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SCHWENCER,A.	Licensing Branch 2

SUBJECT: Responds to NRC 820330 ltr re natural gas pipeline in vicinity of facility.Location acceptable assuming flow restrictive device is used in gas line.

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Pennsylvania Power & Light Company
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Norman W. Curtis
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JUN 0 1 1982

Mr. A. Schwencer, Chief
Licensing Branch No. 2
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUSQUEHANNA STEAM ELECTRIC STATION
NATURAL GAS PIPELINE ANALYSIS
ER 100450 FILE 841-2
PLA-1104

Docket Nos. 50-387
50-388

Dear Mr. Schwencer:

This letter is in response to the NRC letter of March 30, 1982, regarding a natural gas pipeline in the vicinity of Susquehanna Steam Electric Station. The following conservative analysis shows that the location of the gas line is acceptable assuming a passive flow restriction device in the gas line. The restriction would limit the break flow to a value that would not pose a hazard to the Susquehanna plant.

Calculations were performed to determine the maximum distance to the lower flammability limit (LFL) versus steady state break flow. Since natural gas is significantly lighter than air, the calculations were based on dispersion of an elevated plume for which ground reflection does not occur. This results in the following equation for determining the plume centerline concentration:

where

$$\chi = \frac{Q}{2\pi \sigma_y \sigma_z U}$$

χ = concentration at a distance x downwind from the break location

Q = steady state break flow,

σ_y, σ_z = horizontal and vertical dispersion coefficients at the distance x, and

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U = wind speed.

The above equation was used with the following data to calculate the curve shown on Figure 1:

χ = 0.048 volume fraction (LFL of natural gas in air - Ref. 1),

σ_y, σ_z = values from F stability curve on Figure 4-1 of Ref. 2, and

U = 1 m/sec.

In order to determine a limiting flow at which a postulated double ended gas line break would pose no hazard to the Susquehanna plant, it is necessary to consider the distances between the gas line and plant structures critical to safe shutdown. The structures considered are the reactor buildings, the control complex, the diesel generator building, and the ESSW pumphouse. These relationships are shown on Figure 2, which indicates that the air intakes for the reactor building and control complex are over 1500 feet from the nearest approach to the gas line.

Using the 1500 foot value as a limit, a steady state break flow of 39 m^3/sec results (Figure 1). If the break flow was limited to this value, the maximum range of a flammable gas mixture resulting from a double ended break of the gas line at any location would not reach either the reactor buildings or the control complex.

The other two critical structures, the ESSW pumphouse and the diesel generator building, are less than 1500 feet from the gas line, but the air intakes on these structures are lower than the pipline elevation at its nearest approach to these structures. Analysis of break locations at different elevations along the gas line shows that even under an assumption of a two-thirds reduction in buoyancy, the centerline of a plume from a gas line break would clear the pumphouse and the diesel generator building by a substantial margin. The results of this analysis for a steady state break flow of 39 m^3/sec are shown in Figures 3 and 4. The solid plume centerlines are based on Briggs' methodology (refs. 3-5). The dashed plume centerlines are based on the assumed two-thirds reduction in buoyancy.

Based on the above analysis and discussion, a flow restriction sized to limit the steady state break flow to 39 m^3/sec would eliminate the pipeline as a potential threat to the safe operation of the Susquehanna plant. The attached letter from the Pennsylvania Gas and Water Company (PG&W) indicates that a 2" restriction already exists in their system which limits the flow from

one side of the break to 30 m^3/sec. Based on subsequent discussions with PG&W, we believe this calculation to be extremely conservative, and the actual flow would be about 25 m^3/sec. PG&W expects the existing flow restriction to remain unchanged for the next two years.

We have conservatively calculated a maximum backflow from the other direction of 9 m^3/sec based on information supplied by PG&W. We believe this flow is actually substantially lower. Based on these calculations, the maximum flow from a double ended break in the natural gas line would be 39 m^3/sec which is acceptable, as shown above.

PG&W has agreed to perform a detailed study to show the precise flow limitations of their existing system as well as the size of restriction that would be needed in the future as their system develops. This analysis will confirm that the flow from a double ended break would be limited such that the gas plume in the vicinity of the affected air intake structures would be below the lower flammability limit.

At the April 12, 1982 meeting in Bethesda, the NRC Staff indicated concern with respect to the effects of low natural gas concentrations on control room habitability, due to its classification as an asphyxiant. With the flow restriction device, the concentration of natural gas at the control room air intakes will be substantially below the LFL (4.8%). However, to assess the effects on control room operators, it is conservatively assumed that they could breathe a mixture of 4.8% natural gas and 95.2% air. The resulting oxygen content in such a mixture is 19.94%. This value is larger than the minimum 19.5% oxygen concentration specified in OSHA's 29 CFR Chapter XVII Part 1910 for assuring worker safety.

The PG&W pipeline was installed to the Federal safety standards for gas pipelines relating to transportation of natural gas as given in 49 CFR Part 192. The line, although used for distribution, was designed to the more elaborate requirements of a transmission pipeline. The design conservatively assumed Class 4 conditions (i.e., in a city with 4 story buildings). All welds were X-rayed during installation. Prior to being put into service the line was hydrostatically tested to 1130 psi, which is more than three times its maximum operating pressure. The line has cathodic protection to prevent corrosion during operation.

Based on the above information, we believe that operation of the PG&W pipeline will pose no undue risk to the Susquehanna plant.

Very truly yours,

N W Curtis

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

WEB/mks

cc: R. Perch
G. Rhoads

REFERENCES

1. Theordore Baumeister et al eds, Marks Standard Handbook for Mechanical Engineers, Eighth Edition, McGraw Hill Book Company, New York, 1978.

2. D. Bruce Turner, Workbook of Atmospheric Dispersion Estimates, Environmental Protection Agency, Publication No. AP-26, July, 1971.

3. G. A. Briggs, Plume Rise, TIC-25075, November, 1969.

4. G. A. Briggs, Plume Rise Predictions, ATDL Contribution File No. 75/15.

5. G. A. Briggs, Plume Rise and Buoyancy Effects, ATDL Contribution File No. 79/6.

W. E. Barberich

PENNSYLVANIA GAS AND WATER COMPANY

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GERALD B. TAYLOR
Vice-President, Operations and Engineering

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MAY 26 1982
NUCLEAR DEPT.

May 25, 1982

6/26/82

Mr. R. J. Shovlin,
Asst. Project Director
Pennsylvania Power & Light Co.
Two North Ninth Street
Allentown, PA 18101

Dear Mr. Shovlin:

I am writing to confirm our recent discussions regarding our company's position concerning the restriction of gas flows from the Salem Township City Gate Station through the 12" gas main near the Susquehanna Steam Electric Station. This is a result of the N.R.C. request for flow restriction.

Based on load projections for the upcoming two-year period, the Pennsylvania Gas and Water Company feels it will be able to provide system demands through an existing 2" orifice run in the station. This orifice will limit maximum gas flows which will occur in the event of a line rupture to less than 3800 MCF/hr. or 30 cu. meters/second.

Since this is only a short term solution to flow restriction, it will be necessary to conduct further studies to determine the means to provide for flow restriction in event of a rupture of the pipeline while providing alternate supply required to maintain service to customers. With the builtin flow restriction, it will be possible to conduct these studies and complete the analyses while your plant is operating.

The fact is, these points must be studied to quantify each parameter. Once the parameters have been quantified, we must develop alternate plans to minimize to an acceptable level, the overall system effect of the restriction device.

We understand that P. P. & L. is prepared to provide the funds which will be expended on these analyses. Mr. James Palumbo will contact you shortly with schedules and cost estimates.

Very truly yours,

Gerald B Taylor

GBT:P

CC: J. Palumbo

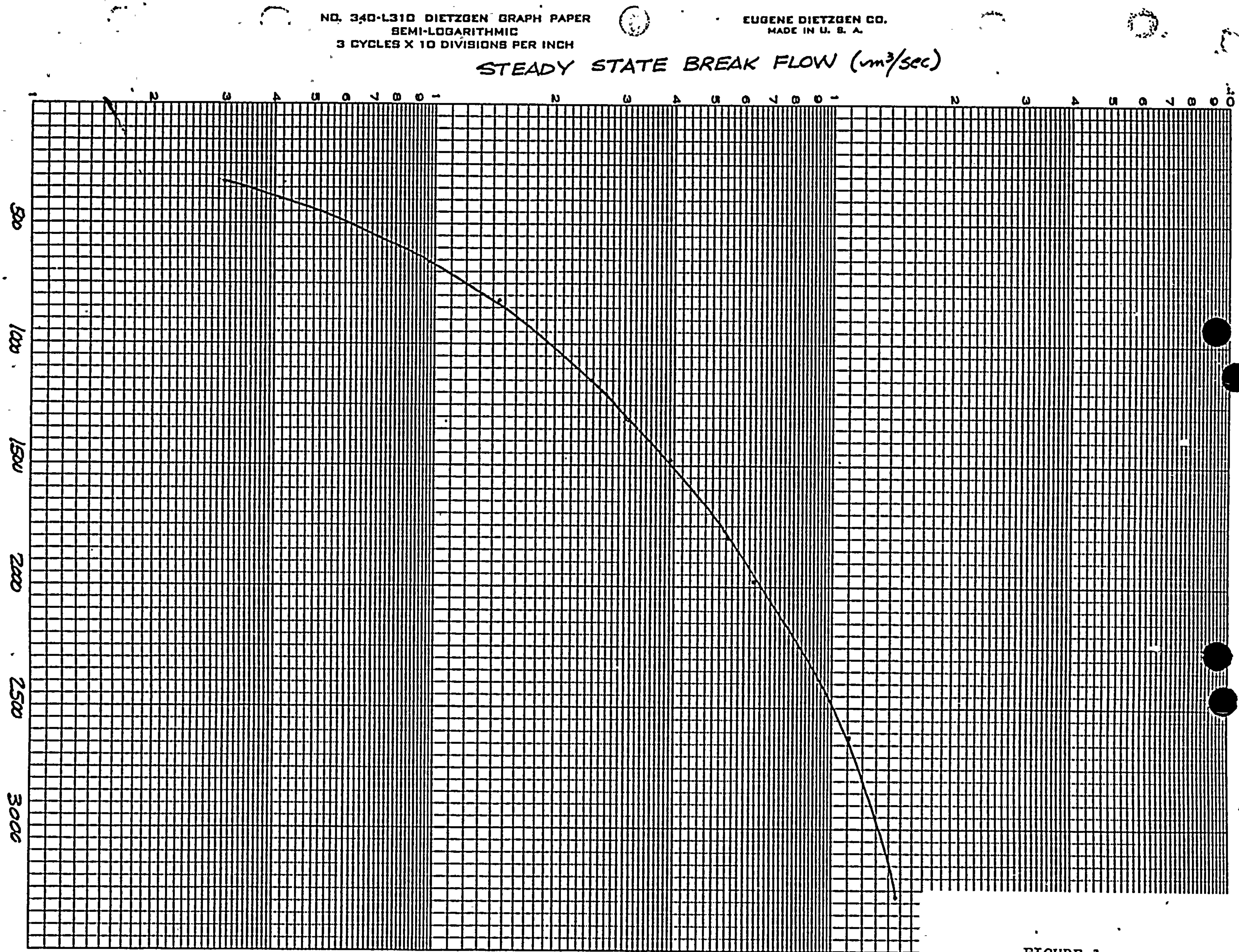
NO. 340-L310 DIETZGEN GRAPH PAPER
SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH
EUGENE DIETZGEN CO.
MADE IN U. S. A.
STEADY STATE BREAK FLOW (cm³/sec)
500
1000
1500
2000
2500
3000

FIGURE 1

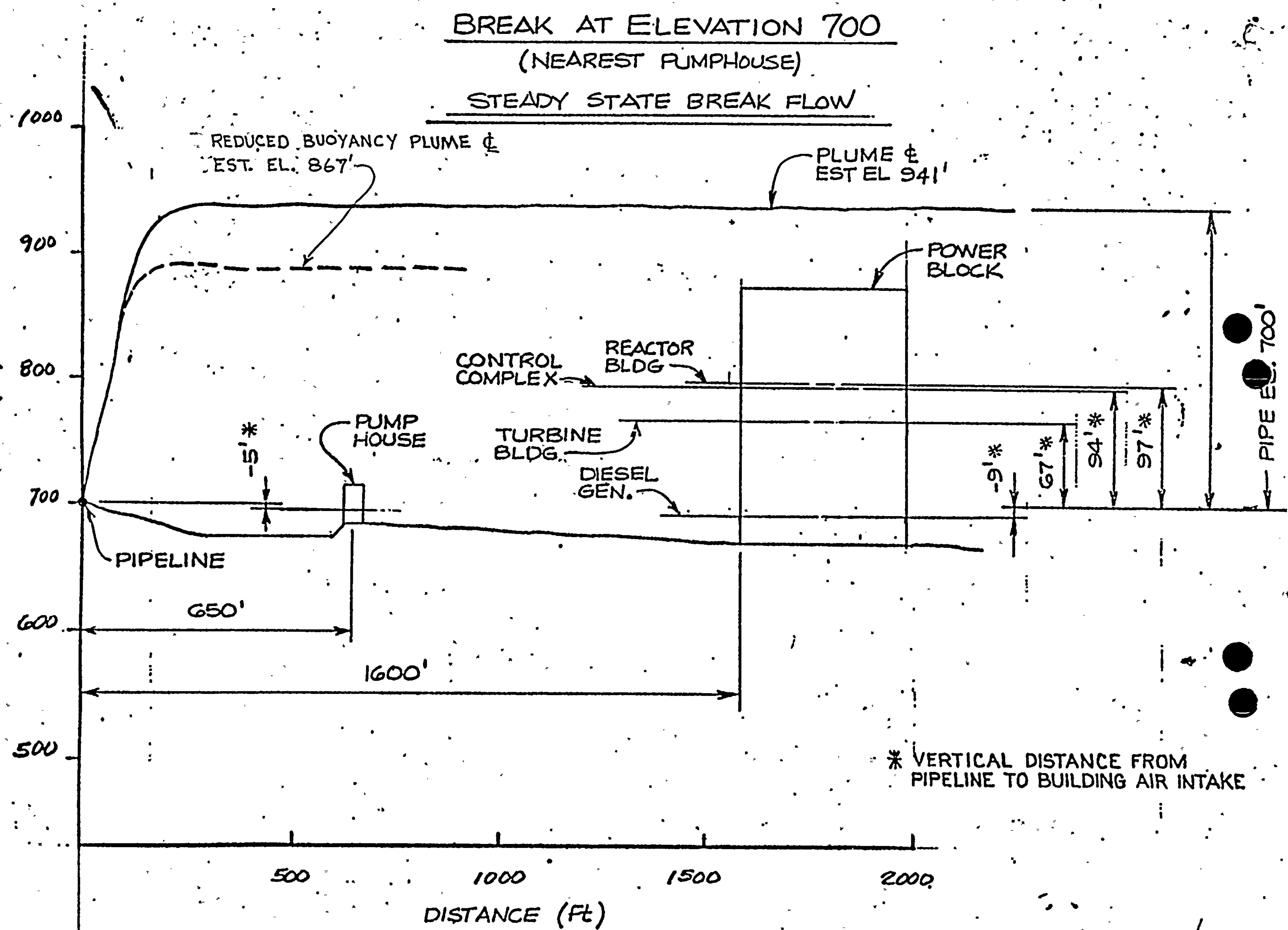
BREAK AT ELEVATION 700
(NEAREST PUMPHOUSE)
STEADY STATE BREAK FLOW
REDUCED BUOYANCY PLUME ℄
EST. EL. 867'
PLUME ℄
EST EL 941'
POWER BLOCK
CONTROL COMPLEX
REACTOR BLDG
TURBINE BLDG.
DIESEL GEN.
PUMP HOUSE
PIPELINE
-5'*
-9'*
67'*
94'*
97'*
PIPE EL. 700'
650'
1600'
1000
900
800
700
600
500
500
1000
1500
2000
DISTANCE (Ft)
* VERTICAL DISTANCE FROM PIPELINE TO BUILDING AIR INTAKE

FIGURE 3

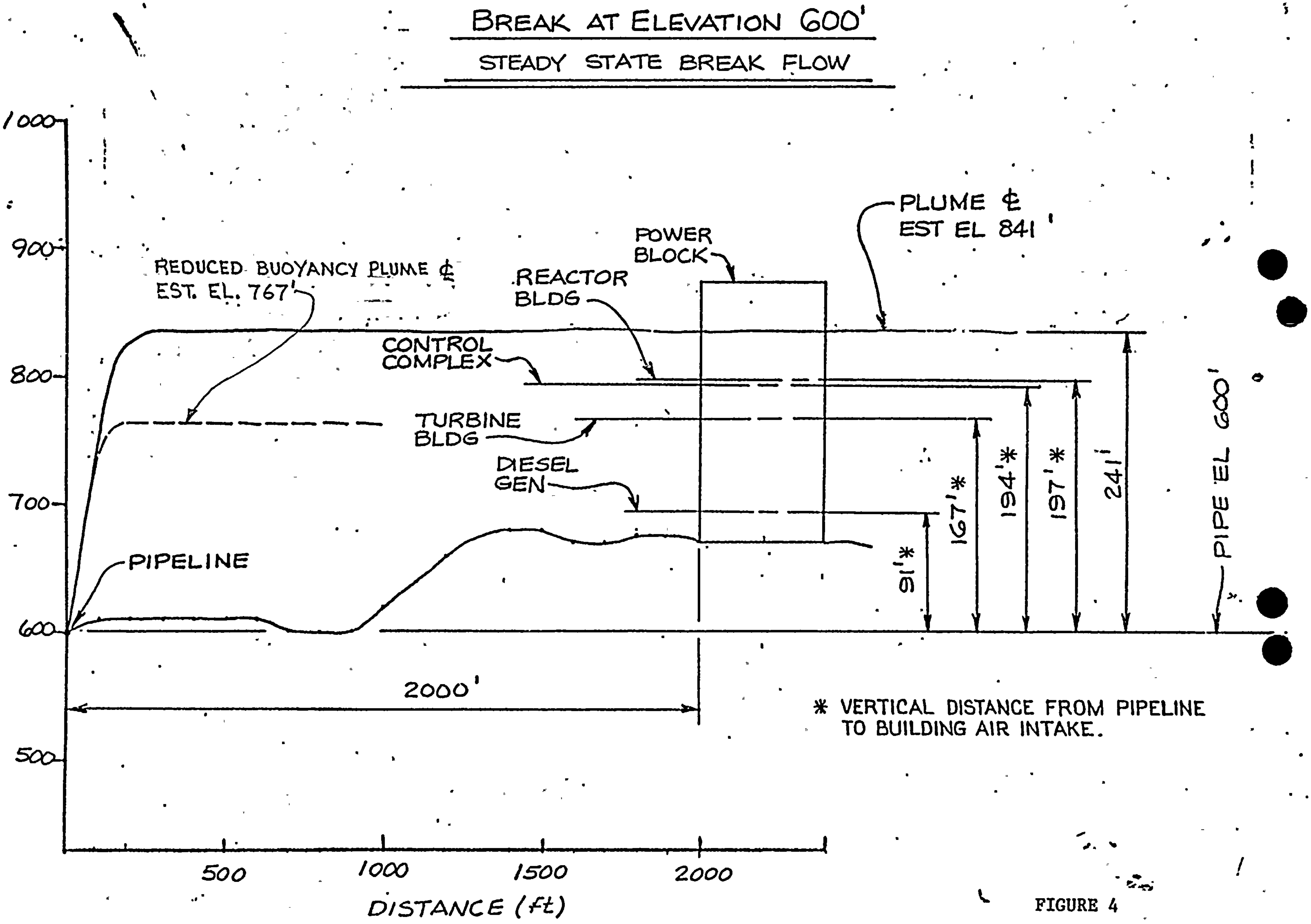
BREAK AT ELEVATION 600'
STEADY STATE BREAK FLOW
1000
900
800
700
600
500
REDUCED BUOYANCY PLUME ℄
EST. EL. 767'
POWER BLOCK
REACTOR BLDG
PLUME ℄
EST EL 841'
CONTROL COMPLEX
TURBINE BLDG
DIESEL GEN
PIPELINE
91'*
167'*
194'*
197'*
241'
PIPE EL 600'
2000'
* VERTICAL DISTANCE FROM PIPELINE TO BUILDING AIR INTAKE.
500
1000
1500
2000
DISTANCE (ft)

FIGURE 4

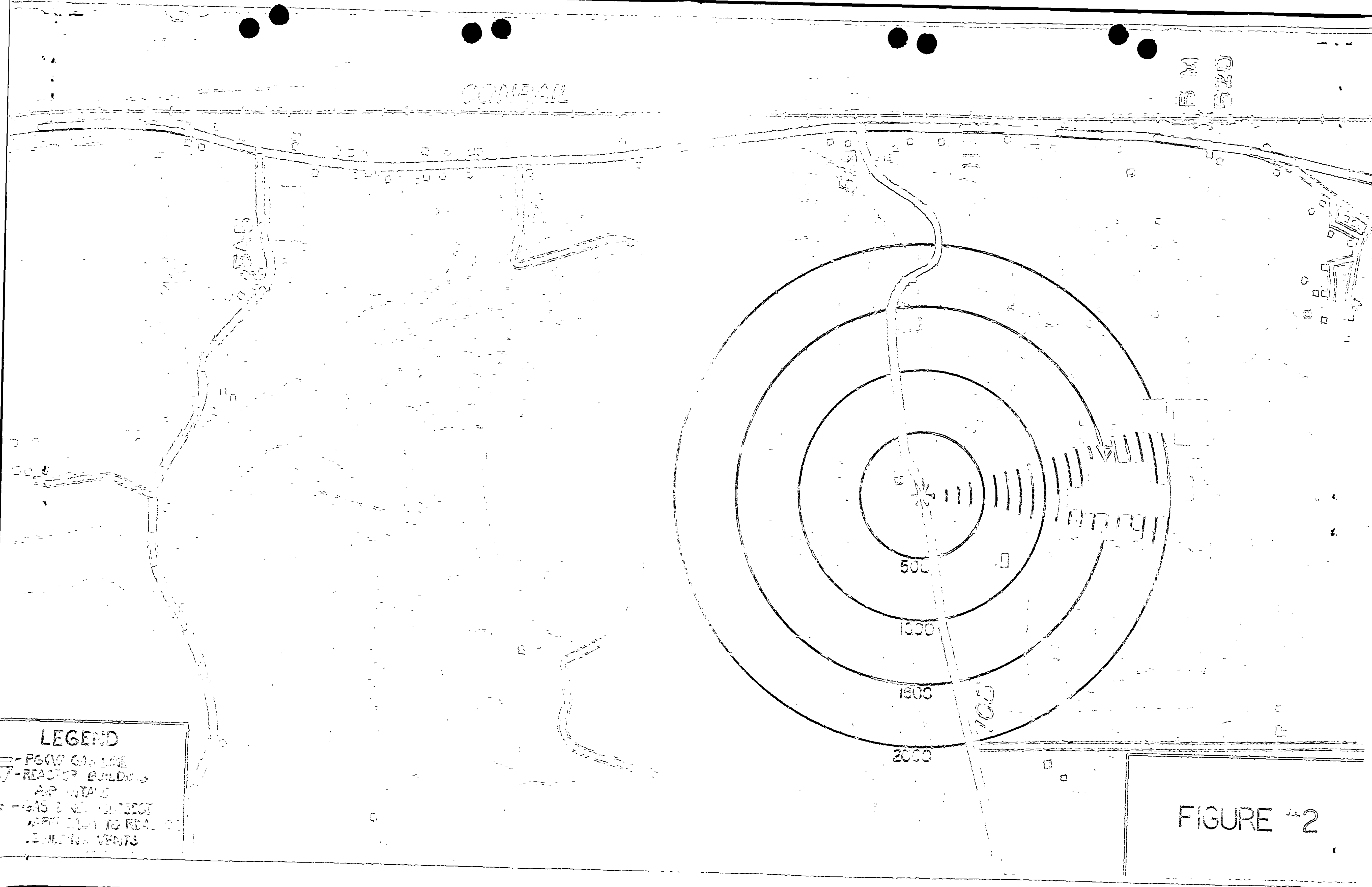

FIGURE #2