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January 25, 1963

Mr. Robert Manning, Manager
Safety Department
Goodyear Tire and Rubber Company
Akron, Ohio

Subject: An Industrial Hygiene Investigation of the First Floor Cement House, Department 137-A, Plant 1, Building 31, Goodyear Tire and Rubber Company, Akron, Ohio.

Dear Mr. Manning:

This is to report the findings of our December 7, 1962 industrial hygiene investigation of the first floor cement house, Plant 1, Building 31, Goodyear Tire and Rubber Company, Akron, Ohio. The purpose of the present investigation, which was requested by the union, was to make an evaluation of the cement house environment so that we can render an opinion on the question whether or not the ventilation in the cement house is adequate.

Findings

From our discussions with the cement house supervisor and with the operators, we learned that (1) the workroom measures 60 feet wide, 120 feet long, and 12 feet high; (2) there are in the center section of the room 16 mixers (1-15 gallon capacity, 1-3½ gallon, 6-100 gallon, and 8-50 gallon); (3) cement mixes contain up to 90% solvent; (4) figured solvent loss through evaporation is 10%; (5) solvents used daily are MEK, toluol, Odine or low test white gasoline, and Skol or hexane; (6) operators have 8-hour work shifts; (7) each batch of cement mix takes about 5 hours to prepare; (8) each operator unloads three mixers per shift average; (9) mixer unloading time is about 20 minutes for a 100-gallon mixer and 10 minutes for a 50-gallon mixer.

From our observations, we found that (A) three mixers were in operation during the investigation period; (B) the operators assumed no permanent work locations; (C) the operators stood at a mixer for any length of time only during loading or unloading of the mixes; (D) no disagreeable solvent vapors were experienced in the general areas in the cement room; (E) no disagreeable toluol fumes were experienced when standing next to mixers 4M and 5M in which cement-containing toluol was being mixed; (F) intolerably strong MEK fumes were experienced when standing next to mixer 7L especially during the cooling of the cement mix with dry ice.

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Our ventilation checks made on December 7, 1962 yielded the following ventilation data and estimations:

Air entering room through main entrance:	20,000 CFM
Air supplied from tempered make-up air system:	21,000 CFM
Total air supply:	41,000 CFM
Air exhausting to 2nd floor cement house through stairway door:	3200 CFM
Air exhausting to 2nd floor cement house through two conveyor belt openings:	3600 CFM
Total air exhausting to 2nd floor:	6800 CFM
Air exhausted by the five wall fans in room:	41,000 -6800 CFM or 34,200 CFM
Calculated average capacity per fan (specifications for all fans are same - 30" dia., 1 HP, 860 RPM, 10 blades) :	6800 CFM
Number of air changes per hour in room:	28.5

A total of seven air samples were collected in the cement house from noon to 3 p.m. on December 7, 1962. The samples were analyzed either for MEK (methyl ethyl ketone) whose threshold limit is 200 ppm, or for toluol (toluene) whose threshold limit is also 200 ppm. The sampling results are given in Table I.

Comments

Based on conditions actually observed during the investigation, and using the figured 10% solvent loss value, the estimated amount of dilution air provided the cement room (almost 15 million cubic feet per 6 hours) was theoretically sufficient to dilute the solvents evaporated to levels below their threshold limits or maximum allowable concentrations, since the calculated required amount of dilution air was less than 7 million cubic feet. It must be remarked, however, that rate of vapor evolution was not constant and that the mixing of dilution air with the solvent vapors was not homogeneous as demonstrated by the sampling results in Table I. This non-uniform mixing, it should be added, is one of the disadvantages of dilution ventilation as a hazards control method.

Sampling results given in Table I showed that in the general areas of the room, the vapor concentrations were either quite low or insignificant. But at mixer 7L, MEK vapor concentrations approaching the maximum allowable level were consistently recorded. And at one stage of the mixing cycle (dry ice cooling), a high concentration three times the MAC was found. Although the operators' weighted average exposure to MEK probably would not have exceeded the threshold limit value because of the limited amount of time they actually spent at the mixer, the fact that a hazardous concentration did occur must be seriously regarded.

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After a careful study of our ventilation data, we inclined to believe there definitely was a ventilation balance problem not only in the first floor cement house under investigation, but also in the second floor cement house as well. The exhausting of polluted air into adjoining work-rooms instead of to the outdoors, as was noted in this investigation, is considered as an undesirable situation.

Conclusions and Recommendations

Because of the fact that the solvent fumes control method used in the cement house is one of general ventilation or dilution ventilation, and because several different solvents of varying degree of toxicity are handled, it would be difficult to conclude generally that the ventilation in the room simply is, or is not, adequate. For the question of adequacy depends to a very large extent on what and how much solvents may be used. Thus, the ventilation should be very adequate when two or three smaller mixers are operated, especially if gasoline is the solvent used, and be inadequate when most or all of the mixers are simultaneously operated. In this consideration, the weather factor plays a pertinent role, too. One can naturally expect that more solvent would be evaporated, increasing thereby the dilution air requirement, in the hot summer months than in the cold season.

But now, if we should assume that the cement mixing activities we actually studied on December 7 to be representative (solvents consumption figures for a recent month supplied by the company appear to indicate that the assumption is reasonable), and that no step-up in production is anticipated, then we believe additional ventilation should not be considered as absolutely necessary. On the other hand, we must again point out that we did detect local high concentrations of MEK and we did find the fumes to be objectionable. So we strongly recommend that the operators be provided with U. S. Bureau of Mines approved respirators for protection against organic vapors. The operators should be instructed to wear these respirators when they are unloading the mixers or at other times when needed. In addition, we wish to offer the following recommendations.

(1) Make a resurvey of the cement room in the summer during which season some operators asserted the fumes condition is a lot more severe than in winter. We shall be pleased to undertake such a resurvey.

(2) Explore the feasibility of relocating some of the larger mixers as close as practicable to the outside wall in which the fans are mounted, and then use these relocated mixers as much as possible. Such a move would place the frequent fumes sources between the operators and the exhaust fans, to say nothing of converting in effect the four general exhaust fans into the more effective local exhaust systems.

(3) Investigate the feasibility of having cooling jackets built into the mixers. Continual removal of heat generated from mixing of the cement would cut down the solvent loss resulting in saving and also in a reduced atmospheric pollution load.

(4) Instruct the operators to keep the mixer covers closed during mixing and storage.

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(5) Make prompt repairs as soon as leaks are detected in the solvent lines.

We hope we have given an impartial and thorough appraisal of the cement problem under investigation. If you or other company officials or union representatives should have any questions regarding this report, we shall be pleased to be consulted. The help and cooperation given us in the investigation by all parties concerned are appreciated.

Very truly yours,

H. T. Yee

H. T. Yee
Industrial Hygiene Engineer
Division of Industrial Hygiene

HTY:bb

cc: Mr. McCloskey, Union

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Table I - Organic

Sample No.	Sampling Location	Solvent Vapor Analyzed	V
GY-XX-1	At mixer 7L (right hand corner)	M.E.K. (methyl ethyl ketone)	
GY-XX-2	Ditto	M.E.K.	
GY-XX-3	At mixer 7L (left hand corner)	M.E.K.	
GY-XX-4	In general area in southwest corner of room	M.E.K.	
GY-XX-5	In general area in southeast corner of room	M.E.K.	
GY-XX-6	At mixer 4M	Toluol	
GY-XX-7	At workmen's writing bench in northeast end of room	Toluol	

olvent vapor concentrations

Vapor concentration, ppm	Remarks
175	In mixer 7L a 150-gallon batch of cement with toluol solvent had been mixing for 1½ hours when sampling started.
145	Sample was taken a few minutes after GF-IR-1 was collected. Dry ice was being added to mixer 7L during last minute of sampling.
608	Cement in mixer 7L was being cooled with dry ice during entire sampling period.
56	
17	
1.5	In mixer 4M a 50-gallon batch of cement with toluol solvent was being mixed during entire sampling period.
0.2	On day this and previous samples were taken, three different mixers were being operated. Mixer 4R (100 gallon capacity), in addition to 7L and 4M, was also in operation.