Role of Laboratory in Chemical Disasters

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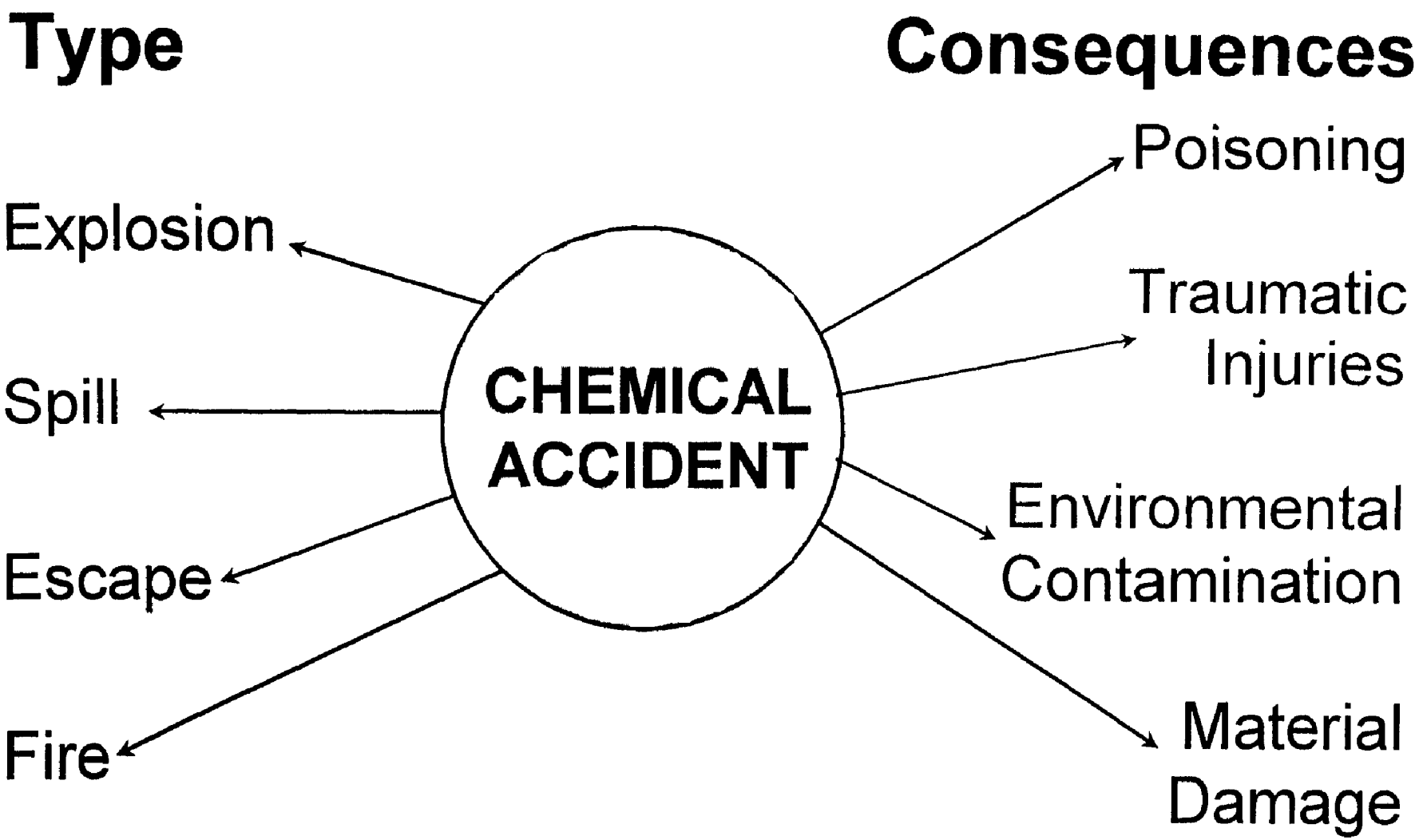
CHEMICAL ACCIDENT



CHEMICAL ACCIDENTS

Historically, most products involved in chemical accidents are in their gaseous state.

Examples

YEAR	PLACE	PRODUCT	DEAD	POISONED PEOPLE
1972	FLIXBOROURGH, U.K.	CYCLOHEXANE	28	89
1976	SEVESO ITALY	DIOXINE TCDD	0	193
1978	LOS ALFAQUES, SPAIN	PROPYLENE	216	200
1981	MONTANA, MEXICO	CHLORINE	29	1000
1983	BOPHAL, INDIA	METHYL ISOCYANATE	2500	50000
1993	BUENOS AIRES, ARGENTINA	HYDROGEN CYANIDE	7	10
1995	TOKYO, JAPAN	SARIN	12	5000

Examples of combustion products

Combustion product:	**Material:**
Carbon monoxide	Most materials
Hydrogen cyanide	Wool, cotton, silk, polyurethanes
Nitrogen oxides	Nitrocellulose, polyamides
Hydrogen chloride	Polyester resins (some) Polyvinyl chloride (PVC) Chlorinated hydrocarbons
Sulphur dioxide	Sulphur compounds, coal, mineral oil
Isocyanates	Polyurethanes
Acrolein	Petroleum products
Phosgene	Polyvinyl chloride
Ammonia	Polyamides, wool, silk, phenol resins
Hydrogen fluoride	Teflon (polytetrafluoroethylene) and other fluoride-containing compounds
Bromic acid	Bromine-containing compounds

CHEMICAL ACCIDENTS

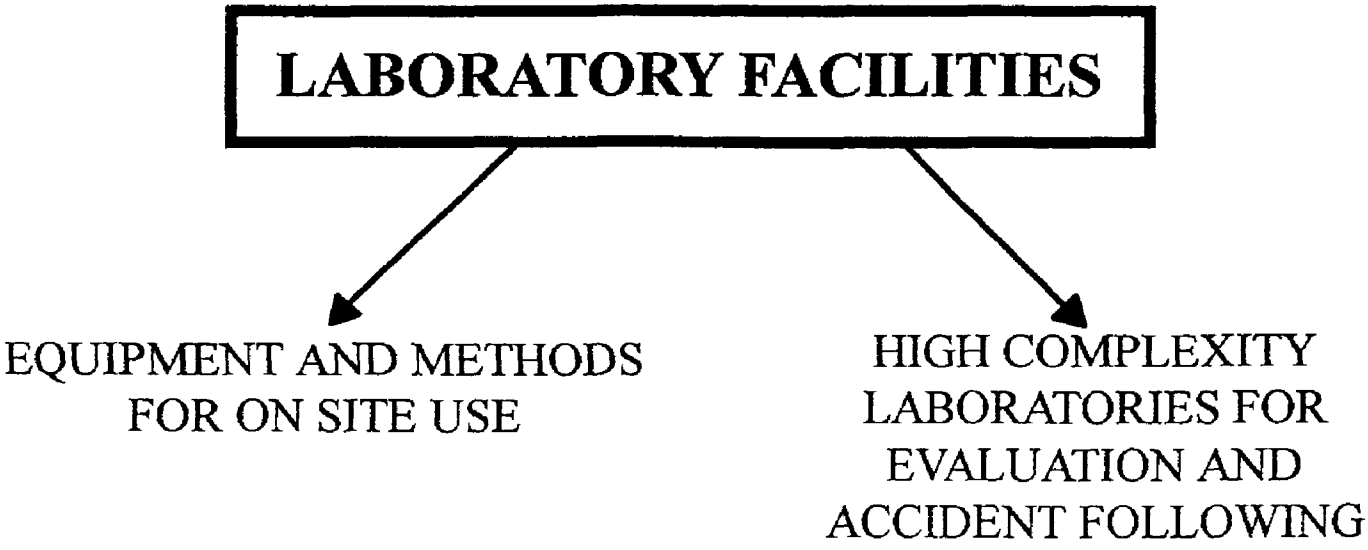
LABORATORY ROLES :

- IDENTIFICATION OF CHEMICAL AGENT(S) IN THE SCENE

- BIOLOGICAL MONITORING VICTIMS

- ENVIRONMENTAL MONITORING (AIR, SOILS, WATER, ETC.)

CHEMICAL ACCIDENTS



CHEMICAL ACCIDENTS

LABORATORY FACILITIES

ANALYTICAL SUPPORT LEVELS

LEVEL 1:	Field screening
LEVEL 2:	Field analysis
LEVEL 3:	Laboratory analysis using primarily methods
LEVEL 4:	Routine Analytical Services
LEVEL 5:	Non-standard methods

CHEMICAL ACCIDENTS

LABORATORY FACILITIES

PARAMETER INFORMATION

PRECISION

ACCURACY

SENSIBILITY

DETECTION LIMIT

REPRESENTATIVENESS

COMPLETENESS

COMPARABILITY

CHEMICAL ACCIDENTS

LABORATORY FACILITIES

EQUIPMENT AND METHODS FOR ON SITE USE:

REQUIREMENTS:

EASY TO OPERATE
DIRECT READING
ABLE TO GENERATE RELIABLE AND USEFUL RESULTS
LIGHT
PORTABLE AND RUGGED
LOW COST

CHEMICAL ACCIDENTS

FIELD SCREENING FIRST OPERATION

1) RADIOACTIVITY

2) OXYGEN INDICATOR :

NORMAL	:	20,8 %	
HIGH	:	25 %	Increase the risk of combustion
LOW	:	19,5 %	Use protection equipment respiratory protection is needed.

3) COMBUSTIBLE GAS INDICATORS - EXPLOSIMETER : Allows to determine the explosion risk according to the gas concentration present.

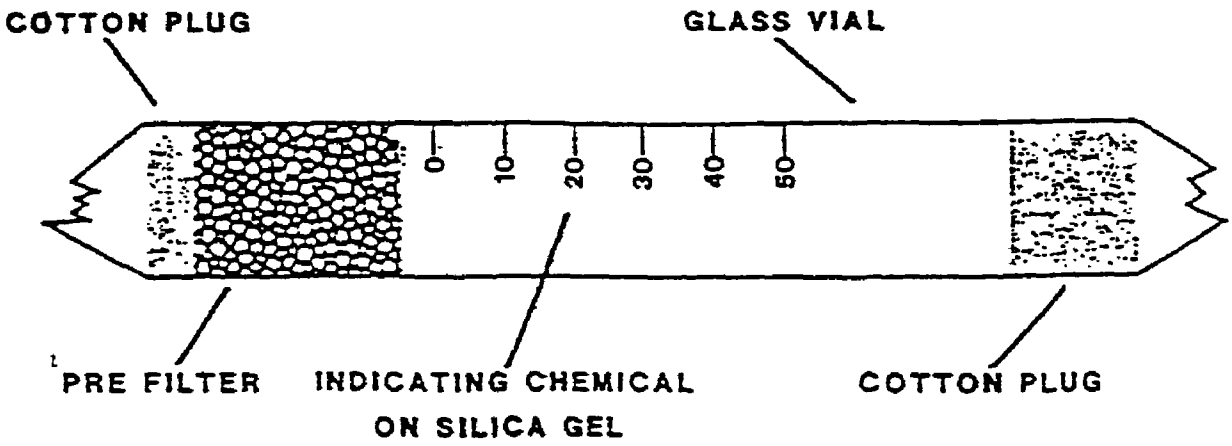


FIGURE 2-1

DIRECT-READING COLORIMETRIC INDICATOR TUBE

Gases — Vapors — Dusts — Fumes — Mists		Measurable Range	(A) Threshold Limit Value	(B) Interferences
Acetaldehyde		25 — 1000 PPM	200 PPM	Turpentine, other Aldehydes
Acetonitrile		10 — 200 PPM	40 PPM	H_2S, Halogen, Nitrogen & Hydrocarbon Compounds
Acetylene		3 — 600 PPM	[illegible]	Ammonia, H_2S, CO, Hydrocarbons
Acrylonitrile		5 — 150 PPM	20 PPM	H_2S, Halogen, Nitrogen & Hydrocarbon Compounds
Ammonia		10 — 1500 PPM	50 PPM	Acid gases
n-Amyl Alcohol		25 — 2000 PPM	[illegible]	Other Alcohols
iso-Amyl Alcohol		50 — 1000 PPM	100 PPM	Other Alcohols
sec-Amyl Alcohol		25 — 2000 PPM	[illegible]	Other Alcohols
tert.-Amyl Alcohol		25 — 2000 PPM	[illegible]	Other Alcohols
Arsine		0.025 — 1.0 PPM	0.05 PPM	Stibine, Phosphine
Benzene (benzol)		5 — 200 PPM	25 PPM	Aromatic, Aliphatic Hydrocarbons
Bromine		5 — 75 PPM	0.1 PPM	H_2S, NH_3, NO_2, Ethylene, Halides
		5 — 200 PPM	0.1 PPM	H_2S, NH_3, NO_2, Ethylene, Halides
Bromobenzene (Mono)		10 — 800 PPM	[illegible]	Aromatic, Aliphatic Hydrocarbons
Butadiene (1, 3-butadiene)		100 — 4000 PPM	1000 PPM	———
2-Butoxy Ethanol (butyl cellosolve)		30 — 900 PPM	50 PPM	Other Alcohols
n-Butyl Alcohol		50 — 4000 PPM	100 PPM	Other Alcohols
iso-Butyl Alcohol		50 — 4000 PPM	100 PPM	Other Alcohols
sec-Butyl Alcohol		50 — 4000 PPM	150 PPM	Other Alcohols
tert.-Butyl Alcohol		100 — 1000 PPM	100 PPM	Other Alcohols
n-Butylamine		2 — 100 PPM	5 PPM	Acid gases
Carbon Dioxide		0.01 — 5.0%	0.50%	———
Carbon Disulfide		5 — 500 PPM	20 PPM	———
Carbon Monoxide	NBS Color Change	001 — 0.1%	0.005%	NO_2, Ethylene
	Length of Stain	10 — 3000 PPM	50 PPM	Hydrogen
Carbon Tetrachloride		10 — 200 PPM	10 PPM	Halogens, Halides, Hydrocarbons
Chlorine		0.5 — 20 PPM	1 PPM	H_2S, NH_3, NO_2, Ethylene, Halides
		3 — 100 PPM	1 PPM	H_2S, NH_3, NO_2, Ethylene, Halides
Chlorine Dioxide		0.05 — 16 PPM	0.1 PPM	H_2S, NH_3, NO_2, Ethylene, Halides
Chlorobenzene (Mono)		10 — 200 PPM	75 PPM	Halogens, Halides
		10 — 800 PPM	75 PPM	Aromatic, Aliphatic Hydrocarbons
Chlorobromomethane		50 — 500 PPM	200 PPM	Halogens, Halides
		25 — 500 PPM	200 PPM	Halogens, Halides, Hydrocarbons

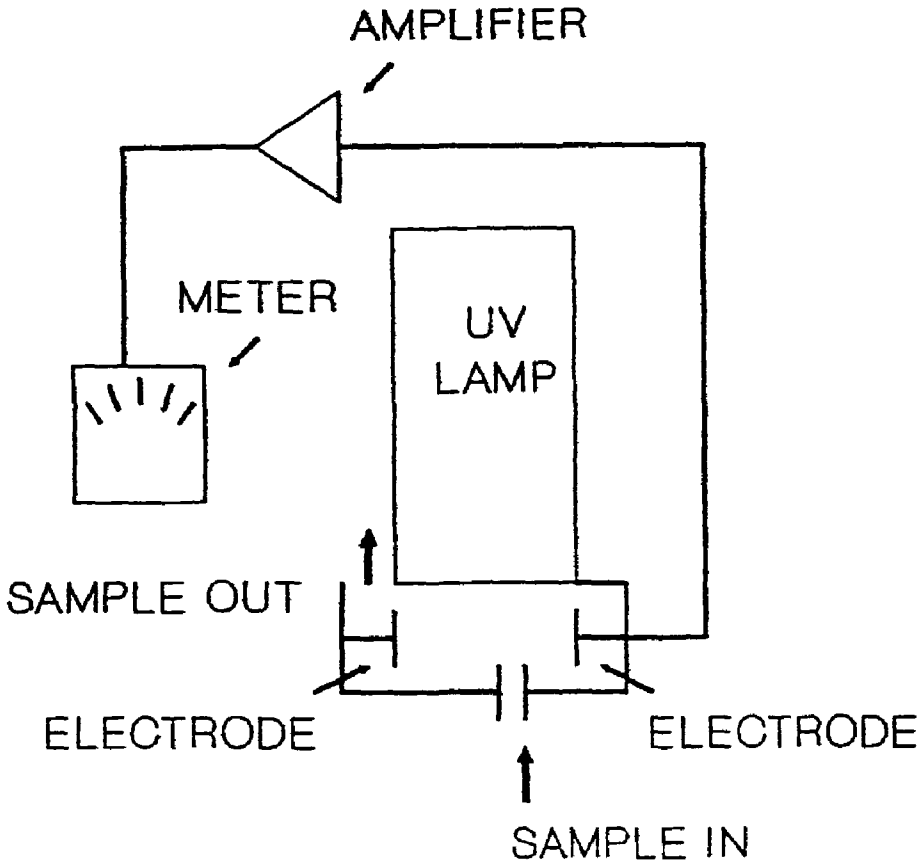


FIGURE 2-2

DIAGRAM OF PHOTOIONIZATION
DETECTOR LAMP AND COLLECTING ELECTRODES

CHEMICAL ACCIDENTS

SAMPLE COLLECTION

- SAMPLING MUST BE DONE RAPIDLY TO PREVENT THE ALTERATION THAT OCCURS AFTER AN ACCIDENT AND THE COVERAGE OF ALL THE POSSIBILITIES OF DETECTING EXTRANEOUS AGENTS.

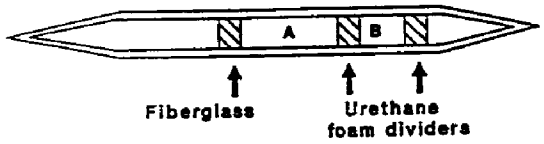
- THE QUANTITY OF THE SAMPLE IS VERY IMPORTANT

- IDENTIFICATION MUST BE CLEAR AND COMPLETE

- DO NOT ADD PRESERVATIVES - ONLY REFRIGERATE

- USE PROPER CONTAINERS - CONTENTS/CONTAINER RELATION - CLEAN AND RESISTANT

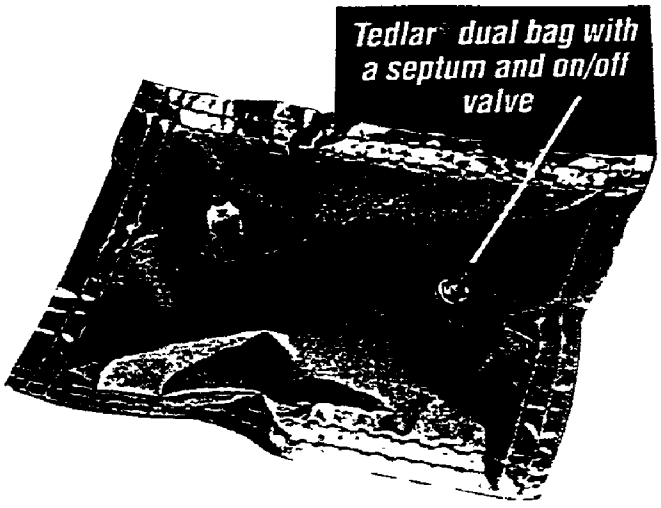
AIR SAMPLE COLLECTION

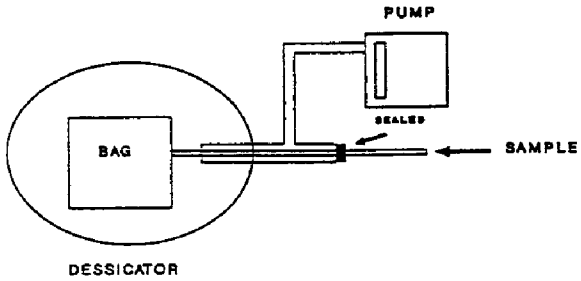


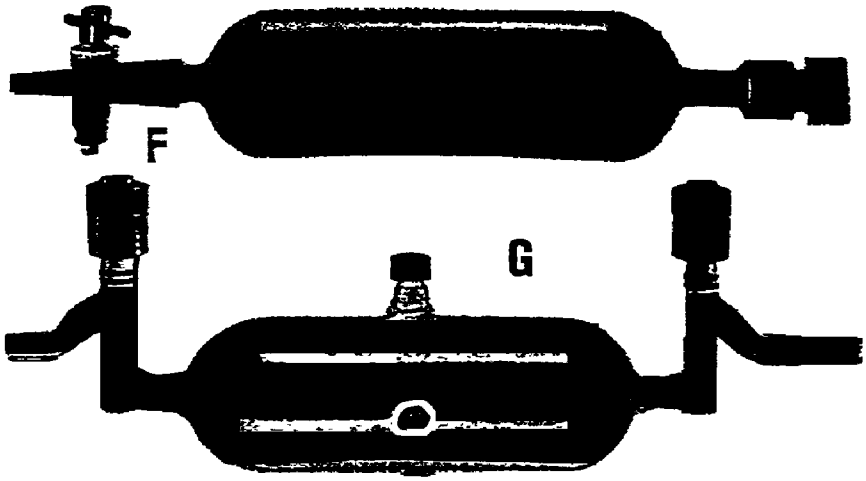
A - 100 mg sorbent
B - 50 mg sorbent

TYPICAL 150 MG SOLID SORBENT TUBE

"Original en mal estado"







CHEMICAL ACCIDENTS

LABORATORY FACILITIES

LEVEL 3
LEVEL 4
LEVEL 5

} Laboratories of different sofistication and complexity degree, with a thorough quality control, high cost equipments, specialized professionals, validation of methods, and so on, that make possible to perform confirmation analysis, advances toxicological studies, update follow up.