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CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 79-74-653

STAR DUST HOTEL
LAS VEGAS, NEVADA

January 1980

I. SUMMARY

On April 5, 1979 the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from an authorized representative of the Teamsters Union (Local 995) to evaluate complaints of sewer odors associated with nausea, headache, and upper respiratory symptoms among telephone (PBX) operators employed at the Star Dust Hotel, Las Vegas, Nevada.

A NIOSH team conducted an industrial hygiene and medical evaluation of the telephone operators and of a comparison group of employees working in the adjacent auditing and personnel departments. The latter had separate air-conditioning systems. Area air samples were collected and analyzed for hydrogen sulfide (H_2S) and other volatile hydrocarbon contaminants. Toluene, tetrachloroethylene, and other hydrocarbons were detected, but at levels well below both the NIOSH ceiling and the OSHA recommended standard. The investigators could smell hydrogen sulfide-like odors, but none were detected using sampling equipment.

A medical questionnaire was administered to 20 of the 28 telephone operators on the day and evening shifts, 16 of 50 employees in the auditing department, and 3 members of the personnel department. Seventeen (85%) of the PBX operators noticed odors and 15 of the 17 also had symptoms. These were commonly burning and irritation of the throat, metallic taste in the mouth, and irritation of lips and skin. Employees in the comparison groups also noticed odors, but experienced milder and less frequent symptoms.

The sewage sump of an adjacent toilet was housed in the same room as the air-conditioning unit for the PBX area. Defective ducting in this room allowed entry of sewage fumes into the air-conditioning system. Also, the room was not under sufficient negative pressure to prevent sewage odors from escaping to the hallway outside. It was concluded that the PBX operators are exposed to H_2S gas that entered the air-conditioning system from the sewage sump. This exposure was at concentrations less

than the NIOSH recommended criteria, but was nonetheless offensive and irritating. It was recommended that the air-conditioning unit be renovated and relocated to prevent the sewage odors from entering the system. Also because of complaints among other workers, the air-conditioning system in the auditing department should be modified to ensure a greater flow of air.

II. INTRODUCTION AND BACKGROUND

On April 5, 1979 the National Institute for Occupational Safety and Health received a request for a health hazard evaluation from an authorized employee representative of the Teamsters Union (Local 995). The request alleged that since 1976 the telephone operators working in the PBX room of the Star Dust Hotel, Las Vegas were intermittently exposed to an irritant gas which smelt "like rotten eggs".* The employees complained of a metallic taste in mouth, nausea, headache, and throat irritation. Complaints had been registered with the hotel management, the Nevada Industrial Commission - Nevada Occupational Safety and Health Administration, and the Clark County Health Department, but their investigations failed to identify a toxic cause of the workers' illness. The Star Dust Hotel also hired a consulting firm (West Coast Technical Services) to carry out environmental sampling in the PBX room, but they did not detect any toxic chemical compounds. The company had recently monitored the PBX room with silica gel tubes, vacuum containers and a direct reading hydrogen sulfide instrument but no chemicals were detected.

In response to this request the NIOSH Regional Industrial Hygienist visited the hotel on May 26 and July 17, 1979 to carry out industrial hygiene surveys. These included studies of the ventilation system, collection of air samples, and interviews with workers (See Interim Report 1, May 5, 1979). Later in September, when workers reported more frequent irritating symptoms, a medical opinion was requested. The hotel was visited on a third occasion on October 7, 1979 for further medical and industrial hygiene studies.

III. HEALTH HAZARD EVALUATION

Twenty-eight telephone (PBX) operators (all female) are currently employed at the hotel on a schedule of 12 possible shifts for each 24-hour period. The PBX room (approximately 50' x 30') is located in the basement of the hotel adjacent to the auditing and personnel departments. Access to

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*Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) authorizes the Secretary of Health, Education, and Welfare, following a written request by an employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

both areas is by a stairway down to a common vestibule at one end. However, the PBX room is a closed area with a door whereas the auditing department is a larger open office space opening to the vestibule. Both areas have separate air-conditioning systems. Employees from all departments mingle socially during break periods in a television room between the two areas. They also share the same toilet facilities located off the vestibule. Adjacent to this is a small (6' x 9') room which houses both the sewage sump tank for the restroom (30 gallon capacity) and the air-conditioning unit for the PBX area. The tank has a non-airtight cover and the ejection system pumps sewage upwards into the main sewer line automatically whenever a float waste level is activated. It is reportedly treated with enzymes on a weekly basis.

The Air-Conditioning System

A 7.5 ton air-conditioning system which was reported to operate at 2900 cubic feet per minute (cfm), supplies air to both the restroom and the PBX room (3675 cubic feet). There are seven ducts supplying air in the PBX room, and one in the restroom. The average air flow velocity was measured to be 100 feet per minute (fpm) at each of the exhaust duct grilles. There are three exhaust air ducts: one above the PBX entrance doors; one in the vestibule; and one in the restroom. Also, an 8-inch make-up air duct extends upwards from the air-conditioning room to a height of 20 feet above the ground. This was reported to supply one-third of the make-up air. Make-up air also enters the basement via the stairwell.

IV. METHODS AND RESULTS

Industrial Hygiene Survey

Environmental air sampling for H_2S gas and volatile hydrocarbons was carried out using direct reading instruments, gas detector tubes, charcoal tubes and fluorosil tubes in the same locations. Area samples were taken from a position about 3 feet from the telephone operators, during day and swing shifts.

Environmental air sampling was carried out for:

a. Hydrogen Sulfide Gas. Eight NIOSH certified gas detector tubes (long and short term) (Drager^R)* were used to measure H_2S gas in the PBX room, the air-conditioning and sewer sump tank room, and the vestibule. Also, a direct reading instrument (Photo-Ionization detector - Model P-101) was calibrated and used to monitor H_2S gas.

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*Mention of commercial names or products does not constitute endorsement by NIOSH.

b. Unknown Contaminants Vacuum pumps were used to draw a known volume of air through collecting media (i.e., 150 milligram (mg) charcoal tubes or fluorosil tubes).

The charcoal tubes were desorbed with 1 milliliter (ml) of carbon disulfide and analyzed by gas chromatography using a 12 foot 10 percent SP2100 column. Some contaminants were identified using mass spectrometry.

The fluorosil tubes were desorbed with one ml ethyl acetate, sonified, and analyzed by gas chromatography using the same column as for the charcoal tube samples.

No measurable levels of H_2S gas were detected with the direct reading instruments; however, the investigators smelled sewer odors at several locations in the basement; especially in the sump tank room.

Only two contaminants (toluene and tetrachloroethylene) and a group of mixed hydrocarbons were identified. The levels of toluene and tetrachloroethylene were both well below the NIOSH recommended criteria of 100 ppm and 50 ppm, respectively (Table 1). The mixed total hydrocarbons identified included several chemicals normally found in the ambient air, but these were not individually identified.

Note: The permissible concentration for each contaminant (as recommended by NIOSH, The American Conference of Governmental Industrial Hygienist, or enforced by OSHA) is based upon the current state of knowledge concerning toxicity of these substances. The concentration is designed to allow an occupational exposure for up to a 10-hour day, 40-hour work week, as a time-weighted average (TWA) over a normal lifetime without the worker experiencing discomfort. The recommend levels for the substances identified in this survey are given below.

	TIME WEIGHTED AVERAGE (TWA)			
Substance	8-Hour	10-Hour	Ceiling Value	Minute
Hydrogen Sulfide*			10 ppm[a]	10
Toluene**		100 ppm	200 ppm	10
Tetrachloroethylene***		50 ppm	100 ppm	15

a -ppm - parts of a vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm. Hg. pressure.

* -NIOSH Criteria Document (1977). The OSHA Standard is 20 ppm ceiling concentration and 50 ppm maximum ceiling concentration for 10 minutes.

** -NIOSH Criteria Document (1973). The OSHA Standard is 20 ppm as an eight hour TWA with a maximum ceiling concentration of 500 ppm for 10 minutes.

*** -NIOSH Criteria Document (1976). The OSHA Standard is 100 ppm as an eight hour TWA with a maximum ceiling concentration of 300 ppm for 5 minutes per three hours.

The odor threshold of H_2S is reported in the literature at between .0005 and 0.02 ppm. Its smell is characteristically offensive (like rotten eggs). However, this is unreliable as a warning signal at higher levels because of olfactory fatigue that occurs at levels above 150 ppm. The threshold for detection using the instruments in this survey is 1 ppm.

A container of enzymes to be used for treatment of sewage in the sump was identified; but it was not clear who added the enzymes and how frequently.

The ventilation ducting for the air-conditioning unit in the sump tank room was in a poor state of repair. The seams had separated enabling sewage gas from the sump to enter the ventilation system. The room had a wall grille to allow make-up air to enter from the vestibule; however smoke tests revealed that the room was not under sufficient negative pressure to prevent the H_2S vapors from escaping to the outside.

Medical Studies

The complaints of the PBX operators that were officially submitted to the hotel management since May 1976 were collected and analyzed. The number of separate days per month when a complaint was submitted between May 1976 and October 1979 are shown in Figure 1. Complaints were particularly frequent during November 1977 and December 1978. On December 12, 1978 seven operators were overcome by odor at one time and were forced to leave work; two were seen briefly at the local hospital and later discharged. No extraordinary events were identified that would explain the higher frequency of complaints during November 1977, December 1978. and May 1979.

Questionnaire Survey

A questionnaire was administered to the telephone operators working on the day and evening shifts, and to a sample of employees working in the adjacent auditing and personnel departments. Twenty (71%) of the PBX operators were interviewed. Their ages ranged from 25 to 58 years (mean 44 years) and nine (45%) had worked as telephone operators at the hotel for more than 10 years. Seventeen (85%) of those interviewed had noticed unpleasant odors and 15 of these had also experienced symptoms. Most commonly the odors were described as "sulphurous" and "sewage-like"; however, five workers described an irritating "chemical acid smell" that burned the lips and skin. Some noted odors everyday and others as infrequently as 1-2 times per month. The commonest symptoms complained of were burning and irritation of the throat (13), irritation of the eyes (13), an unpleasant metallic taste in the mouth (9), and irritation of the lips and skin (10). Other less common complaints were of nausea, dizziness and somnolence. There was no particular pattern

to the occurrence of odors and symptoms. They were experienced at all times of the day and night and were not related to season or climatic conditions. Symptoms were equally common among smokers and non-smokers. Eight women gave a history of previous allergic reactions. However, symptoms were not more common in this group compared with those with no such history. Two operators who had the most severe symptoms gave a history of severe allergic reactions in the past and it was difficult to establish firmly that their recent symptoms resulted solely from exposure in the work place.

Sixteen of 50 employees in the adjacent auditing department and 3 members of the personnel department were also interviewed. In general, they were younger (average age 34) and had been employed at the hotel for a shorter time (average time 13 months). Of these, 14 complained of occasion faecal odors in their work place, which seemed to emanate from the vestibule area at one end. Eight workers reported mild symptoms of irritation of the eyes, throat, and upper respiratory tract. However, their commonest complaint was of "stale air", poor ventilation and bothersome cigarette smoke.

The symptoms experienced by these workers are compatible with the reported effects of exposure to low concentrations of H_2S. These include irritation of the eyes and the respiratory tract. Prolonged exposure at 50 ppm can cause rhinitis, pharyngitis, bronchitis, and pneumonitis. The recommended threshold limit value is set to prevent eye irritation. The instruments used in this survey could detect H_2S at a minimun concentration of 1 ppm which was considerably higher than that at which symptoms may occur.

V. CONCLUSION

None of the substances detected in environmental air samples exceeded the recommended NIOSH criteria or the OSHA standards. A hydrogen sulfide-like gas was detected intermittently only by odor and not by measuring instruments.

The symptoms of mild upper respiratory tract irritation and nausea experienced by the PBX operators are most probably caused by sewage fumes entering the air-conditioning system. The employees in the auditing and personnel departments also experienced the odors which seemed to enter their office area directly from the vestibule. Their milder and less frequent symptoms may be explained in part by the fact that their office has a separate air-conditioning system.

VI. RECOMMENDATIONS

1. Vapors from the sewer sump tank should be vented to the outside air since the covering on the tank is not airtight.

2. The tank effluent should be treated with chemical enzymes regularly and records of this kept.

3. The air-conditioning unit and the sewer sump tank, should be located in separate rooms so that there is no opportunity for the sewage gas to enter the air-conditioning system. The air-conditioning ducting should be repaired and maintained.

4. The room housing the tank should be under negative pressure to prevent sewage gas contamination of adjacent office areas.

5. The air-conditioning system in the auditing department should be modified to ensure a greater flow of air, especially in areas where non-smoking employees are troubled by cigarette smoke.

VII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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VIII. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to the following:

1. Star Dust Hotel, Las Vegas, Nevada.
2. Authorized Representative of the Teamsters Union Local No. 995, Las Vegas, Nevada
3. International Teamsters Union
4. NIOSH - Region IX
5. Nevada Industrial Commission - Occupational Safety and Health Administration
6. U.S. Department of Labor - Region IX

For the purpose of informing the approximately 80 "affected employees", the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where the exposed employees work.

IX. REFERENCES

1. Criteria For a Recommended Standard...Occupational Exposure to Hydrogen Sulfide, (1977) DPEW (NIOSH) Publication No. 77-158.

2. NIOSH Manual of Sampling Data Sheets, DPEW (NIOSH) Publication No. 77-158.

3. NIOSH Manual of Analytical Methods, DPEW (NIOSH) Publication No. 77-157.

4. Documentation of Threshold Limit Values, ACGIH, 3rd Ed, Cincinnati, Ohio, 1971.

5. Patty, F.A. Industrial Hygiene and Toxicology, Second Revised Ed., Vol. II, Interscience Publishers, New York, 1976.

6. Gregory Leonardos, David Kendall, and Nancy Barnard, Odor Threshold Determination of 53 Odorant Chemicals. J. Air Pollution Control Assoc. Vol. 19 No. 2 pp 91-95, Feb. 1969.

7. Occupational Diseases, A Guide to Their Recognition, U.S. Department of Health, Education and Welfare, DHEW (NIOSH) Publication No. 77-181.

8. American Conference of Governmental Industrial Hygienists: TLV's - Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Air, Ed 3, 1971. Cincinnati, ACGIH, 1976, p. 132.

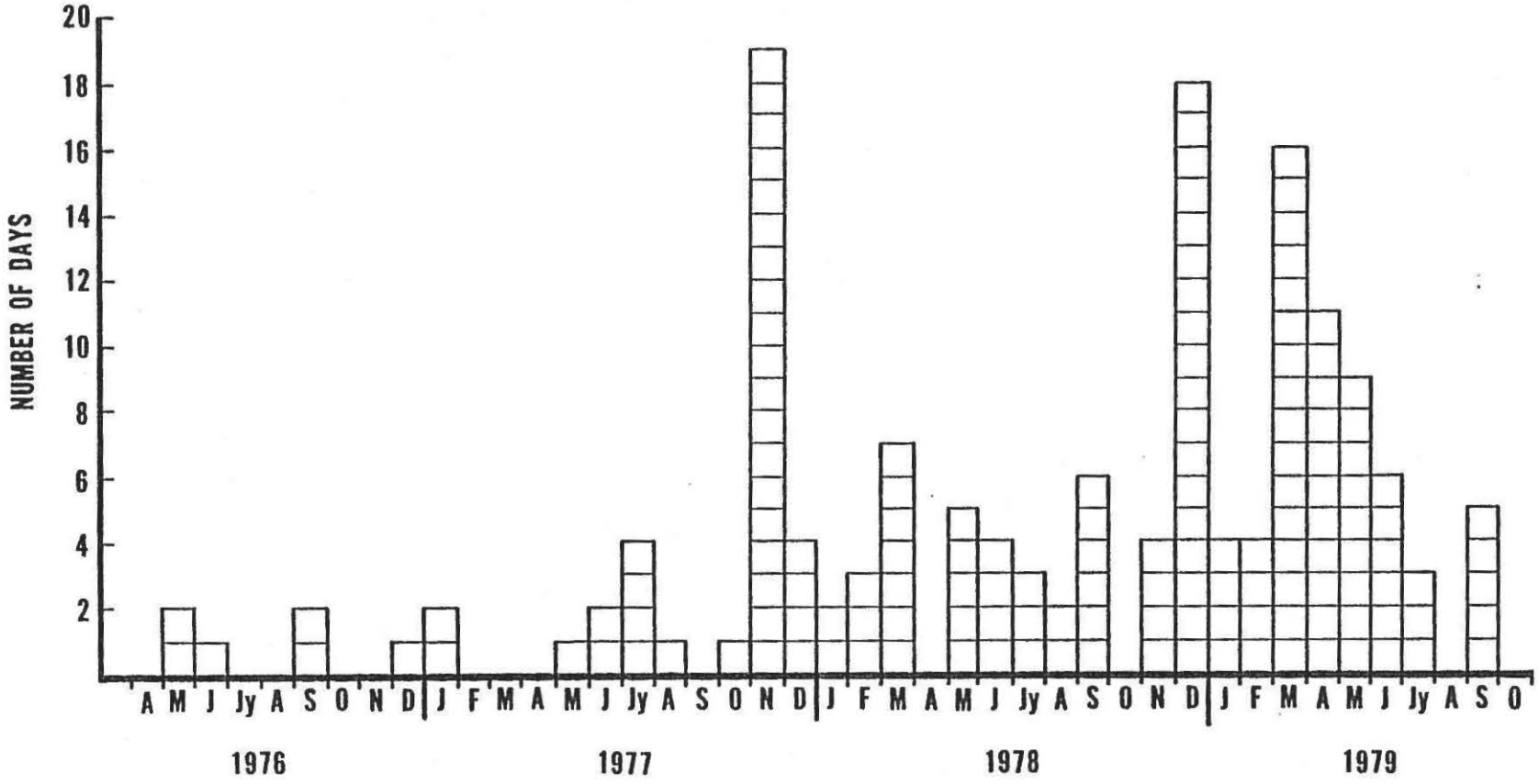
TABLE I
Area Samples Collected on Charcoal Tubes
for Analysis of Volatile Air Contaminants

Star Dust Hotel
Las Vegas, Nevada

Date	Number	Job Description or Location	Sample Volume(Liters)	Sample Period(Hrs)	Concentration-PPM[1] Toluene	Concentration-PPM[1] Perchloroethylene	Total (mg/m^3)[2] Hydrocarbons
7/17	1	PBX Room, between operators	570	11:05-17:25	N.D.	0.02	0.63
7/17	2	PBX Room, between operators	300	11:05-17:25	0.03	0.05	0.97
7/17	3	PBX Lobby	560	11:10-17:25	0.01	0.03	0.66
7/17	4	Air-Conditioning-Sump Tank Room	550	11:10-17:25	0.01	0.02	0.33
7/18	5	PBX Room, between operators	480	15:30-21:30	0.01	0.04	0.67
7/18	6	PBX Room, between operators	480	15:30-21:30	N.D.	0.02	0.35
7/18	7	PBX Lobby	480	15:30-21:30	N.D.	0.03	0.31
7/18	8	Air-Conditioning-Sump Tank Room	480	15:30-21:30	0.01	0.05	0.46

1. PPM - Parts of a gas or vapor per million parts of contaminated air by volume.
2. mg/m^3 - Approximate milligrams of contaminant per cubic meter of air.

NIOSH Criteria:
1. Toluene - 100 ppm
2. Perchloroethylene - 50 ppm



Number of days per month with one or more complaints registered by PBX operators.
Stardust Hotel Las Vegas - May 1976-September 1979.