UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
Philadelphia Electric Company	)	Docket Nos. 50-352
	)	50-353
(Limerick Generating Station, Units 1 and 2)	)	
	)	

APPLICANT'S MEMORANDUM IN SUPPORT OF, ITS MOTION FOR SUMMARY DISPOSITION OF CONTENTIONS V-3a AND V-3b

Legal Introduction

Applicant hereby incorporates the legal intrcduction contained in Applicant's Memorandum in Support of Its Motion for Summary Disposition or Contention V-4 (September 27, 1983) at pages one to six.

Argument

In its Special Prehearing Conference Order, issued June 1, 1982,[1/] the Atomic Safety and Licensing Board ("Licensing Board") denied the contentions proposed by Friends of the Earth ("FOE"), but gave FOE an opportunity to file more specific contentions. In a subsequent order, FOE's Contentions V-3a and V-3b, relating to postulated accidents at

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1/ Philadelphia Electric Company (Limerick Generating Station, Units 1 and 2), LBP-82-43A, 15 NRC 1423, 1513-14 (1982).

nearby offsite pipelines, were admitted.[2/] These contentions alleged that Applicant had inadequately analyzed the effect on the facility of the postulated failure of two pipelines passing near the Limerick station, one carrying refined petroleum products and a pair sharing the same right-of-way carrying natural gas.

The affidavit of John D. Walsh, who is employed by the Bechtel Group, Inc., has been prepared in response to these two contentions. Mr. Walsh prepared the analysis which Applicant utilized to support its conclusions in the Final Safety Analysis Report ("FSAR") that the nearby pipelines would not adversely affect the safe operation of the Limerick Generating Station.

As explained in greater detail in Applicant's Answer to Friends of the Earth Petition for Extension of Time and Scheduling of Evidentiary Hearings after January 1, 1984 and Motion to Dismiss Contentions V-3a and V-3b or, Alternatively, for Other Sanctions (October 6, 1983), Applicant pursued discovery relating to these two contentions. To date, however, FOE has totally failed to provide a substantive answer to Applicant's interrogatories, produce requested documents, or identify its experts and prospective

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2/ Limerick, supra, "Order (Concerning Proposed FOE Contentions on Hazards from Industrial Activities)" (November 22, 1982) (slip op. at 4-7).

witnesses.[3/] FOE's position has been that research supportive of its contentions is still in progress. For its part, Applicant has responded to interrogatories propounded by FOE with appropriate answers or objections. FOE has neither questioned the adequacy of Applicant's answers nor taken any action regarding its objections.

Mr. Walsh, the principal affiant, is a Science Specialist with the Bechtel Group, Inc. He has been responsible for the hazards analyses associated with nearby industrial and transportation facilities for a number of nuclear power plants, including the Limerick Generating Station. He received training as an aerographer with the U.S Navy. He attended New York University from 1956-1959 and received an A.B. degree in meteorology. He is a meteorological officer with the U.S. Naval Reserve with the rank of commander. Mr. Walsh has pursued part-time graduate studies in meteorology, physics, mathematics and psychology. He has also completed the requirements for an M.S. degree in environmental management at the University of San Francisco.

Mr. Walsh has previously been employed by Brookhaven National Laboratory as a research meteorologist in the field of atmospheric dispersion research. He was also employed by New York State Department of Health as a senior

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3/ Three possible witnesses were named in FOE's response. These witnesses stated to Applicant's counsel that they did not intend to testify for FOE.

meteorologist and by NUS Corporation as a Senior Scientist, where he worked primarily on the preparation of meteorological and climatological input to safety analysis reports, including accident analyses. Mr. Walsh has been employed by the Bechtel Group, Inc. since September, 1974 where he works as a staff consultant on a number of Bechtel projects. He has performed numerous accident analyses for over one dozen nuclear power plants. These have included analyses of the effects of nearby industrial, military and transportation facilities on the operation of these stations. Accordingly, Mr. Walsh is qualified by his education, training and experience to conduct the analysis required to respond to these contentions and is an expert in their subject matter.

Contention V-3a

In its Order of November 22, 1982, the Licensing Board admitted Contention V-3a as follows:

> In developing its analysis of the worst case rupture of the ARCO [Atlantic Richfield Company] pipeline, the Applicant provided no basis for excluding consideration of siphoning. Thus, the consequences from the worst case pipeline accident are understated.4/

The ARCO refined petroleum products pipeline passes within 1600 feet of the Unit 2 reactor enclosure, which is the

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4/ Limerick, supra, "Order (Concerning Proposed FOE Contentions on Hazards from Industrial Activities)" (November 22, 1982) (slip op. at 5).

nearest it approaches to safety-related structures (Walsh Affidavit at ¶4). The pipeline is approximately 1675 feet from the Unit 2 diesel generating building at its nearest point (Id.). The pipeline runs generally north and south in the vicinity of the plant with the product being pumped in a northward direction (Id.). The routing of the pipeline and its relationship to the facility is shown on the attached Figure 1, which is a copy of FSAR Fig. 2.2-4.[5/] The ARCO pipeline is nominally 8 inches in diameter and operates at 1200 psig pumping pressure (Id.). According to ARCO, the pipeline was constructed in 1955 (Id.). The pipeline is buried a minimum of 3 feet below grade and is a dedicated carrier for refined petroleum products. Gasoline is carried in this pipe as are diesel and home heating oil (Id.). Propane is not and has never been carried and, according to ARCO, could not be carried without major modifications to the pipeline. Philadelphia Electric Company has obtained an agreement from ARCO that it will not transport propane through this pipeline (Id.; Affidavit of Vincent S. Boyer Regarding Contentions V-3a and 3b at ¶4).

Pumping stations for the ARCO pipeline are equipped with pressure sensors to detect sudden rises or falls in pressure which could indicate a leak or break in the lines

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5/ An enlarged copy of this figure has been provided to the Licensing Board, FOE and the NRC Staff for their convenience.

(Walsh Affidavit at ¶5). In such an event, the pumps would be automatically shut off (Id.). Operators monitoring the pipeline and pump stations would note a speedup of the pumps and could terminate pumping if necessary (Id.). Operators are able to detect even small leaks through routine inventory procedures in a relatively short time (Id.)

For purposes of the analysis reported in the FSAR, Mr. Walsh assumed that a rupture occurs while gasoline is being transported in the pipeline since gasoline is the most volatile substance carried and has the highest energy content (Id.). Thus, as far as its potential effect on the plant, gasoline was chosen for analysis because its deflagration or detonation of its vapors would result in the most severe consequences.

Mr. Walsh's analysis involved the postulation of a complete rupture of the ARCO pipeline at a location which would cause the greatest effect on the Station (Walsh Affidavit at ¶6). The rupture of the pipeline was assumed to occur at the point where it crosses Possum Hollow Run, which is the lowest point between adjacent points of the terrain (Id.). It was further assumed that pumping would automatically stop at the sudden pressure drop in the broken line or by means of operator actions (Id.). Ruptures of the pipeline at other locations in the vicinity of the Limerick plant would either release less gasoline, because of the relative elevations involved, or would cause the gasoline to

drain into other, less proximate, drainage systems, and thus result in lesser effects upon the Station (Id.).

Following the postulated pipeline rupture at Possum Hollow Run, it was assumed that the entire gasoline content of that portion of the pipeline between the two adjacent high points of land 1400 feet north and 600 feet south, calculated to be 4962 gallons, flowed into the stream bed. It was further assumed that the flow was distributed over the streambed between the pipeline and the first downstream bridge in a pool 610 meters long by 1 meter wide by approximately 3 centimeters deep (Walsh Affidavit at ¶7). Mr. Walsh has personally observed the Possum Hollow Run and has stated the pooling capacity of the creek bed is very small (Id.). Thus, even if the amount of gasoline is significantly larger than postulated in the analysis, the additional gasoline in excess of the conservative pool capacity utilized would drain downstream away from the plant. Even in the event of large releases (such as where pumping would continue), therefore, the impact on the station would not significantly change (Id.).

The Applicant's analysis demonstrated that siphoning of gasoline from beyond the adjacent high points of land would not occur (Walsh Affidavit at ¶8). Air would enter the lines at the point of rupture and travel through the upper portions of the pipe above the surface of the draining fluid until it reached the adjacent high points. At that point, it would accumulate and prevent further drainage by gravity

flow (Id.). Liquid in the pipe beyond the adjacent high points would not siphon because a siphon requires the presence of atmospheric pressure at both ends (Id.). To drain more gasoline than contained between the two adjacent high points would require that air at atmospheric pressure enter the line at a point beyond the adjacent high points which is higher than the postulated break (Id.). Two separate openings of the pipe must be postulated to permit such siphoning to occur (Id.). There is no basis to postulate such an event.

Once distributed in the Possum Hollow Run streambed, the gasoline was assumed to evaporate, forming a gradient of gasoline vapors at decreasing concentrations above the stream and confined horizontally within the valley walls (Walsh Affidavit at ¶9). It was conservatively assumed that winds are calm and the only mixing which occurs is due to the vapor pressure of the evaporating gasoline forcing the vapor upward (Id.). If winds were not calm, greater dilution of the gasoline would occur, resulting in less gasoline vapor within flammable limits near the facility. Because of mixing, this would be true even if the winds were in the direction of the Limerick Station (Id.).

The amount of gasoline vapor within explosive limits was calculated and the TNT-equivalent energy was determined (Walsh Affidavit at ¶10). Detonation was assumed to occur with the centroid of the explosion approximately 800 feet from the Unit 2 reactor enclosure. This location was chosen

based upon examination of the area topographic map (Id.). It represented a wide spot in the valley where direct exposure to safety-related structures exists. No credit was taken for intervening terrain at this location (Id.). Using Regulatory Guide 1.91 methodology, the resulting peak reflected overpressure was calculated to be 1.9 psi. The design reflected average overpressure of the affected safety-related structures is 12 psi (Id.).

Even if the closest approach of Possum Hollow Run to the Station (approximately 550 feet) were selected as the location of the centroid of the explosion, the calculated peak overpressure at the critical safety-related components of the Station would be 3.0 psi and would not affect these structures (Id.). No credit was taken for the shielding affects of the Possum Hollow Run valley walls for either of these two cases (Id.).

Alternatively, it was assumed that the 5,000 gallons of spilled gasoline would deflagrate in a 15 minute period (Walsh Affidavit at ¶11). The 15 minute period was conservatively utilized to maximize the heat generation rate. Using American Petroleum Institute methods, it was calculated that the resulting fire would produce a radiant heat load of 85 Btu per square foot per hour at the Unit 2 reactor enclosure (Id.). This level would not, according to Mr. Walsh, have any effect on the reactor enclosure other than a slight warming of the concrete surface, even for extended periods of exposure. By comparison, a flat surface in the

sun at mid-day would receive solar heat at approximately 50 to 60 Btu per square foot per hour (Id.).

Neither the peak overpressure of 1.9 psi by detonation nor the radiant heat at 85 Btu per square foot per hour by deflagration of spilled gasoline vapors would significantly affect safety-related structures. There exists no material question of fact and Applicant's motion for summary disposition should be granted.

Contention V-3b

The Order of November 22, 1982 granted Contention V-3b as follows:

> In discussing deflagration of gas and petroleum due to pipeline rupture, no specific consideration has been given to the effect of radiant heat upon the diesel generators and associated diesel fuel storage facilities.6/

Two Columbia Gas Transmission Company pipelines pass within approximately 3500 feet of the Unit 2 reactor enclosure at their closest approach. These pipelines carry only natural gas (Walsh Affidavit at ¶13). Both pipelines share the same right of way and run south-southwest to north-northeast (Id.). The routing of these gas pipelines and their relationship to the facility is shown on the figure attached to the Walsh affidavit, which is reproduced from FSAR Fig.

6/ Limerick, supra, "Order (Concerning Proposed FOE Contentions on Hazards From Industrial Activities)" (November 22, 1982) (slip op. at 7).

2.2-4 (Id.; Boyer Affidavit at ¶¶2-3). The smaller pipeline is 14 inches in diameter, operates at a maximum pumping pressure of 1,000 psig, is 34 years old and is buried a minimum of 3 feet below grade. The larger pipeline is 20 inches in diameter, operates at a maximum pumping pressure of 1200 psig, is 17 years old, and is also buried a minimum of 3 feet below grade (Walsh Affidavit at ¶13).

It was conservatively assumed that the larger of the two lines ruptures at the point at which the pipeline passes closest to Unit 2 reactor containment, approximately 3500 feet (Walsh Affidavit at ¶14). It was further assumed to be a double ended rupture, that is, a complete separation of the pipe at the point of rupture with the two ends forced into a vertical orientation from pressure and whip (Id.). This assumption ignores the fact that the lines are buried, which would mitigate the whip effect (Id.). If the pipes were not in the assumed vertical orientation, the momentum of the two opposed streams of gas would result in rapid mixing and dilution. This would cause the gas emitted to be a ground level source, resulting in an explosion centroid further from the plant than assumed in the conservative analysis (Id.).

It is possible that the entire contents of the pipeline between adjacent compressor stations some 7.5 miles south and 3.7 miles north of the Limerick Generating Station would be released at sonic velocity in the assumed vertical jet (Walsh Affidavit at ¶15). The calculations of any potential

impact on Limerick are, however, dependent upon the rate of release rather than the total amount available for release (Id.).

It was assumed that the escaping gas rises in a column to about 500 feet above plant grade where the momentum energy decays and the gas commences to travel horizontally, directly towards the Unit 2 reactor enclosure (Walsh Affidavit at ¶16). The mitigating effect of the height above plant grade was not used in the analysis for overpressure (Id.). It was assumed that the natural gas began dispersing downwind toward the Limerick plant from directly above the rupture point at a low dispersion rate consistent with Pasquill "F" stability and one meter per second wind speed, which is about the 95th percentile meteorology (Walsh Affidavit at ¶17). These conservative assumptions allow the plume to approach the plant at the nearest point prior to reaching detonable concentrations (Id.). Using standard meteorological dispersion meteorology, the amount of the gas within explosive limits was calculated (Id.). If the wind were blowing in any other direction than directly towards the plant, the effects of a gas explosion would be less (Id.). Similarly, if the wind speed were higher, greater dilution would occur and the zone of explosive limits would be closer to the point of release and further from the Station (Id.).

The peak overpressure at the Unit 2 reactor enclosure was calculated using Bureau of Mines methodology and

assuming detonation (Walsh Affidavit at ¶18). The resulting overpressure of 10 psi is less than the design overpressure for critical safety-related structures (Id.). Mr. Walsh noted that natural gas clouds seldom detonate in the open air (Id.). Further, he stated that it is difficult to hypothesize an ignition source to trigger a detonation in the elevated cloud (Id.).

An analysis was performed to evaluate the effects of the natural gas cloud on the facility if it were to deflagrate rather than detonate (Walsh Affidavit at ¶19). The analysis made the very conservative assumption that the cloud continues to burn at the original point of ignition. In actuality, the flame front would probably move back towards the point of rupture and form a flame pillar which would then have negligible effect on the plant (Id.). The transport and dispersion of the natural gas used in this calculation is the same as that used for the explosion analysis discussed above (Id.). Using American Petroleum Institute methodology, the calculated radiant heat load at the Unit 2 reactor enclosure would be about 70 Btu per square foot per hour (Id.). Mr. Walsh concluded that this level would cause only slight warming of the outer layer of concrete and would not cause any noticeable or lasting effect, even for extended periods of deflagration. The diesel fuel storage tanks and associated piping are buried underground and they would therefore not be affected by

either the detonation or the deflagration of the natural gas (Walsh Affidavit at ¶20).

Thus, whether detonation or deflagration of the natural gas from either of the two Columbia Gas Transmission lines were postulated, no adverse effects on safety-related structures or equipment would result (Walsh Affidavit at 21). There being no material facts in dispute, Applicant is entitled to summary disposition.

Respectfully submitted,

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