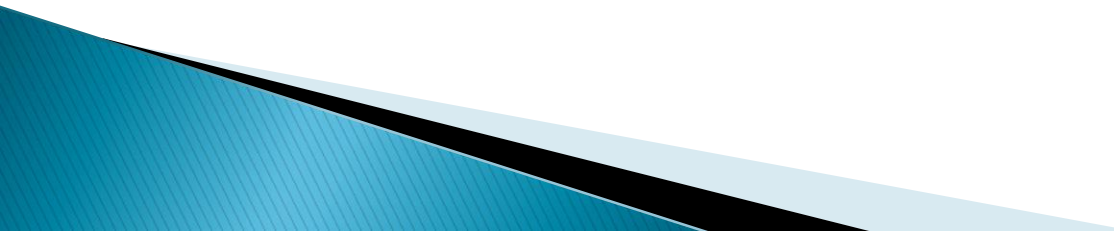


WHY TALK
ABOUT
CHEMICAL
EMERGENCIES



**WE LIVE IN THE WORLD OF
CHEMICALS.....**

**CHEMICALS ARE NATURAL AND IMPORTANT
PART OF OUR ENVIRONMENT**

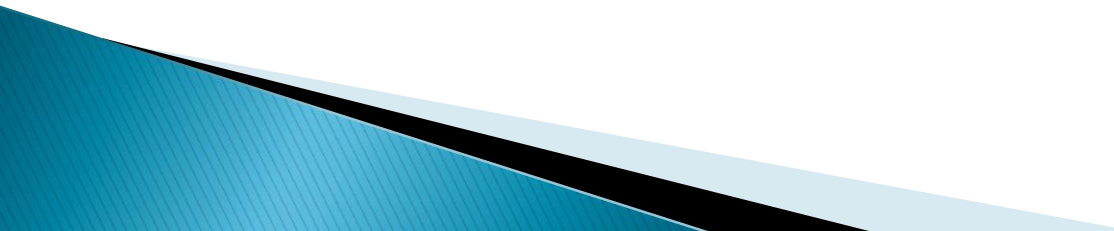
THEY CAN BE FOUND IN OUR:

KITCHEN, MEDICINE CABINETS, BASEMENT

THEY HELP US :

- TO KEEP OUR FOOD FRESH AND BODIES CLEAN**
- OUR PLANTS GROW AND FUEL OUR CARS**
- MAKE IT POSSIBLE FOR US TO REMAIN
HEALTHY**

Chemical Disaster and Urban Areas

- ▶ Cities grow around industries.
 - ▶ Cities grow to envelop industries.
 - ▶ Hazardous substances transported through the cities
 - ▶ Pipelines for transportation of hazardous chemicals
 - ▶ Hazardous substances are used/ stored in the cities
- 

Some Basics on chemicals

- ▶ THE CHEMICALS FOUND IN NATURE DO NOT HARM US AS HUMAN BODY HAS BECOME COMPATIBLE WITH THESE CHEMICALS.
- ▶ **IT IS EITHER BECAUSE OF**
 - CONCENTRATION OF ONE CHEMICAL
- ▶ **OR**
 - TRANSFORMATION OF ONE OR MANY CHEMICALS TO FORM A DIFFERENT CHEMICAL LEADS TO SUCH MATERIALS WHICH ARE HAZARDOUS TO HUMAN USE.

Some Basics on chemicals(contd.)

▶ **MATERIALS**

- **CHEMICAL**
- **NON-CHEMICAL**

Understanding Hazard

HAZARDOUS MATERIALS ARE SUBSTANCES WHICH WHEN **RELEASED** OR **MISUSED** POSE A THREAT TO THE ENVIRONMENT

Understanding Hazard

STATES OF MATTER

- SOLIDS
- LIQUIDS
- GAS

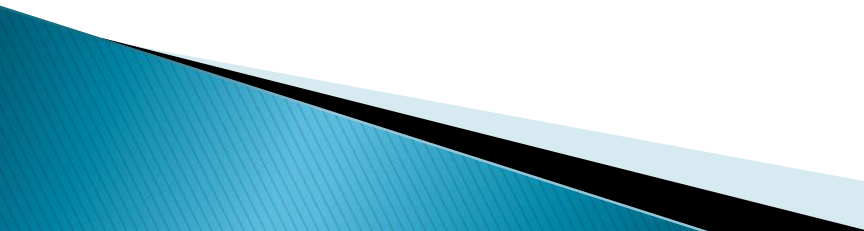
MEDIUM OF CONTAMINATION

- AIR
- WATER
- LAND

EXPOSURE TO CHEMICALS

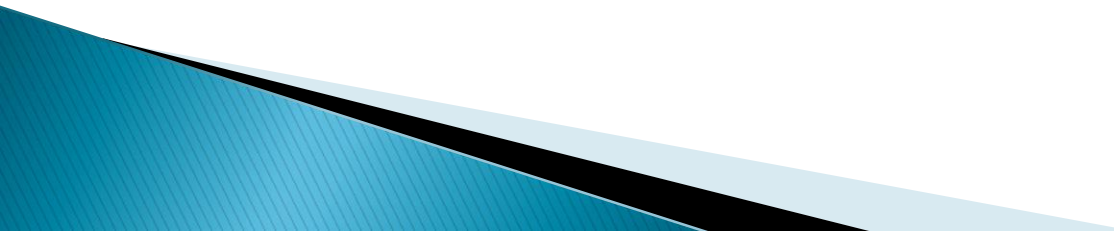
- INHALATION
- INGESTION
- DERMAL
CONTACT

Sources of Chemical Disasters

- ▶ Manufacturing and formulation installations including during commissioning and process operations; maintenance and disposal.
 - ▶ Material handling and storage in manufacturing facilities, and isolated storages; warehouses and godowns including tank farms in ports and docks and fuel depots.
 - ▶ Transportation (road, rail, air, water, and pipelines).
- 

Causative Factors Leading to Chemical Disasters

Chemical disasters, in general, may result from:

- ▶ Fire.
 - ▶ Explosion.
 - ▶ Toxic release.
 - ▶ Poisoning.
 - ▶ Combinations of the above.
- 

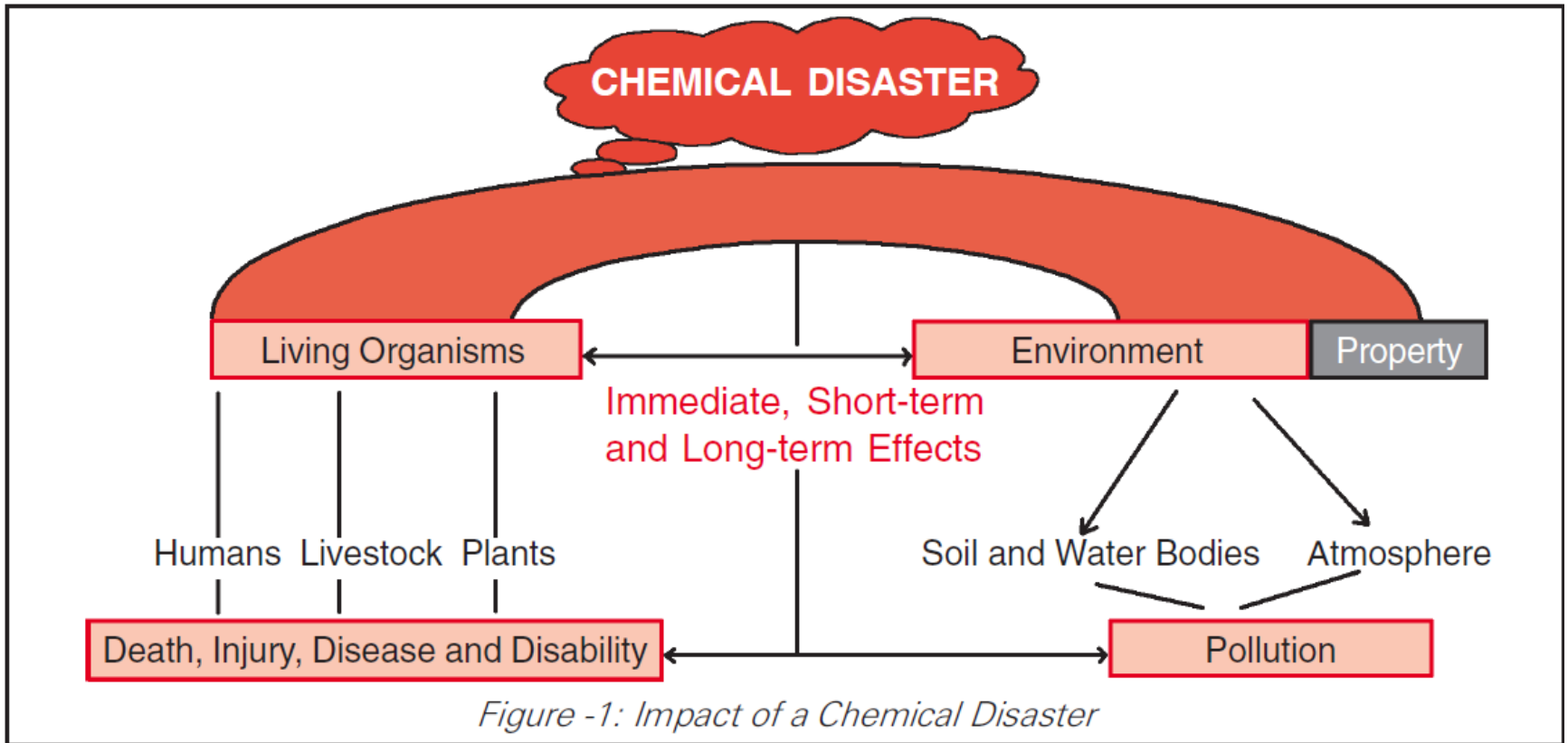
Initiators of Chemical Accidents

▶ Process and Safety System Failures

- Technical errors; design defects, fatigue, metal failure, corrosion etc.
- Human errors: neglecting safety instructions, deviating from specified procedures etc.
- Lack of information: absence of emergency warning procedures, nondisclosure of line of treatment etc.
- Organisational errors: poor emergency planning and coordination, poor communication with public

▶ Natural Calamities:

▶ Terrorist Attacks/Sabotage:



SAFE HANDLING OF MATERIAL

- ▶ **INTRINSICALLY HAZARDOUS PROPERTIES OF MATERIAL**
 - ▶ **HAZARDOUS CONDITIONS CREATED DURING STORAGE, TRANSPORT AND PROCESSING**
- 

FOR SAFE HANDLING

**STORAGE AND
TRANSPORTATION**

IDENTIFICATION IS

ESSENTIAL



IDENTIFICATION OF HAZARDOUS MATERIAL

SHOULD INCLUDE

- **LIST** OF ALL MATERIALS RECEIVED, USED OR MANUFACTURED ON SITE
- **MSDS** FOR ALL MATERIALS OF ABOVE
- **ALL STORAGE VESSELS AFFIXED WITH NFPA DIAMOND (704M SYSTEM)**
- **DOT SHIPPING LABEL**



DOT SHIPPING LABEL

GENERAL PLACARD INFORMATION

RED - indicates a flammable material

GREEN - indicates nonflammable substance

YELLOW - indicates an oxidizer

BLUE - indicates dangerous when wet

WHITE - indicates inhalation hazard and poison

BLACK & WHITE - indicates corrosive (acid and caustic)

RED & WHITE - indicates flammable solid or spontaneously combustible (depending on the color pattern on the placard)

WHITE & YELLOW - indicates radiation or radioactive

ORANGE - indicates explosives

WHITE & BLACK STRIPES - indicate miscellaneous hazardous materials



A second placard information indicator is the number in the bottom corner of the diamond. This number refers to the hazard classes as used internationally and by the United States DOT.

There are 9 classes for hazardous materials:

Class 1 - Explosives

Class 2 - Gases (flammable, nonflammable, inhalation hazard/poison, or oxygen)

Class 3 - Liquids that burn (flammable and combustible liquids, based on their flashpoint)

Class 4 - Flammable Solids, Spontaneously Combustible, or Dangerous when wet materials

Class 5 - Oxidizers and Organic Peroxides

Class 6 - Poison/Toxic Solids and Liquids, Infectious Materials

Class 7 - Radioactive (three sub classes)

Class 8 - Corrosives (acids and bases)

Class 9 - Miscellaneous

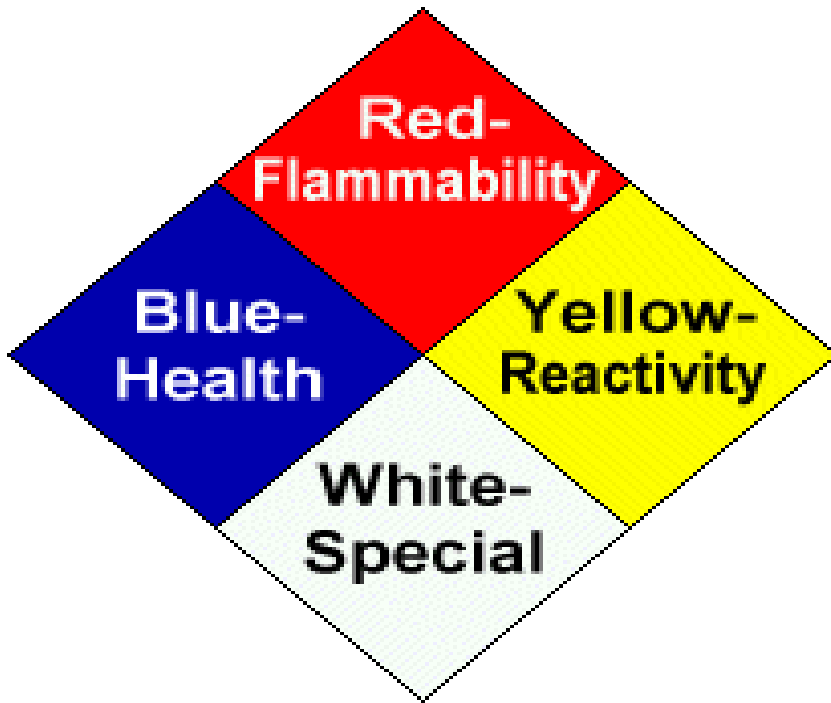
A third indicator is the symbol in the upper corner of the diamond. A variety of symbols are used to indicate combustion, radiation, oxidizers, compressed gas, etc...such as destruction of materials and skin by corrosives, an explosion for flammables, or skull and cross bones to indicate poisons.



The fourth item on a placard is the four digit United Nations (UN) number used for the hazardous material contained in the container. There are hundreds of four digit numbers used, from 1001 (acetylene) to 9279 (hydrogen, absorbed in metal hydride).



NFPA Chemical Hazard Labels



Health Hazard 4-Deadly 3-Extremely Hazardous 2- Hazardous 1- Slightly Hazardous 0- Normal Material	Fire Hazard 4- Below 73°C 3- Below 110°C 2- Below 200°C 1-Above 200°C 0- Will not Burn
Specific Hazard Ox-Oxidizer W-Use no Water	Reactivity Hazard 4- May Detonate 3- May Detonate with Heat /Shock 2- Violent Chemical Change 1- Not stable if heated 0-Stable

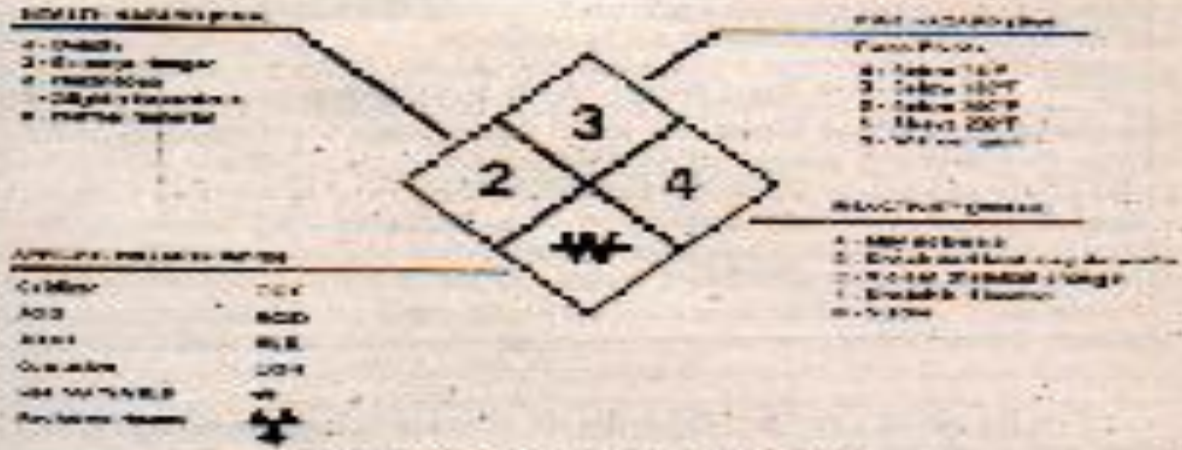


FIGURE 3-3. Typical 704 Hazard Rating Diagram

NFPA LABELS



Water



Oxygen



Phosphorus



Calcium Carbide



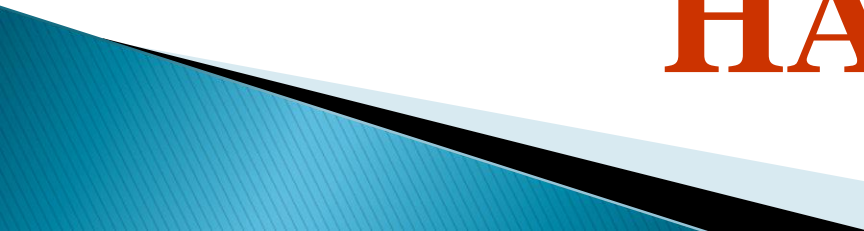
Benzene




Acrylonitrile

FIGURE 3-4. Typical 704 Hazard Rating Diagrams

**ONCE YOU DO
THE
IDENTIFICATION
YOU KNOW THE
ASSOCIATED
HAZARD**



MATERIAL HANDLING HAZARDS

- **FIRE AND EXPLOSIVE HAZARDS**
 - **CHEMICAL TOXICITY**
 - **BIOLOGICAL HAZARDS**
 - **RADIATION HAZARDS**
 - **OTHERS**
- 

FIRE AND EXPLOSIVE PROPERTIES

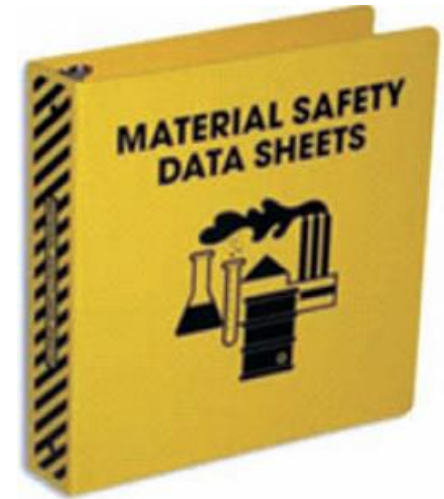
YEAR	PLACE	DEATHS
DEC1995	DABWALI	425
JUNE 1997	UPHAAR	59
AUG' 2001	MENTAL ASYLUM(TN)	28
JAN 2004	SRIRANGAM(TN)	54
JULY 2004	KUMBHAKONAM	91
APR 2006	MEERUT	50



- FUEL
- OXYGEN
- SOURCE OF IGNITION

CHEMICAL TOXICITY DATA ON MSDS

- LIST OF HAZARDOUS COMPONENTS
- THRESHOLD LIMIT VALUES TLV-TWA, TLV-STEL
TLV-C OR PEL
- MECHANISM BY WHICH EXPOSURE OCCURS
 - INGESTION
 - INHALATION
 - DERMAL ABSORPTION
- HEALTH HAZARDS
 - ACUTE
 - CHRONIC
- SYMPTOMS OF EXPOSURE



Chemical disasters

Bhopal gas tragedy

- 2,000 people died immediately
- Another 13,000 died next fifteen years
- 10-15 persons dying every month
- 520,000 diagnosed chemicals in blood causing different health complications
- 120,000 people still suffering from
 - Cancer
 - Tuberculosis
 - Partial or complete blindness,
 - Post traumatic stress disorders,
 - Menstrual irregularities



BIOLOGICAL HAZARDS

- PRODUCTION OF PHARMACEUTICALS
- HOSPITALS/ NURSING HOMES AND PATH LABS
- MANUFACTURE OF GENETICALLY ENGINEERED MATERIALS

Nuclear and biological disasters

- Cities of the world, particularly large cities are increasingly getting exposed to nuclear threats
- Threats of pandemics like avian flu and human induced biological disasters are also looming large



RADIATION HAZARDS

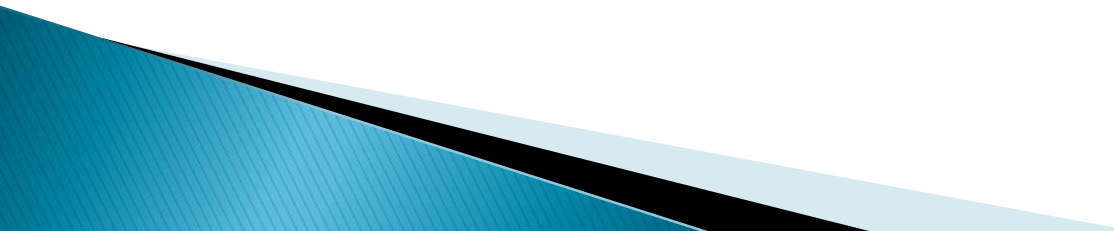
Potential sources of exposure include

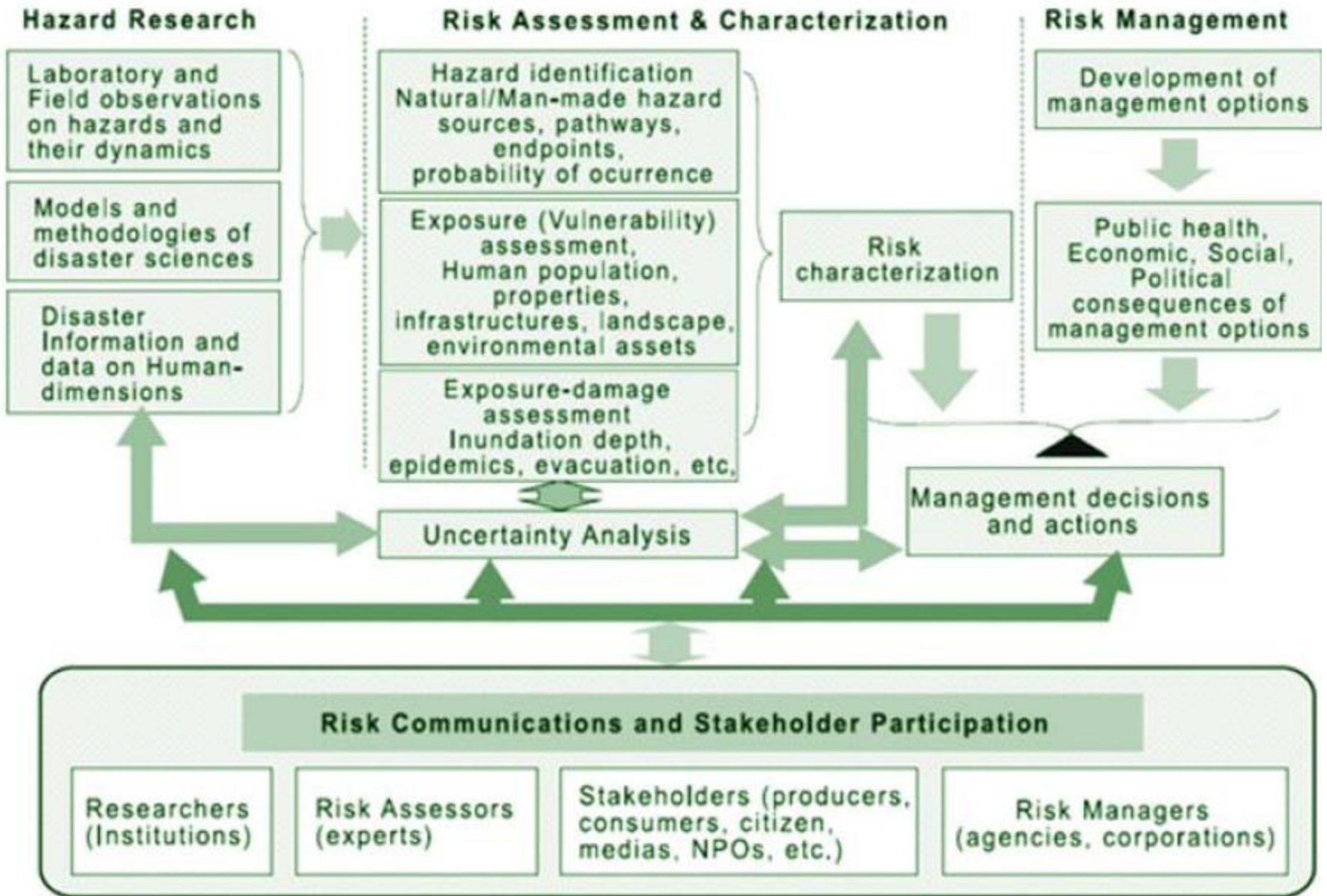
- POWER PLANTS
- ATOMIC RESEARCH CENTRE
- RADIOGRAPHIC EQUIPMENTS
- RADIO ISOTOPES
- INSTRUMENTS USING RADIOACTIVE ELEMENTS
- OTHERS

IMPROPER PROCESS CONTROL AND WASTE DISPOSAL



PROCESS HAZARD REVIEW

- SAFETY SURVEY
 - PRELIMINARY HAZARD ANALYSIS
 - “WHAT-IF” ANALYSIS
 - HAZARD AND OPERABILITY STUDIES (HAZOP)
 - FAILURE MODES AND EFFECTS ANALYSIS (FMEA)
 - FAULT TREE ANALYSIS (FTA)
- 



CHEMICAL EMERGENCIES

CAN BE

**HOME CHEMICAL
EMERGENCY**

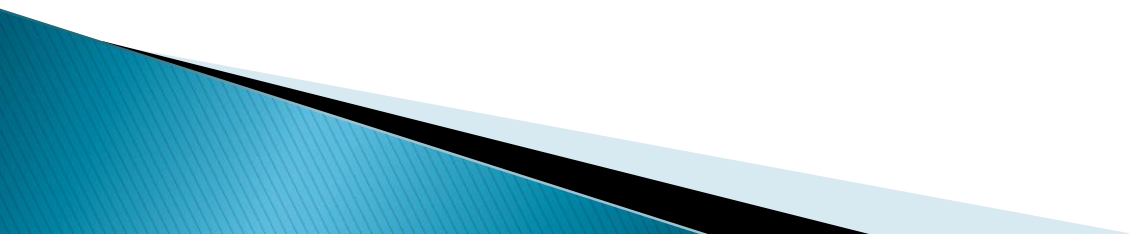
OR

**MAJOR CHEMICAL
EMERGENCY**

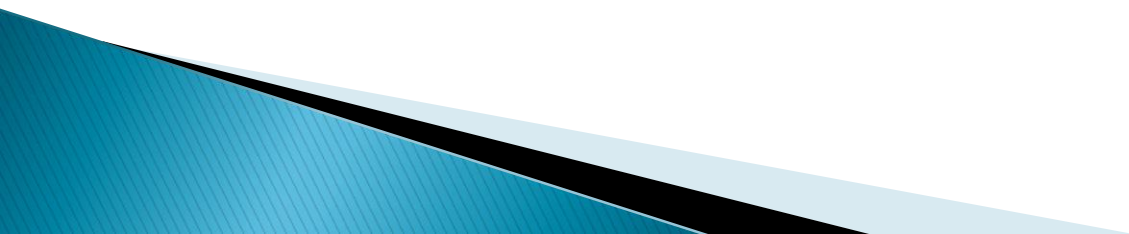


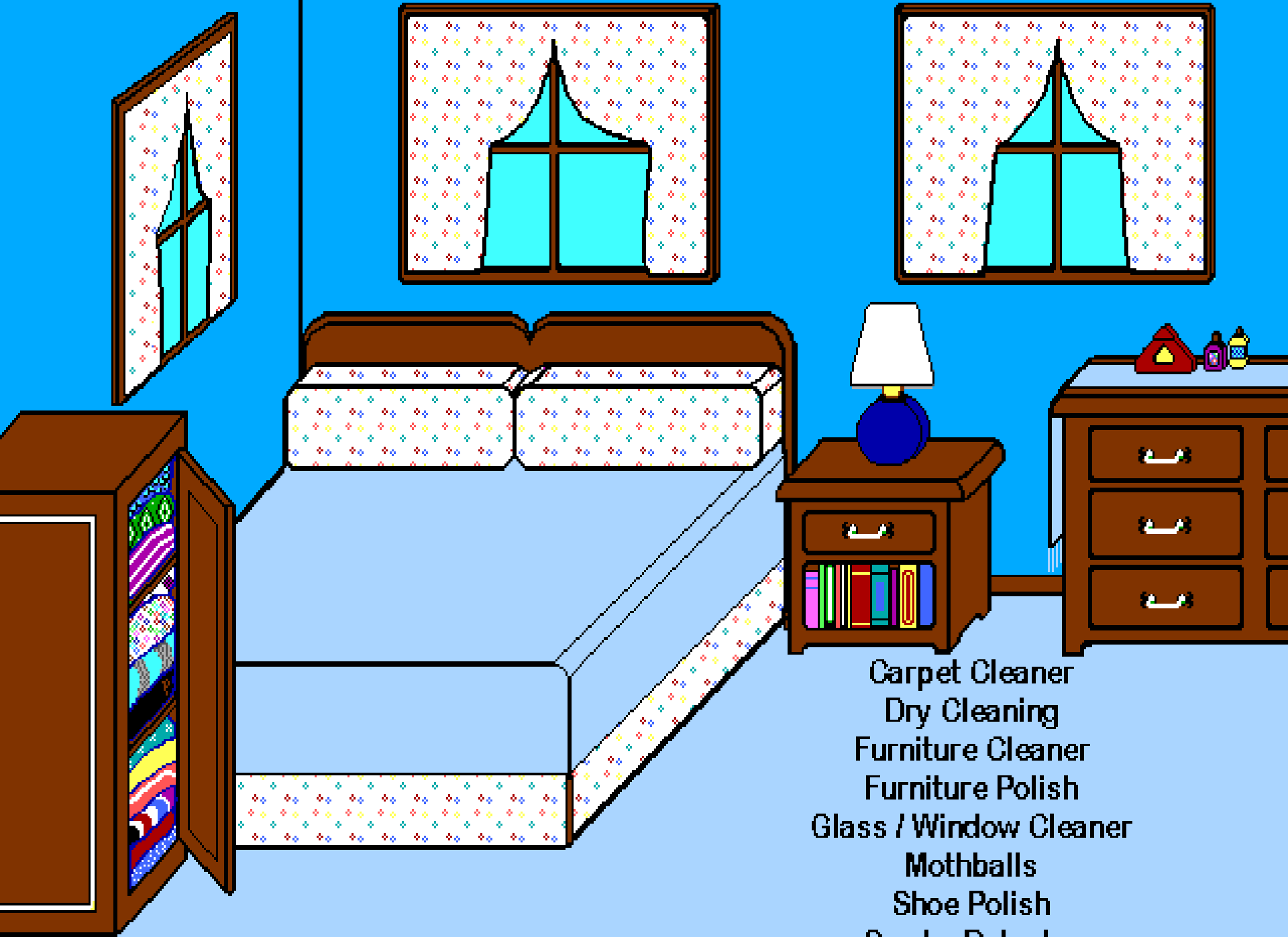
EMERGENCY RESPONSE

INFORMATION



HOME CHEMICAL EMERGENCY



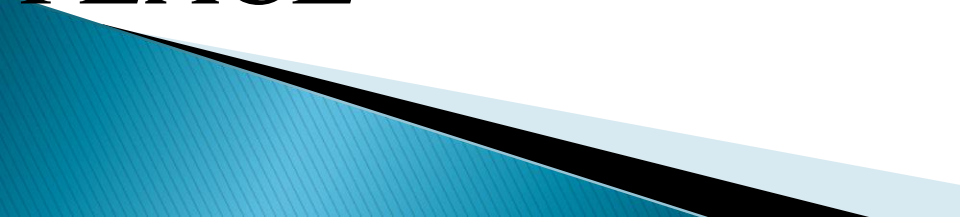



Carpet Cleaner
Dry Cleaning
Furniture Cleaner
Furniture Polish
Glass / Window Cleaner
Mothballs
Shoe Polish
Smoke Detector



- Aerosols
- Asbestos Floor Tiles
- Disinfectant
- Drain Cleaner
- Floor Cleaner
- Glass / Window Cleaner
- Hair Color
- Hair Permanent
- Hair Spray
- Hydrogen Peroxide
- Isopropyl Alcohol
- Mildew Remover
- Nail Polish
- Nail Polish Remover
- Pharmaceuticals
- Scouring Powder
- Toilet Cleaner


PREVENTING CHEMICAL EMERGENCY AT HOME

- LEARN ABOUT HOUSEHOLD
CHEMICAL RISK**
 - KEEP ALL MEDICINES OUT OF SIGHT
AND OUT OF REACH OF CHILDREN**
 - DISCARD MEDICINES AT SAFE
PLACE**
- 

- STORE HOUSE CHEMICALS AS PER INSTRUCTION
 - AVOID MIXING CHEMICALS
 - READ DIRECTION FOR USE BEFORE USING CHEMICALS
 - READ INSTRUCTIONS ON DISPOSAL
 - NEVER SMOKE WHILE USING A CHEMICAL
- 

- IF YOU SPILL CLEAN IT UP PROTECTING EYES AND SKIN
- BUY ONLY AS MUCH OF THE CHEMICAL AS YOU WOULD USE
- KEEP FIRE EXTINGUISHER AND KNOW HOW TO USE THEM
- KEEP EMERGENCY NUMBER
- LEARN TO DETECT THE PRESENCE OF HAZARD
- LEARN TO **RECOGNISE SYMPTOMS OF TOXIC POISONING**

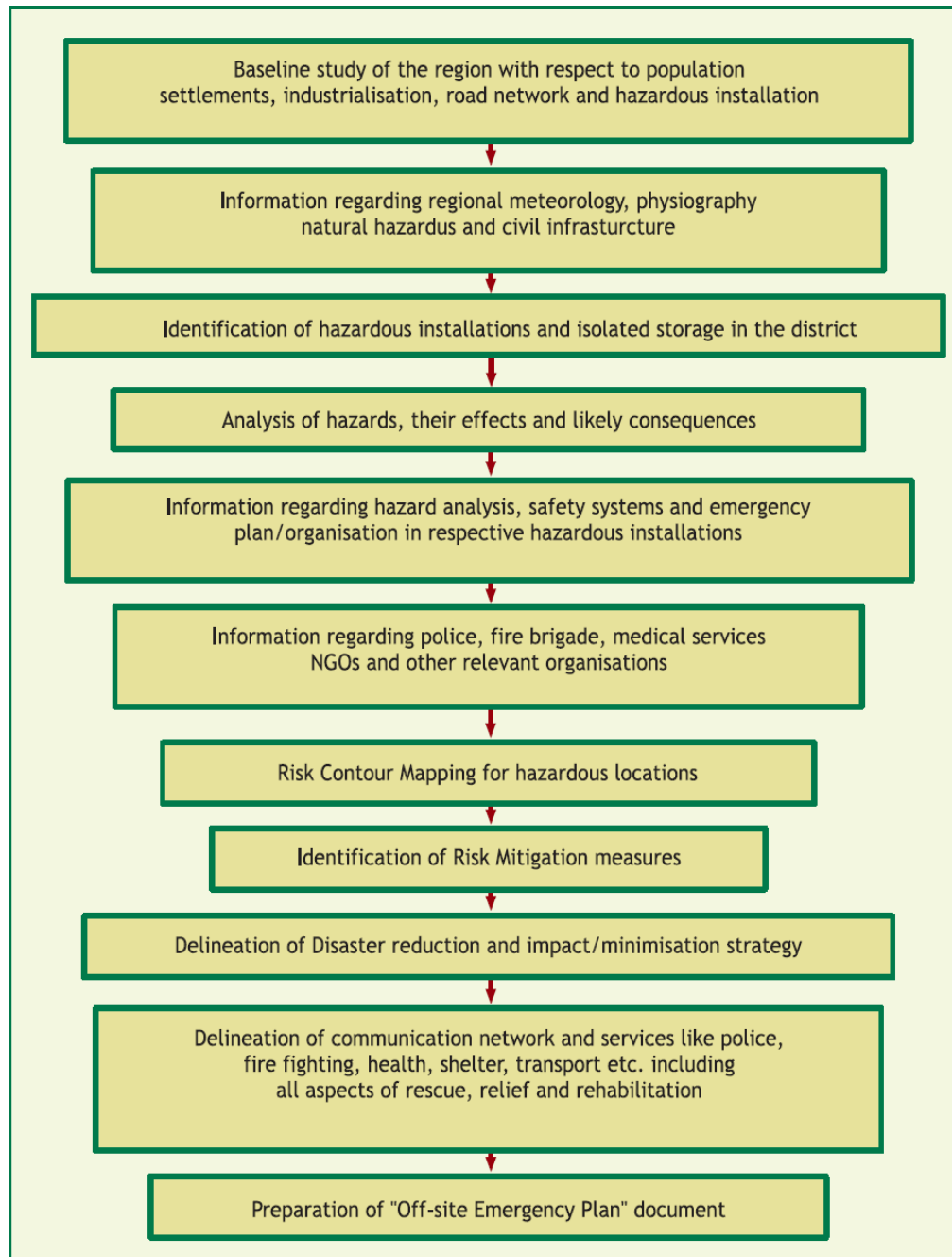
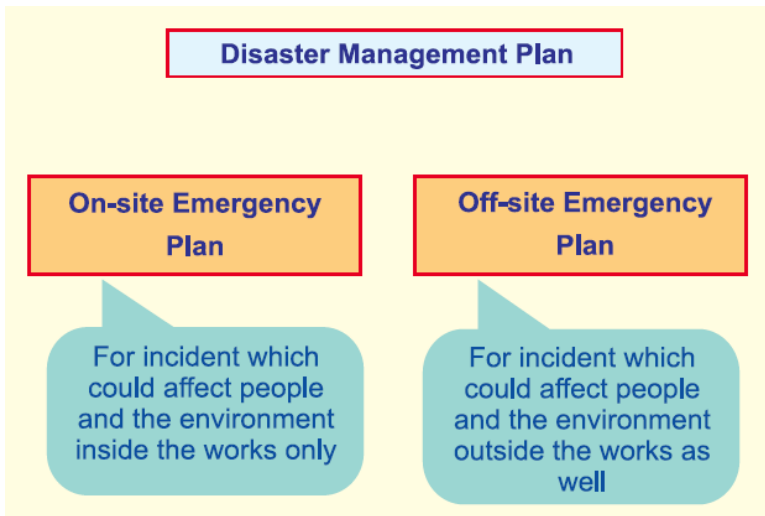
SYMPTOMS OF TOXIC POISONING

- DIFFICULTY IN BREATHING**
 - IRRITATION OF EYES SKIN OR THROAT**
 - CHANGES OF SKIN COLOUR**
 - HEADACHE OR BLURRED VISION**
 - DIZZINESS**
 - CLUMSINESS OR LACK OF COORDINATION**
 - CRAMPS OR DIARRHEA**
- 

HOME EMERGENCY MEASURES

- IF YOUR CHILD EATS NON-FOOD SUBSTANCE SEEK EMERGENCY ADVICE GIVING FULL DETAILS**
- FOLLOW THE ADVICE VERY CAREFULLY**
- IF THERE IS DANGER OF FIRE AND EXPLOSION GET OUT IMMEDIATELY**
- CALL FIRE DEPTT. FROM OUTSIDE**
- STAY AWAY FROM HOUSE TO AVOID POSSIBILITY OF TOXIC FUMES**
- WASH YOURSELVES AND DISCARD CLOTHING YOU FEAR CONTAMINATED**
- ADMINISTER FIRST AID TREATMENT TO VICTIMS OF CHEMICAL BURNS**

MAJOR CHEMICAL EMERGENCY



Institutional Framework

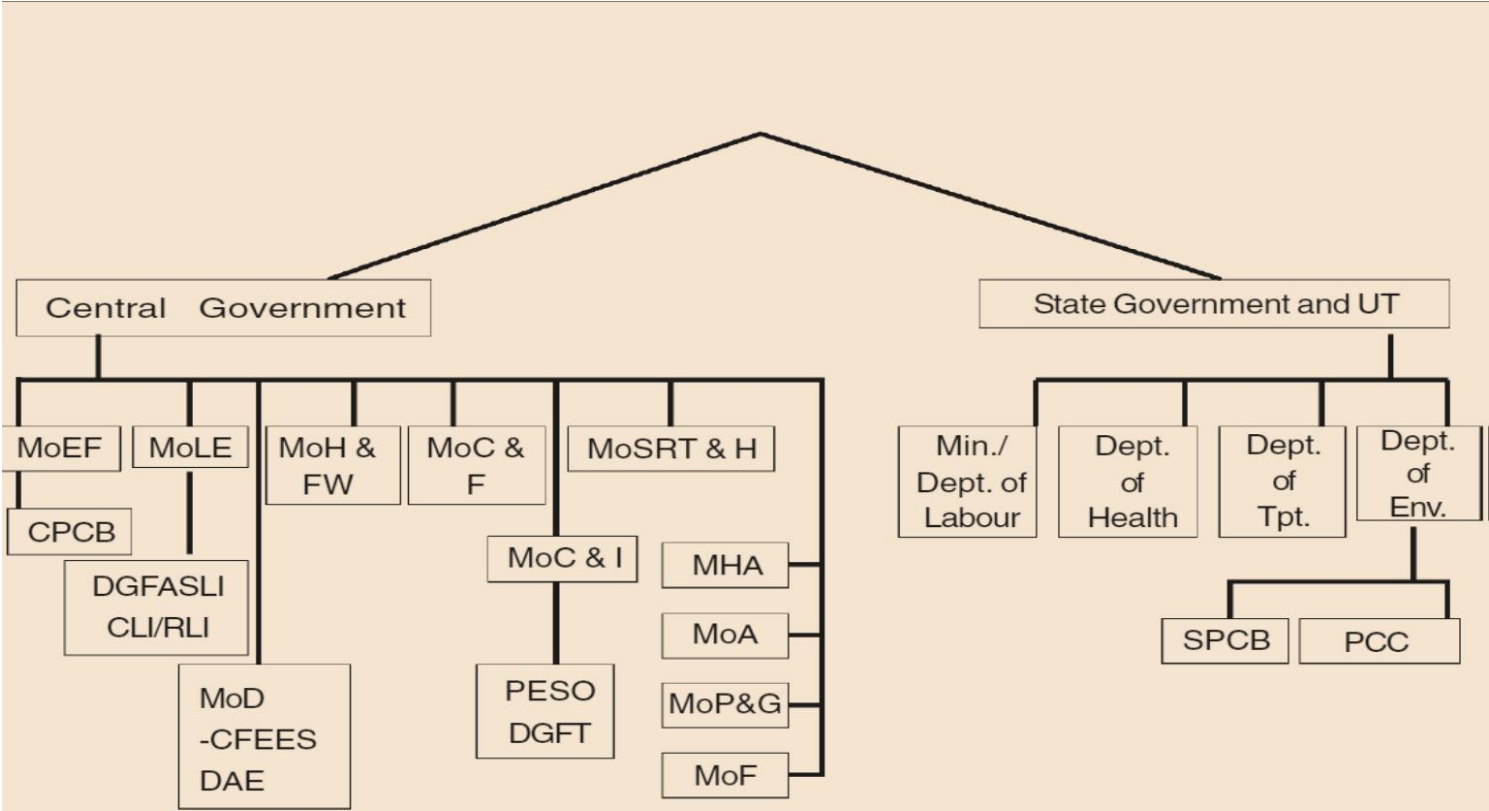
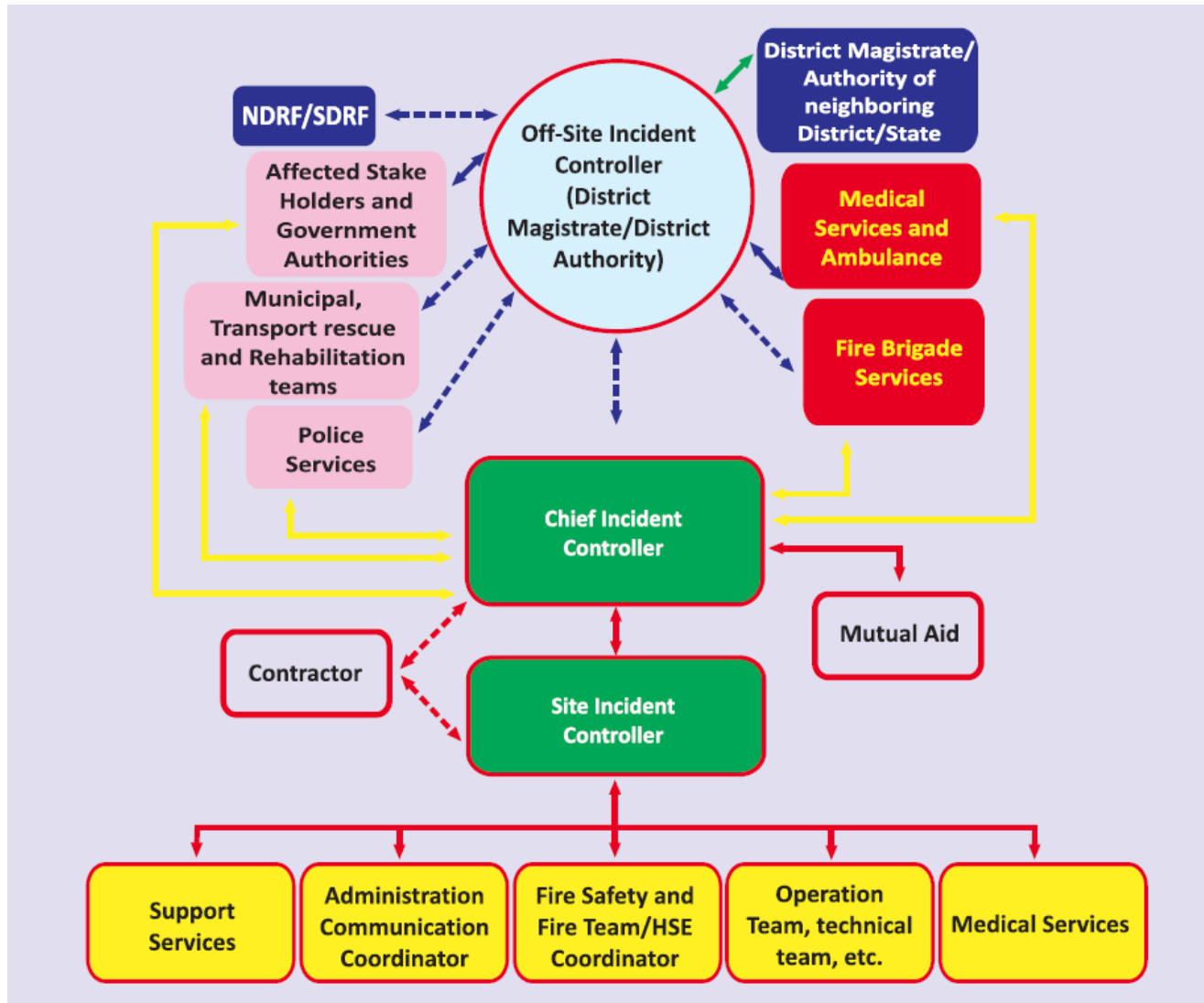



Figure-2: Existing Institutional Framework.

Institutional Setup at district level



INFORMATION ON

- THE TYPE OF HAZARD**
 - THE AREA AFFECTED/TRANSPORTATION ROUTES**
 - PROTECTION MEASURES**
 - LEARN ABOUT INDUSTRY AND COMMUNITY**
- WARNING SIGNALS**
- EVACUATION**
 - SHELTER LOCATION**
 - MEDICAL FACILITIES**
 - SPECIALIST HELP/EMS TELEPHONE NUMBER**
- 

WHAT TO DO

IF YOU ARE AT THE SCENE OF ACCIDENTS

- CALL AUTHORITIES IF YOU ARE AT THE LOCATION
- MOVE AWAY AS FAST AS POSSIBLE
- STAY AWAY FROM CHEMICAL CONTACT
- TRY AVOIDING GASES,FUMES OR SMOKE
- COVER MOUTH WITH A CLOTH
- STAY AWAY FROM VICTIMS UNTIL HAZMAT HAS BEEN IDENTIFIED
- TRY TO STAY UPSTREAM,UPHILL,UPWIND



WHAT TO DO


IF YOU ASKED TO SHELTER IN PLACE

- **PROVIDE BREATHING PROTECTION USING DAMP CLOTH**
- **TURN OFF WATER SUPPLY AND USE STORED WATER**
- **IF TOXIC FUMES HAVE ENTERED HOUSE TAKE SHALLOW BREATHS THROUGH DAMP CLOTH**
- **AVOID EATING CONTAMINATED FOOD AND WATER**
- **SEAL HOUSE COMPLETELY**
- **GO TO ABOVE GROUND ROOM NOT BASEMENT**
- **TAKE DISASTER SUPPLY KIT WITH YOU**
- **LISTEN TO RADIO AND TELEVISION FOR INFORMATION**
- **IF DANGER OF EXPLOSION STAY AWAY FROM WINDOWS**

FAMILY DISASTER SUPPLIES KIT

- **A FIRST AID KIT**
- **A BATTERY OPERATED RADIO**
- **FLASHLIGHT AND EXTRA BATTERIES**
- **BATH SIZE TOWELS**
- **PLASTIC GARBAGE BAGS**
- **WIDE TAPE**
- **A CITY/ VILLAGE/ LOCALITY MAP**
- **BOTTLED WATER(APROX. 15 LIT/PERSON)**
- **NONPERISHABLE FOOD**
- **FAMILY MEDICATIONS,EYEGGLASSES ETC.**

EVACUATION


- **STAY CALM, LISTEN , FOLLOW INSTRUCTION**
 - **MAKE SURE EVACUATION APPLIES TO YOU AND MOVE AS SOON AS POSSIBLE**
 - **AVOID USING TELEPHONE**
 - **TAKE DISASER SUPPLY KIT**
 - **SEAL YOUR HOUSE IF YOU HAVE TIME**
 - **POOL VEHICLES**
 - **CLOSE CAR WINDOWS AND AIR VENTS**
 - **FOLLOW EXACT ROUTE**
- 



Federal Emergency Management Agency

<https://www.fema.gov/community-emergency-response-teams>

AFTER CHEMICAL EMERGENCY

- RETURN HOME WHEN
AUTHORITIES SAY IT IS SAFE**
 - FOLLOW INSTRUCTIONS
CONCERNING THE SAFETY OF
FOOD AND WATER**
 - CLEAN UP AND DISPOSE OF
RESIDUE CAREFULLY**
- 

EMERGENCY RESCUE TEAM

:TRAINING:

**PROTECTIVE
EQUIPMENTS**



GOALS OF A EMS HAZMAT RESPONDER

- **PROTECT YOURSELVES**
- **IDENTIFY THE CHEMICAL**
- **GET SPECIALIST INFORMATION**
- **POTENTIAL OF SECONDARY CONTAMINATION**
- **ADEQUATE DECONTAMINATION MEASURES**
- **PROVIDING BASIC AND ALS**



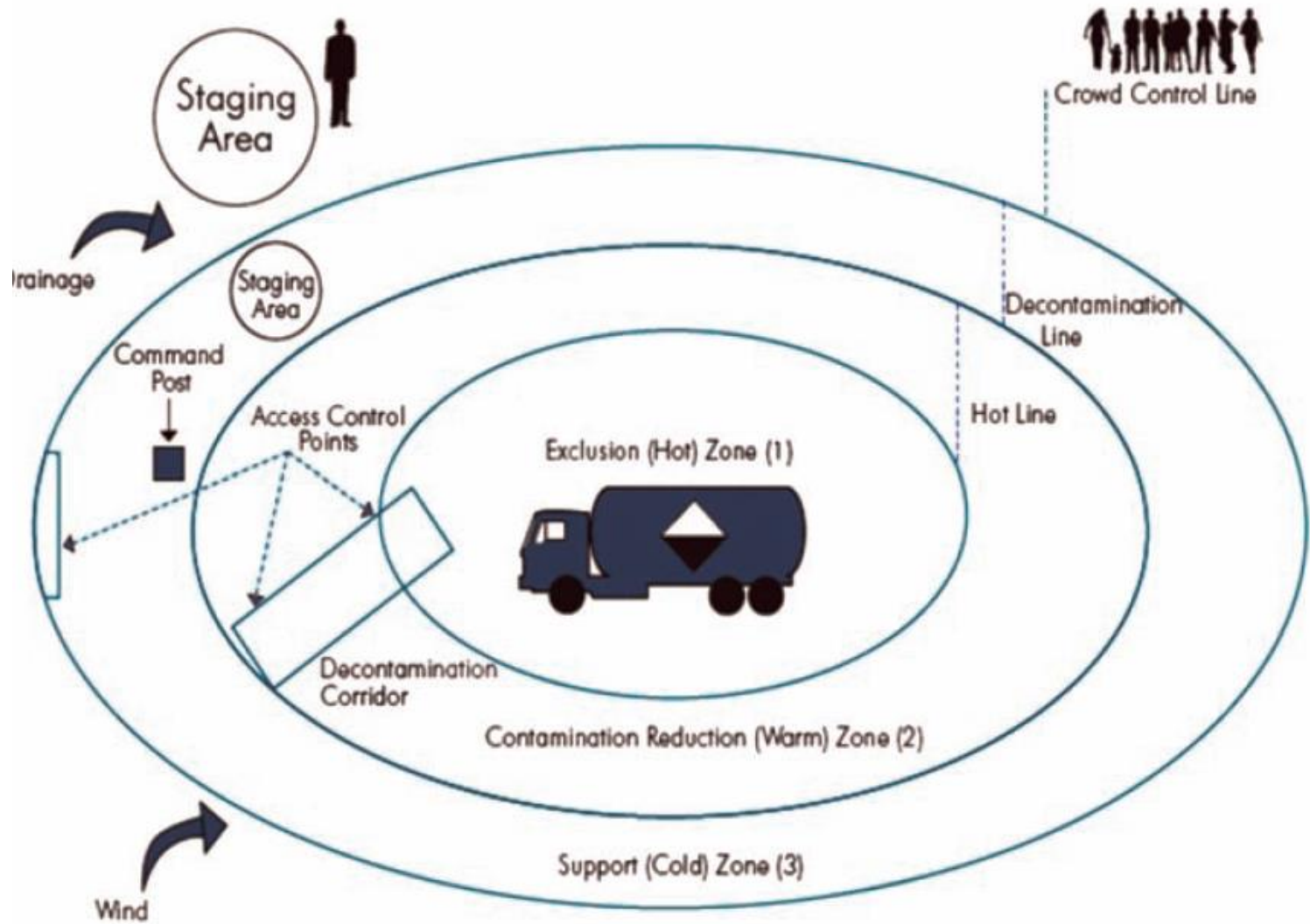


Figure 41 : Emergency control system and incident response landscaping

RESCUER PROTECTION

**LEVEL A: HIGHEST LEVEL,
SCBA+CHEMICAL RESISTANT
SUIT**



**LEVEL B: SCBA+ LESS
PROTECTION AGAINST SKIN
EXPOSURE**

**LEVEL C: AIR PURIFYING
RESPIRATOR+GLOVES AND
BOOTS**

**LEVEL D: COMMON WORK
CLOTHES**



SOURCES OF INFORMATION ON CHEMICALS

- **INDIAN SOCIETY OF INDUSTRIAL HYGIENE(MSDS)**
- **AGENCY FOR TOXIC SUBSTANCE AND DISEASE REGISTRY,PUBLIC HEALTH SERVICES, U.S. DEPTT OF HUMAN SERVICES**
- **POLLUTION CONTROL BOARD**
- **NFPA(NATIONAL FIRE PROTECTION AGENCY)**
- **OSHA(OCCUPATIONAL SAFETY AND HEALTH ADMN.)**
- **FEMA(FEDERAL EMERGENCY MANAGEMENT AGENCY)**
- **RED CROSS**
- **NATIONAL SAFETY COUNCIL**

BHOPAL DISASTER

LESSONS TO BE LEARNED



**THANK YOU
ANY QUESTIONS?**

