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50-352
353

October 3, 1983

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

Subject: Limerick Generating Station, Units 1 and 2
Meteorology and Effluent Treatment Branch (METB)

Reference: PECO and NRC Conference Call Dated September 26, 1983

File: GOVT 1-1 (NRC)

Dear Mr. Schwencer:

As requested by the Meteorology and Effluent Treatment Branch Reviewer in the referenced telecon, we are providing additional information concerning dust loading of the first HEPA filter in each of the Limerick ESF HVAC filtration trains with this letter.

The attached analysis of the dust loading on the first HEPA filter in each ESF HVAC filtration train was discussed in the referenced telecon. Based on results of the analysis it is concluded that the dust loading on the first HEPA filter bank of the ESF HVAC filtration trains will not exceed their dust holding capacities.

Sincerely,

John S. Kemper

JTR/gra-I-3

Copy to: See Attached Service List

B001
1/1

cc: Judge Lawrence Brenner	(w/enclosure)
Judge Richard F. Cole	(w/enclosure)
Judge Peter A. Morris	(w/enclosure)
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Docket and Service Section	(w/enclosure)
Jay. M. Gutierrez	(w/enclosure)

DUST LOADING OF THE FIRST HEPA FILTER IN EACH OF THE LIMERICK ESF HVAC FILTRATION TRAINS (SGTS, RERS, CREFAS).

An analysis was performed to determine the worst case dust loading that could be experienced by the first HEPA filter of the ESF HVAC filtration trains during accident conditions. The following conservative assumptions were made for this analysis:

1) A HEPA filter dust loading capacity of 4 pounds per 1000 CFM of rated flow capacity was used. This is the recommended dust loading capacity given in ERDA 76-21 "Nuclear Air Cleaning Handbook", page 44. The conservatism of this assumption was verified by reviewing the dust holding capacities of the HEPA filters procured for Limerick.

2) An atmospheric dust load of 2.0 mg/cubic meter was used. Per ASHRAE 1983 Equipment Guide, page 10.1, this figure is seldom exceeded. The conservatism of this assumption was verified by data contained in the Limerick EROL, Table 2.3.1-9. This table shows that the highest observed atmospheric dust load in the Pottstown area from 1972 thru 1976 was 0.294 mg/cubic meter.

3) No credit was taken for the dust removal capabilities of the prefilter banks which were specifically provided in the Limerick design to protect the HEPA filters against excessive dust loading. In the ERDA 76-21 "Nuclear Air Cleaning Handbook", page 43, the following statement is made regarding the dust holding capacity of HEPA filters; "For HEPA filters it is often not an important factor since they will be protected by prefilters, particularly in high dust concentration applications"

4) For the Reactor Enclosure and Refueling Area Secondary Containment, it was assumed that the isolated volume dust load would equal the assumed atmospheric dust load of 2.0 mg/cubic meter. This assumption is conservative since the normal, once-thru ventilation systems that service these areas are provided with supply air roll filter units. (Initial dust load of the Control Room was neglected due to it's small volume and the continual filtration provided by the Control Room HVAC system roll filters).

5) The post accident filter loadings were based on design basis outside air infiltration quantities.

6) HEPA filter bank loading was assumed to be uniform. Flow equalization will be attained due to the equalizing effect of the upstream prefilter banks and verified by HEPA filter in-place tests performed per ANSI N-510.

7) It was assumed that dust accumulations within the ductwork system would be negligible. The basis for this assumption is as follows:

   a) Prior to installation of the permanent HEPA filters, the ventilation systems are cleaned and will be run to purge any construction stage dust.

b) The majority of ductwork that is utilized by the ESF filter systems is also used for normal ventilation, at greater than or equal to emergency flow rates. This ductwork is therefore not considered a source for dust accumulation that would be dislodged upon actuation of the ESF filter systems. The only portions of ductwork that do not experience normal air flows and could be considered as potential dust accumulation points would be the ESF filter system connection points between the isolation valves and connection to normal ventilation ductwork or outside air source. (See attached sketches for connection arrangements). In all cases, there is a normal operating flow path across the connection point. From the following information on the normal distribution of atmospheric dust particles and their settling characteristics (Reference ASHRAE 1981 Fundamentals, page 11.3) it is apparent that the dust particles would follow the normal ventilation air streams and not settle out in any appreciable amounts to warrant a concern for exceeding the high dust loading capacities of the HEPA filter banks:

1) Particles less than 0.1 micron - These particles travel in Brownian motion and have no measureable settling effect.

2) Particles from 0.1 micron to 1.0 micron - These particles do have settling velocities, but they are so low as to be negligible since normal air currents counter-act the settling.

3) Particles from 1 micron to 10 microns - These particles settle at a constant rate and appreciable velocity. However, normal air currents tend to keep them in suspension for appreciable periods of time.

(Note: Particles in the range of 0.1 to 1.0 micron (items 1 and 2 above) account for 99 percent of particles in a typical atmosphere by count and 72 percent by weight).

A. The pounds of atmospheric dust per cubic foot of air was calculated as follows:

$$\frac{\text{Pounds Dust}}{\text{Cubic Foot}} = 2 \times 10^{-3} \left(\frac{g}{m^3}\right) \times 2.205 \times 10^{-3} \left(\frac{lb}{g}\right) \times \frac{1}{35.31} \left(\frac{m^3}{ft^3}\right)$$

$$= 1.25 \times 10^{-7} \frac{lb}{ft^3}$$

B. Dust loading of the Control Room Emergency Fresh Air System (CREFAS) HEPA filter bank:

1) The daily dust load due to the design basis outside air required for control room pressurization (525 CFM) was calculated as follows:

$$\frac{\text{Pounds Dust}}{\text{Day}} = 1.25 \text{ X } 10^{-7} \left(\frac{\text{lb}}{\text{ft}^3}\right) \text{ X } 525 \left(\frac{\text{ft}^3}{\text{min}}\right) \text{ X } 1440 \left(\frac{\text{min}}{\text{day}}\right)$$

$$= 0.094 \frac{\text{lbs}}{\text{day}}$$

2) The dust loading capacity of the 3,000 CFM rated HEPA filter bank is 12 lbs. Based on the above daily dust loading, the number of days that this system could operate before reaching its dust loading capacity was calculated as follows:

$$\text{Days} = \frac{12 \text{ (lbs)}}{0.094\left(\frac{\text{lbs}}{\text{day}}\right)} = 127 \text{ days}$$

C. Dust loading of the Reactor Enclosure Recirculation System (RERS) HEPA filter bank:

1) The dust load that would initially be removed from the isolated Reactor Enclosure Secondary Containment Volume (1,800,000 ft^3), was calculated as follows:

$$\text{Pounds Dust} = 1{,}800{,}000 \text{ (ft}^3\text{) X } 1.25 \text{ X } 10^{-7} \left(\frac{\text{lb}}{\text{ft}^3}\right)$$

$$= 0.225 \text{ lbs. (negligible)}$$

2) The daily dust load due to the design basis reactor enclosure secondary containment infiltration rate (625 CFM) was calculated as follows:

$$\frac{\text{Pounds Dust}}{\text{Day}} = 1.25 \text{ X } 10^{-7} \left(\frac{\text{lb}}{\text{ft}^3}\right) \text{ X } 625 \left(\frac{\text{ft}^3}{\text{min}}\right) \text{ X } 1440 \left(\frac{\text{min}}{\text{day}}\right)$$

$$= 0.1125 \frac{\text{lbs}}{\text{day}}$$

3) The dust loading capacity of the 60,000 CFM rated HEPA filter bank is 240 lbs. Based on the above daily dust loading, the number of days that this system could operate before reaching its dust loading capacity was calculated as follows:

$$\text{Days} = \frac{240 \text{ (lbs)}}{0.1125\left(\frac{\text{lbs}}{\text{day}}\right)} = 2{,}133 \text{ days}$$

D. Dust loading of the Standby Gas Treatment System (SGTS) HEPA filter bank: (Note: For SGTS, only dust loads due to the Refueling Area Secondary Containment Isolation mode were considered. For the Reactor Enclosure Secondary Containment Isolation mode, all air going to SGTS would have been already filtered by the RERS).

1) The dust load that would initially be removed from the isolated Refueling Area Secondary Containment (2,200,000 ft^3) was calculated as follows:

$$\text{Pounds Dust} = 2{,}200{,}000\ (ft^3) \times 1.25 \times 10^{-7} \left(\frac{lb}{ft^3}\right)$$

$$= 0.275 \text{ lbs (negligible)}$$

2) The daily dust load due to the design basis refueling area containment infiltration rate (764 CFM) was calculated as follows:

$$\frac{\text{Pounds Dust}}{\text{Day}} = 1.25 \times 10^{-7} \left(\frac{lb}{ft^3}\right) \times 764 \left(\frac{ft^3}{min}\right) \times 1440 \left(\frac{min}{day}\right)$$

$$= 0.137 \frac{lbs}{day}$$

3) The dust loading capacity of the 11,000 CFM rated HEPA filter bank is 44 lbs. Based on the above daily dust loading, the number of days that this system could operate before reaching its dust loading capacity was calculated as follows:

$$\text{Days} = \frac{44\ (lbs)}{0.137 \left(\frac{lbs}{day}\right)} = 321 \text{ days}$$

Conclusion: Based on the above conservative analysis it is concluded that the dust loading of the first HEPA filter bank of the Limerick ESF HVAC filtration trains will not result in exceeding their dust holding capacities.

RBA/bls 2/1

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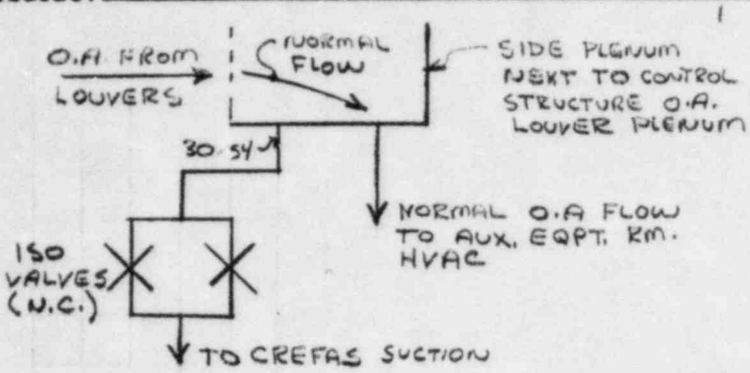
CALCULATION SHEET

PHILADELPHIA ELECTRIC CO.

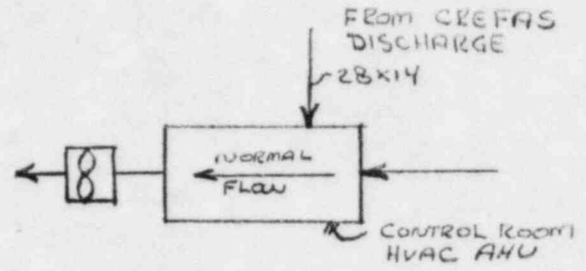
NAME RBA

LOCATION LIMERICK GEN STATION - ESF HVAC FILTER   DATE 9·28·83   SHEET NO.

SUBJECT DUCTWORK CONNECTIONS TO NORMAL SYSTEMS   JOB/CA NO.

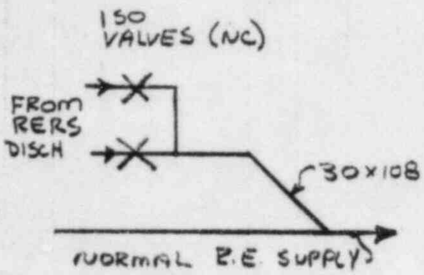


SUCTION CONNECTION (ELEVATION)

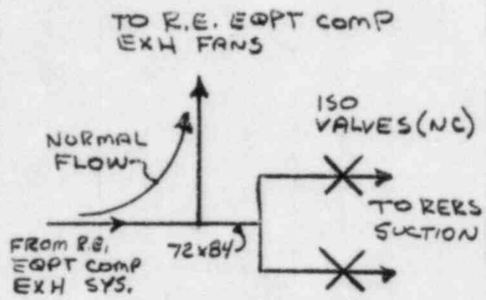


DISCHARGE CONNECTION (ELEVATION)

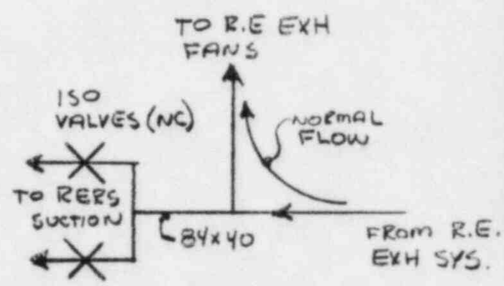
CREFAS DUCTWORK CONNECTIONS



DISCHARGE CONNECTION (ELEVATION)

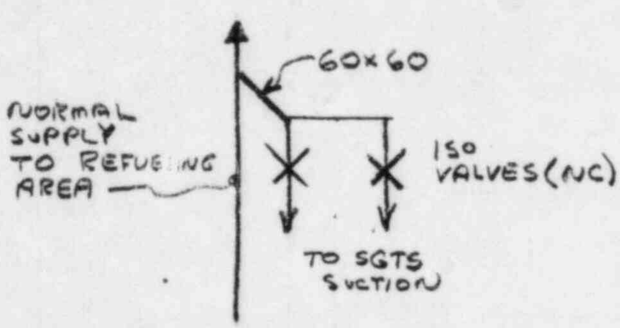


SUCTION CONNECTION FROM R.E. EQPT COMP EXH (ELEVATION)



SUCTION CONNECTION FROM R.E EXH (ELEVATION)

RERS DUCTWORK CONNECTIONS



SGTS DUCTWORK CONNECTION TO REFUELING AREA (ELEVATION)