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

HEALTH HAZARD EVALUATION DETERMINATION REPORT 78-38-512
TRANS WORLD AIRLINES CORPORATION
LOS ANGELES, CALIFORNIA

JULY 1978

I. TOXICITY DETERMINATION

It has been determined at the Trans World Airlines (TWA) Maintenance Base, Los Angeles, California, that:

1) Exposure of workers to methyl chloroform and trichloroethylene at the ultrasonic cleaning operation are not at toxic concentrations. This determination is based on the low levels measured in the samples collected and the work practices observed.

2) Exposures of spray painters to octane, nonane, acetone, isopropyl alcohol, methyl ethyl ketone, toluene, xylene, and isobutyl acetate are not at toxic concentrations for the specific paint spraying job studied. This determination is based on the low levels measured in the samples collected and observations of work practice. Paint spraying jobs are highly variable at TWA and chemical exposures will reflect this variability.

3) Exposure of the oven cleaner to butyl cellosolve was not at toxic concentrations. This determination is based on the low levels of butyl cellosolve in the samples collected.

4) From the medical study, only one employee had a condition which could be related to the work environment. The body repair mechanic had developed nasal irritation from dust entering an improperly fitted respirator.

5) From a review of the medical data, the inplant medical program seemed to be lacking in several areas to adequately monitor employee exposure to potentially toxic agents.

The above conclusions and determinations were based on on-site evaluations conducted by the National Institute for Occupational Safety and Health (NIOSH) and the California Occupational Safety and Health

Administration (CAL/OSHA) representatives. More detailed information is contained in the body of the report. Recommendations by NIOSH are included in Section V of this report.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from the National Institute for Occupational Safety and Health, 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 Service (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:

(a) Trans World Airlines, Los Angeles, California

(b) U.S. Department of Labor, Region IX

(c) CAL/OSHA

(d) NIOSH, Region IX

(e) Authorized Representative of Employees - Lodge No. 1111, International Association of Machinists and Aerospace Workers, El Segundo, California.

For the purpose of informing the approximately 80 affected employees, the employer will post the report in a prominent place(s) accessible to the employees for a period of 30 calendar days.

III. INTRODUCTION

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 from any 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.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees of the International Association of Machinists and Aerospace Workers (IAM&AW),

Lodge No. 1111, concerning the health hazards from exposure to various chemicals used at the Trans World Airlines Maintenance Shop at the Los Angeles International Airport.

The designated State Agency in California (CAL/OSHA) entered into an investigation of TWA approximately one week after NIOSH's initial visit to the maintenance facility. Many of the maintenance operations at TWA were very sporadic and did not occur every day. CAL/OSHA conferred with NIOSH after its visit to TWA and it was decided by NIOSH to conduct a partial joint investigation with CAL/OSHA because the operations were sporadic and because CAL/OSHA's office was located in Los Angeles with easier access to TWA. For the purposes of this hazard evaluation, NIOSH investigated TWA's medical monitoring program and utilized the data from CAL/OSHA's environmental survey.

IV. HEALTH HAZARD EVALUATION

A. Description of Plant Process

On February 3, 1978, an initial visit to the TWA maintenance base was made by NIOSH. The TWA maintenance base consists of one main building with two hangars and several smaller shops. Many routine maintenance procedures are performed here while more extensive overhaul work is done in Kansas City, Missouri. In terms of a 40 hour work week, most of the operations surveyed would be considered sporadic in nature.

The chemical exposure causing the greatest amount of concern to the requestor was the "dy-check" procedure where checks were made for cracks in the wing section of the aircraft. Inspectors entered the cabin and used Turco "dy-check" chemicals on the aircraft underneath the floor of the cabin. Turco products (cleaners, penetrants, developers, and removers) were applied with spray cans. One inspector averaged about two hours per month exposure to "dy-check" chemicals in an enclosed area of the aircraft. Respiratory protection is not mandatory. About 40 inspectors are employed for all three shifts. Bulk samples of the Turco "dy-chek" products were analyzed by the CAL/OSHA laboratory. The "dy-check" developer contained freon 11 and 12, nitromethane, and petroleum distillates. The "dy-chek" remover was essentially isopropyl alcohol. The cleaner that was used and analyzed was a Magnaflux Company product (Zyglo cleaner) instead of the Turco "dy-chek" cleaner. The Zyglo cleaner contained freon 12, methyl chloroform, nitromethane, perchloroethylene, and dioxane.

There were several other sporadic operations surveyed by NIOSH during the initial visit. A small amount of paint stripping is done at the maintenance base on small aircraft parts such as doors. The stripping

can be done both indoors and outdoors. Cee-Bee Company A-29 SCW stripper is used. According to the material safety data sheet it contains mainly methylene chloride with small amounts of methanol, toluene, ammonia, and methyl cellosolve acetate. Paint stripping is done only a couple of hours a month. Painting is done in a spray room. According to TWA, painting is also sporadic and is done only several hours per week. If there is a color change (every several years), however, the painting load increases. Respiratory protection is used by painters who number five for the three shifts. The chemical exposures would depend upon the paint that was used.

Other sporadic operations included occasional use of epoxies, glues, sealants, etc. None of the above described operations were in progress during the time of NIOSH's visit.

Three jobs required employees to work with chemicals every day (but not necessarily all day). One employee was responsible for cleaning aircraft ovens with Oakite CRX oven cleaner. An analysis of the bulk sample by CAL/OSHA's laboratory indicated that it contained a small amount of sodium hydroxide and 2-butoxy ethanol (butyl cellosolve). This employee wore a respirator (not mandatory) while cleaning ovens, but the physical condition of the respirator was unacceptable in the opinion of the NIOSH investigator. One employee operated an ultrasonic cleaner which was located outdoors in a covered lean-to. This worker wore a respirator whenever he entered the lean-to. The Turco Jetisoil cleaning compound contained, according to the material safety data sheet, trichloroethylene, petroleum distillates, and cresylic acid. One employee did body repair work on trucks outdoors. He worked with a polyester resin and wore a respirator during the sanding of the body filler material. This employee was one of 35 garage mechanics at TWA but only he did body repair work.

B. Evaluation Methods

1. Environmental

Environmental samples were collected by CAL/OSHA on the operations which were on-going or could be arranged. These jobs included the oven cleaning, ultrasonic cleaning, and paint spraying operations. "Dy-chek" operations were done so infrequently that neither NIOSH nor CAL/OSHA could arrange an environmental survey with TWA.

2. Medical

City of Hope National Medical Center, Duarte, California, was contracted by NIOSH to conduct an initial medical survey at TWA. Seven employees

were pre-selected by the IAM&AW employee representative for medical assessment. The Health Hazard Evaluation request was generated by worker inquiries. These workers were included in the seven pre-selected employees. Other workers interviewed were considered to be representative of current jobs at TWA even though they did not bring up the question of job-related health problems.

Each person was interviewed by the City of Hope contractor using the NIOSH Health Hazard Evaluation Survey Employee Interview Questionnaire which included an occupational and non-occupational medical history administered in a non-direct manner. However, when positive responses (e.g., symptoms) were elicited, specific questions were asked to determine the occupational or other nature of these complaints. Additionally, the inplant medical records of five interviewed employees were reviewed, the CAL/OSHA occupational illness reporting forms covering 1974-1978 were read, and a meeting with the TWA medical director was held to discuss the plant medical program. The results of these interviews and reviews were used to determine the necessity of further medical follow-up or any recommendations.

C. Evaluation Criteria

1. Environmental

The evaluation criteria were either the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's) for particular substances or NIOSH Criteria Documents. In California, CAL/OSHA enforces ACGIH TLV's. The following table contains TLV's and/or existing NIOSH recommended limits.

	ACGIH TLV	NIOSH CRITERIA DOCUMENT
Trichloroethylene	100 ppm	100 ppm
Methyl Chloroform	350 ppm	--
Acetone	1000 ppm	--
Isopropyl Alcohol	400 ppm	400 ppm
Methyl Ethyl Ketone	200 ppm	--
Toluene	100 ppm	100 ppm
Xylene	100 ppm	100 ppm
Isobutyl Acetate	150 ppm	--
Butyl Cellosolve	50 ppm	--
Octane	300 ppm	75 ppm*
Nonane	200 ppm	--

*NIOSH recommends a limit of 350 milligrams per cubic meter of air (approximately 120 ppm) for alkanes (C_5-C_8) with five to eight carbon atoms. If octane (C_8) alone is present, the NIOSH recommended limit is 75 ppm.

Only the environmental limits in parts per million (ppm), based on a time-weighted average for a work shift, for the substances found in the CAL/OSHA samples are listed in the above table. Chemicals which can become airborne during many of the unsampled sporadic operations are not listed.

2. Medical

Only medical criteria for chemicals listed in the environmental criteria section are discussed in this section of the report.

a. Trichloroethylene

The major adverse effects of trichloroethylene overexposure include headache, dizziness, tremors, nausea, vomiting, sleepiness, fatigue, a feeling of light-headedness or drunkeness increasing to unconsciousness.[1] Adverse effects on the kidney and liver are considered rare. There is also some evidence that trichloroethylene may be a carcinogen, but the data is inconclusive.

b. Methyl Chloroform

Methyl chloroform (1,1,1-trichloroethane) acts as a narcotic like many other organic solvents and depresses the central nervous system. Acute exposure effects include dizziness, incoordination, drowsiness, and unconsciousness. The liquid and vapor is irritating to the eyes and repeated skin contact may cause dermatitis.[2]

c. Acetone

High acetone concentrations can irritate the conjunctiva and the mucous membranes of the nose and throat. In higher concentrations, narcosis is produced with such symptoms as headache, nausea, vomiting, dizziness, and unconsciousness.[3]

d. Isopropyl Alcohol

Isopropyl alcohol vapor is a mild irritant to the eyes, nose, and throat. Adverse skin effects are minimal. In summarizing the effects of isopropyl alcohol on humans, no cases of industrial poisoning by ingestion are recorded in the literature. However, there are reported cases of poisoning among chronic alcoholics, but these reports are not valid for assessing the clinical picture of industrial exposure because of pre-existing disorders among the chronic alcoholics studied. In general, isopropyl alcohol intoxication from ingestion manifests itself in nausea, vomiting, headache, dizziness, depression, and coma with or without shock.[4]

e. Methyl Ethyl Ketone

Methyl ethyl ketone produces similar effects to those of actone. High vapor concentrations can cause eye, nose, and throat irritation. Skin contact can cause dermatitis. In high concentrations, narcosis is produced with symptoms of headache, dizziness, nausea, incoordination, and unconsciousness.[5]

f. Toluene

Toluene may cause irritation of the eyes, respiratory tract, and skin. Acute exposure to toluene results in central nervous system depression. Signs and symptoms include headache, dizziness, muscular weakness, drowsiness, staggering gait, skin paresthesias, collapse, and coma.[6]

g. Xylene

Symptoms of overexposure to xylene include headaches, nausea, and dizziness. Additionally, irritation of the eyes, nose, and throat is common. Skin dermatitis can also develop from liquid contact. Effects upon the liver and kidney have also been reported in the literature.[7]

h. Isobutyl Acetate

The acetates, in higher concentrations, are irritants to the mucous membranes. All of them irritate the eyes and nasal passages in varying degrees. All acetates can cause headaches, drowsiness, and unconsciousness if concentrations are high enough.[8]

i. Butyl Cellosolve

Butyl cellosolve (ethylene glycol monobutyl ether) is one of the ethylene glycol ethers. The vapor may cause conjunctivitis and upper respiratory tract irritation. Acute exposures can result in narcosis, pulmonary edema, and severe kidney and liver damage.[9]

j. Octane and Nonane

In the NIOSH Criteria Document, alkanes are considered to be those straight or branched-chain saturated hydrocarbons containing from five to eight carbon atoms. In practice, alkanes are available as mixtures of two or more isomers. Thus octane (C_8) would fall under the NIOSH definition of alkanes, but nonane (C_9) would not. Since the alkanes are usually mixtures, the effects on humans were difficult to attribute to one compound. In general, overexposure to alkanes result in central nervous system depression.

Irritation of the upper respiratory tract and skin is common and a dermatitis can result.[10] At least one alkane (hexane) has neurotoxic properties. Hexane is implicated in the causation of peripheral neuropathy.

D. Evaluation Results and Discussion

1. Environmental

Environment samples were collected by CAL/OSHA at three different operations. Charcoal tube samples were taken in the operator's breathing zones using MSA Model G pumps. Samples by CAL/OSHA were collected at a rate of one liter per minute and were taken for the length of the operation. The three operations were the ultrasonic cleaning, oven cleaning, and paint spraying jobs. These were the only jobs that ran with any regularity and even these operations did not run continuously for a full shift. The job that the requestor was most interested in, "dy-cheking," was not scheduled during either NIOSH's or CAL/OSHA's visits to TWA, and scheduling of "dy-cheking" could not easily be arranged. The results of the samples are listed in Table I.

On April 3, 1978, four charcoal tube samples were collected in the breathing zone of the employee who operated the ultrasonic cleaning bath. The four samples covered a total time period of 64 minutes. These samples covered the total time of the worker in the ultrasonic cleaning area. The methyl chloroform levels ranged from 4 to 182 ppm. The average for the 64 minutes was 45 ppm. The time-weighted average (TWA) over a full work shift, if calculated, would be much lower. The CAL/OSHA standard for methyl chloroform is 350 ppm. Thus, the ultrasonic cleaner's exposure to methyl chloroform was extremely low. His exposure to trichloroethylene ranged from 1-7 ppm. The average was about 2 ppm. The TWA would be even lower. The CAL/OSHA standard and the NIOSH recommended limit is 100 ppm for trichloroethylene. The ultrasonic cleaner's exposure to trichloroethylene was minimal.

On April 4, 1978, two samples were collected on a spray painter in the spray room. Painting was not done every day and the total time period for the samples covered 26 minutes. Several solvents (octane, nonane, acetone, isopropyl alcohol, methyl ethyl ketone, toluene, xylene, and isobutyl acetate) were isolated from the charcoal tube samples and these compounds are also listed in Table I. In terms of the TLV's (CAL/OSHA standards), the spray painter's exposure to these solvents individually were extremely low. If the equivalent exposure of the mixture of solvents is calculated for each of the samples, they are approximately 0.34 and 0.30 respectively. If the equivalent exposure exceeds unity (1.0), the combined exposure of all the solvents in the mixture would be considered excessive. These samples covered only a total of 26 minutes for that particular day and the time-weighted average, if calculated, would be even lower. Exposures of painters to chemicals during days when painting is done for longer time periods or using other paints may be different.

On April 4, 1978, four samples were collected on the oven cleaner. An analysis of the bulk sample of the oven cleaning compound (Oakite CRX) showed a small amount of sodium hydroxide and butyl cellosolve. The remainder was mostly a detergent. Sodium hydroxide samples were not taken, but measurable levels of butyl cellosolve were found. Four samples were collected covering 69 minutes which covered the total time the oven cleaner actually worked with Oakite CRX. The butyl cellosolve levels were 0.0, 0.0, 1.0, and 2.0 ppm in the four samples. The TLV for butyl cellosolve is 50 ppm. Thus, the oven cleaner's exposure to butyl cellosolve was minimal.

2. Medical

Seven employees were pre-selected by the union for medical assessment. Only six were available when the NIOSH contract medical team made their visit to TWA (April 24, 1978). The job classifications studied included inspector, tire shop mechanic, aircraft and power plant mechanic, body work mechanic, painter, and general maintenance. (The general maintenance worker had been an oven cleaner for 16 years before switching jobs one month previous to the interview.) For all three shifts, 40 inspectors, 5 painters, and 38 mechanics are currently employed. The priority list of employees included mainly workers who were concerned about health effects that might be related to work.

All six workers were male. Their ages ranged from 42 to 61 years with an average of 51.8 years. The mean duration of their employment was 22.5 years (13-31 years). Only one employee, the body work mechanic, complained of a job related condition, "pimples and irritation in nostrils," which was no longer present. He stated that this had developed six months previously and was due to the dust being trapped under his respirator from sanding the plastic body filler. The body work is done outdoors and this employee works on TWA trucks all day.

One employee, presently an inspector, had suffered a myocardial infarction in 1971. His personal physician had told him then that this was due to the emotional pressure of the job. Except for occasional extrasystoles, which occurred during strenuous exercise or under emotional stress, he stated to be asymptomatic and to jog 8-10 miles per day. He stopped smoking in 1971. His work with chemicals involved the use of "dy-chek" spray cans for one to two hours per month.

Another employee, a painter, gave a history of shortness of breath which he did not feel was related to his work. Moreover, during January of this year, he was hospitalized for fainting spells on an outing and the treating physician stated he had "the lungs of a 70 year old man." On further

questioning, he could not recall having any pulmonary function tests since January. He has smoked about one pack of cigarettes daily for 33 years. This worker stated that he felt the spray room was inadequately ventilated.

Review of the CAL/OSHA Forms 102 and 200 for 1974 through the first quarter of 1978 showed that three occupational skin conditions had been recorded, one each during 1978, 1977, and 1976. All three had occurred in Fleet Service Workers and none involved any lost time. The fourth occupational disease was a respiratory condition which occurred in 1977 in a maintenance worker and resulted in one day of lost time. Additionally, one case of chemical conjunctivitis and one of tenosynovitis had been misrecorded as occupational injuries. During this review it was found that the CAL/OSHA Forms 102 and 200 were filled out by non-medical clerical personnel, apparently with little or no input from the inplant medical department staff.

The inplant medical records review of the interviewed workers who gave written permission did not turn up any information that could be ajudged as related to occupational exposure to toxic agents. Information obtained during the meeting with the inplant Medical Director disclosed the absence of any type of periodic medical surveillance program for employees in any of the maintenance jobs.

E. Conclusions

1. Environmental

The operations at the TWA maintenance base were very sporadic and were hard to characterize. The operations that were sampled by CAL/OSHA (ultrasonic cleaning, oven cleaning, and paint spraying) were considered more routine, but even these jobs were intermittent. The levels of chemicals found in the work atmosphere were not very high in terms of the evaluation criteria used here. The "dy-chek" operation could not be investigated.

The respirator program at TWA was poor and did not meet the minimal respirator program that was required in the CAL/OSHA regulations. During NIOSH's initial visit, respirators were found in deteriorated condition, an uncertified respirator was being used in the tire shop and expired certifications on fresh chemical cartridges were discovered in the supply room.

2. Medical

After reviewing the information and data obtained, the following conclusions are made:

a. Garage mechanics who work with the automobile body filler material can develop dermatitis from the dust unless proper protective measures are taken.

b. The potential for sporadic and short term exposures to a variety of chemicals is real, but little data indicating that these exposures were causing adverse effects could be substantiated.

c. The inplant medical program needs some improvement in order to insure that worker health is being adequately monitored.

V. RECOMMENDATIONS

1. The "dy-chek" operation should be monitored environmentally by TWA's industrial hygiene section to see if short-term exposures to the chemicals in the "dy-chek" spray cans are excessive to the inspectors.

2. The respirator program should be upgraded to meet the minimal respirator program requirements under CAL/OSHA.

3. The Medical Department should consider instituting periodic medical surveillance programs appropriate to the toxic nature of the occupational exposures: e.g., chest x-rays and pulmonary function tests for body repair garage mechanics and painters; liver and kidney function tests for workers exposed to chlorinated hydrocarbons and other hepato and nephrotoxic agents; and skin and eye examinations for workers exposed to acute irritants and sensitizers. Pertinent information on some of the compounds used at TWA can be found in NIOSH Criteria Documents and Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, June 1977.

4. Review of the accuracy of information recorded on CAL/OSHA Forms 102 and 200 should be the responsibility of the Medical Department at TWA.

VI. REFERENCES

1. NIOSH: "Criteria for a Recommended Standard...Occupational Exposure to Trichloroethylene," Department of Health, Education, and Welfare, Publication No. (NIOSH) 73-11025, 1973.

2. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, pp. 215-216, 1977.

3. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, pp. 192-193.

4. NIOSH: "Criteria for a Recommended Standard...Occupational Exposure to Isopropyl Alcohol," DHEW Publication No. (NIOSH) 76-142, 1976.

5. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, pp. 192-193.

6. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, pp. 242-243.

7. NIOSH: "Criteria for a Recommended Standard...Occupational Exposure to Xylene," DHEW Publication No. (NIOSH) 75-168, 1975.

8. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, p.175.

9. NIOSH: Occupational Diseases: A Guide to their Recognition, Revised Edition, DHEW (NIOSH) Publication No. 77-181, pp. 162-163.

10. NIOSH: "Criteria for a Recommended Standard...Occupational Exposure to Alkanes (C_5-C_8)," DHEW Publication No. 77-151, 1977.

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TABLE I. AIRBORNE CONCENTRATIONS OF SELECTED CHEMICAL SUBSTANCES BY OPERATION IN BREATHING ZONE SAMPLES COLLECTED BY CAL/OSHA ON APRIL 3-4, 1978, AT THE TWA MAINTENANCE FACILITY, LOS ANGELES, CALIFORNIA, AND THE EVALUATION CRITERIA (TLV'S) USED.

Sample #	Date	Job or Operation	Sample Time	MCL[1]	TCE[2]	OCT[3]	NON[4]	ACE[5]	ISA[6]	MEK[7]	TOL[8]	XYL[9]	IAC[10]	BC
TW 1	4/3/78	Ultrasonic Cleaning	18 min	145ppm	1ppm	-*	-	-	-	-	-	-	-	-
TW 2	4/3/78	Ultrasonic Cleaning	19 min	4ppm	7ppm	-	-	-	-	-	-	-	-	-
TW 3	4/3/78	Ultrasonic Cleaning	8 min	4ppm	1ppm	-	-	-	-	-	-	-	-	-
TW 4	4/3/78	Ultrasonic Cleaning	19 min	182ppm	7ppm	-	-	-	-	-	-	-	-	-
TW 40	4/4/78	Spray Painting	13 min	-	-	6ppm	5ppm	15ppm	7ppm	6ppm	13ppm	5ppm	8ppm	-
TW 41	4/4/78	Spray Painting	13 min	-	-	14ppm	2ppm	10ppm	7ppm	7ppm	8ppm	5ppm	9ppm	-
TW 50	4/4/78	Oven Cleaning	18 min	-	-	-	-	-	-	-	-	-	-	ND
TW 51	4/4/78	Oven Cleaning	17 min	-	-	-	-	-	-	-	-	-	-	1p
TW 52	4/4/78	Oven Cleaning	17 min	-	-	-	-	-	-	-	-	-	-	2p
TW 53	4/4/78	Oven Cleaning	17 min	-	-	-	-	-	-	-	-	-	-	ND

*(-) - Not sampled for
**ND - Below limits of detection by the analytical method used
[1]MCL - (methyl chloroform) TLV = 350 parts per million (ppm)
[2]TCE - (trichloroethylene) TLV = 100 ppm
[3]OCT - (octane) TLV = 300 ppm
[4]NON - (nonane) TLV = 200 ppm
[5]ACE - (acetone) TLV = 1000 ppm
[6]ISA - (isopropyl alcohol) TLV = 400 ppm
[7]MEK - (methyl ethyl ketone) TLV = 200 ppm
[8]TOL - (toluene) TLV = 100 ppm
[9]XYL - (xylene) TLV = 100 ppm
[10]IAL - (isobutyl acetate) TLV = 150 ppm
[11]BC - (butyl cellosolve) TLV = 50 ppm