]	[SN]			

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

(W) All Bracketed Data Subject to Proprietary Codes, b,c,e,
[ ] b,c,e,

ID # : D0801C0903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GOV
6. DISC# 5
7. TEST NO. TK1528

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] TE
(MIN. Y.S. (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : D0801C0903

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK# ‑C
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GOV
6. DISC# 6
7. TEST NO. TA1529

B. MATERIAL PROPERTIES (HUB) TA
1. TYPE
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [ ]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to (a)Proprietary Codes, b,c,e

[ ]b,c,e

ID # : 008010030*

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 2
5. LOCATION GEN
6. DISC# 1
7. TEST NO. TN1516

B. MATERIAL PROPERTIES (HUB)
1. TYPE TB
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY
[C] [MN] [SI] [P] [CR] [MO] [V]
[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS
SPEED (RPM) STRESS
1. 1800 (KSI)
2. 2160 (120%) (KSI)
[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to
Proprietary Codes, b,c,e
b,c,e

ID # : D080100904

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK #0
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 2
5. LOCATION GEN
6. DISC# 2
7. TEST NO. TN1519

B. MATERIAL PROPERTIES (HUB)
1. TYPE T2
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

C [ ]	MN [ ]	SI [ ]	P [ ]	CR [ ]	MO [ ]	V
NI [ ]	AS [ ]	[ ]	SN [ ]	AL [ ]	CU [ ]	S [ ]

E. BORE STRESS
SPEED (RPM) STRESS
1. 1800 (KSI) [ ]
2. 2160 (120%) (KSI)

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e
b,c,e

ID # : 0080120904

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK — 42
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 2
5. LOCATION — GEN
6. DISC# — 3
7. TEST NO. — TN1520

B. MATERIAL PROPERTIES (HUB)

1. TYPE — T3
   (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPE- [illegible] (M)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.) [ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 0080100904

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK# 3
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GEN
6. DISC# 4
7. TEST NO. TN1573

B. MATERIAL PROPERTIES (HUB) 13
1. TYPE
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY
[C] [MN] [SI] [P] [CR] [MO] [V]
[NI] AS [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 00801C0904

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 2
5. LOCATION GEN
6. DISC# 5
7. TEST NO. TN1522

B. MATERIAL PROPERTIES (HUB) T3
1. TYPE [ ] (KSI)
(MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [S]

[NI] [AS] [SB] [SN] [AL] [CU]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : D080100904

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK — 6C
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE GEE
4. LP# — 2
5. LOCATION — GEN
6. DISC# — 6
7. TEST NO. — TN1523

B. MATERIAL PROPERTIES (HUB)

1. TYPE — TA
   (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: — MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

C [ ] MN [ ] SI [ ] P [ ] CR [ ] MO [ ] V [ ]

NI [ ] AS [ ] SB [ ] SN [ ] AL [ ] CU [ ] S [ ]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : DC8010C09C5

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK — 40
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 3
5. LOCATION — GOV
6. DISC# — 1
7. TEST NO. — TN1536

B. MATERIAL PROPERTIES (HUB) — T2
1. TYPE [ ] (KSI)
(MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL P... (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [ ]
[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS
SPEED (RPM) — STRESS
1. 1800 — (KSI)
2. 2160 (120%) — (KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX CR/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e
b,c,e

ID # : D08C100905

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP#
5. LOCATION GOV
6. DISC#
7. TEST NO. TN1537

B. MATERIAL PROPERTIES (HUB)
1. TYPE
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

b,c,e

ID # : 0080100305

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 3
5. LOCATION GOV
6. DISC# 3
7. TEST NO. TA1S1e

B. MATERIAL PROPERTIES (HUB)
1. TYPE
(MIN. Y.S. [ ] (KSI)
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM) STRESS
1. 1800 (KSI)
2. 2160 (120%) (KSI)
[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.
[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e
b,c,e

ID # : DC801C0905

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK #2
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GOV
6. DISC# 4
7. TEST NO. TN1519

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] T3
(MIN. Y.S. (KSI))
2. SUPPLIER: (DOUBLE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQR[illegible]))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : DC801C09C5

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK -C
2. UNIT [illegible] CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GOV
6. DISC# 5
7. TEST NO. [illegible]

B. MATERIAL PROPERTIES (HUB)
1. TYPE (MIN. Y.S. [ ] (KSI)) TE
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX [illegible] (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e
b,c,e

ID # : D0801C0905

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK #2
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP# 1
5. LOCATION GOV
6. DISC# 6
7. TEST NO. TN1341

B. MATERIAL PROPERTIES (HUB)
1. TYPE TA
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 0080103906

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE GLE
4. LP#
5. LOCATION — GEN
6. DISC# — 1
7. TEST NO.

B. MATERIAL PROPERTIES (HUB)
1. TYPE (MIN. Y.S. [ ] (KSI))
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

[ ] b,c,e

ID # : 008010090b

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK   AC
2. UNIT   CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE GEE
4. LP#   GEN
5. LOCATION   2
6. DISC#
7. TEST NO.   TN1571

B. MATERIAL PROPERTIES (HUB)   T3
1. TYPE
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[S] [CU] [AL] [SN] [SB] [AS] [NI]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to
Ⓦ Proprietary Codes, b,c,e
r — b,c,e

ID # : 00801CC906

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK #2
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 2
5. LOCATION GEN
6. DISC# 3
7. TEST NO. MN1532

B. MATERIAL PROPERTIES (HUB) T5

1. TYPE
   (MIN. Y.S. [ ] (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]

[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

— — b,c,e

ID # : 0C901CC906

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK -2
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 3
5. LOCATION GEN
6. DISC# 4
7. TEST NO. TN1221

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] (KSI) TE
(MIN. Y.S.
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V] [S]
[NI] [AS] [SB] [SN] [AL] [CU]

E. BORE STRESS
SPEED (RPM) STRESS
1. 1800 (KSI)
2. 2160 (120%) (KSI)

[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to
(b) Proprietary Codes, b,c,e
— b,c,e

Data for this disc will be supplied by Westinghouse at a later date.

ID # : 0080100906

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK
2. UNIT CALVERT CLIFFS #2
3. CUSTOMER: BALTIMORE G&E
4. LP# 1
5. LOCATION GEN
6. DISC# 5
7. TEST NO. TN1534

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] (KSI)) TS
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROP. (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

C	MN	SI	P	CR	MO	V
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

NI	AS	SB	SN	AL	CU	S
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.) [ ]
2. A-CR-OS (OVERSPEED) (IN.) [ ]

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e

b,c,e

ID # : 0080100906

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK — BC
2. UNIT — CALVERT CLIFFS #2
3. CUSTOMER: — BALTIMORE G&E
4. LP# — 1
5. LOCATION — GEN
6. DISC# — 6
7. TEST NO. — TN1535

B. MATERIAL PROPERTIES (HUB)
1. TYPE — TA
(MIN. Y.S. [ ] (KSI))
2. SUPPLIER: — MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]

D. CHEMISTRY

[C] [MN] [SI] [P] [CR] [MO] [V]
[NI] [AS] [SB] [SN] [AL] [CU] [S]

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	[ ]

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
3. Calculated keyway crack size till inspection time.
4. Ratio of calculated crack to critical crack size.

[ ]

All Bracketed Data Subject to Proprietary Codes, b,c,e
b,c,e