

# **EMERGENCY PREPAREDNESS AND EXCLUSION ZONE REQUIREMENTS FOR INDIAN NPPs**

**S.S.BAJAJ**

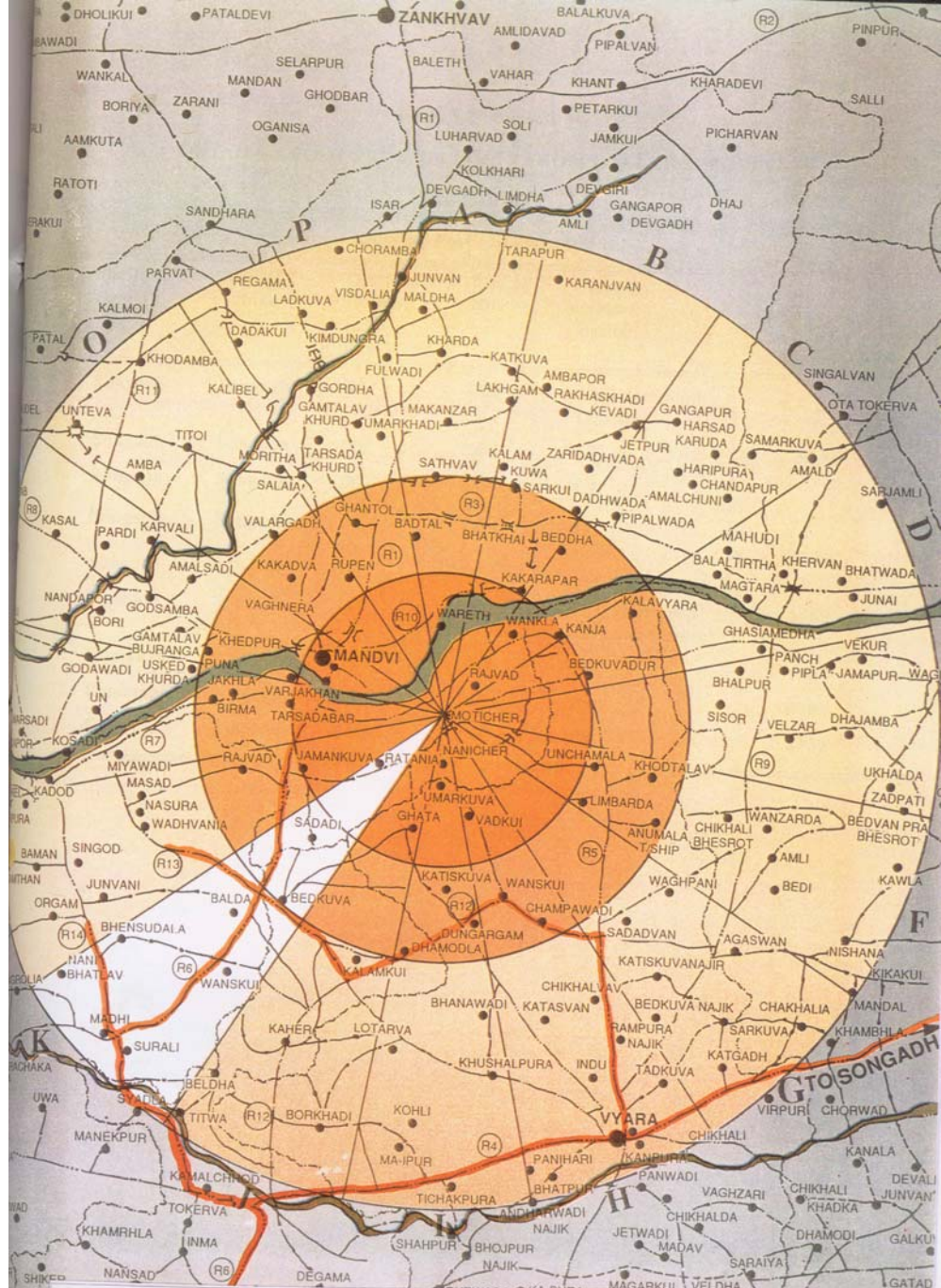
**AERB-USNRC DISCUSSION MEET, WASHINGTON, SEPTEMBER  
2004**

# **PROTECTION OF PUBLIC IN EVENT OF MAJOR ACCIDENTS IN NPPs, PROVIDED THROUGH:**

- ZONING AROUND NPPs
- PREPAREDNESS FOR EMERGENCY  
COUNTERMEASURES IN PUBLIC DOMAIN

# ZONES:

- **EXCLUSION ZONE : 1.5KM/1.6 KM**
- **`STERILIZED' ZONE : 5 KM**  
**(CONTROLLED POPULATION ZONE)**
- **EMERGENCY PLANNING ZONE : 16KM**
  - ✓ **PRIMARY : 8KM**
  - ✓ **SECONDARY : 16 KM****(16 SECTORS)**
- **ENVIRONMENTAL SURVEY ZONE : 30 KM**



**EVACUATION ROUTE MAP OF SECTOR - K**

# **REQUIREMENTS FOR EMERGENCY PREPAREDNESS**

## **AERB GUIDE AERB/SG/EP-1, EP-2**

- **PLANS TO BE IN PLACE BEFORE NPP OPERATION IS LICENSED.**
- **CATEGORIES OF EMERGENCIES:**
  - ✓ **EMERGENCY ALERT**
  - ✓ **PLANT EMERGENCY : TYPE A,B**
  - ✓ **SITE EMERGENCY**
  - ✓ **OFF-SITE EMERGENCY –PLAN 1, PLAN 2, PLAN 3**
- **OFFSITE EMERGENCY HANDLED BY STATE AUTHORITIES WITH TECHNICAL INPUT FROM OPERATING ORGANISATION**

# **OBJECTIVES OF EMERGENCY INTERVENTION**

**FORM, SCALE AND DURATION OF INTERVENTION SHOULD BE OPTIMISED:**

- **AVOID SERIOUS NON-STOCHASTIC EFFECTS (DOSE<THRESHOLD)**
- **LIMIT STOCHASTIC RISKS (NET POSITIVE BENEFIT TO INDIVIDUAL)**
- **LIMIT OVERALL INCIDENCE OF STOCHASTIC EFFECTS (COLLECTIVE DOSE –ALARA)**

# INTERVENTION LEVELS (IL) FOR COUNTERMEASURES DEFINED FOR THREE SPACE-TIME DOMAINS:

*(DOMAINS OF DECREASING ORDER OF  
RADIOLOGICAL SEVERITY)*

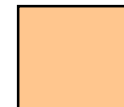
<b>DIST</b> → <b>TIME</b>	<b>NEAR FIELD</b> <b>(A1)</b>	<b>INT. FIELD</b> <b>(A3)</b>	<b>FAR FIELD</b> <b>(A3)</b>
<b>EARLY PHASE</b> <b>(B1)</b>	D1	D2	D3
<b>INT. PHASE</b> <b>(B2)</b>			
<b>LATE PHASE</b> <b>(B3)</b>			



**DOMAIN 1**



**DOMAIN 2**



**DOMAIN 3**

# INTERVENTION LEVELS

DOMAIN	MAJOR PATHWAY	OBJECTIVE OF COUNTER MEASURES	COUNTER-MEASURE	IL mSv	
				WB	THYROID
1	INHALATION  EXT.GAMMA	AVOID SERIOUS NON-STOCHASTIC EFFECT TO INDIVIDUAL	IODINE PROPH. SHELTER EVACUATE	20/100 100/500	500/2500
2	INGESTION	LIMIT STOCHASTIC RISK TO INDIVIDUAL	IODINE PROPH. SHELTER CONTROL FOOD	5/20 5/20	50/500
3	INGESTION	MINIMISE OVERALL INCIDENCE OF STOCHASTIC EFFECTS	CONTROL FOOD	1/5	



# **USE OF INTERVENTION LEVELS**

- **IF ASSESSED RELEASE AND MEASUREMENTS CONFIRM THAT LOWER IL IN A DOMAIN IS NOT LIKELY TO BE EXCEEDED, THE RELEVANT COUNTERMEASURE MAY NOT BE INITIATED.**
- **IF LOWER IL IS LIKELY TO BE EXCEEDED, INITIATE & COMPLETE THE COUNTERMEASURE SUCH THAT UPPER IL IS NOT EXCEEDED.**

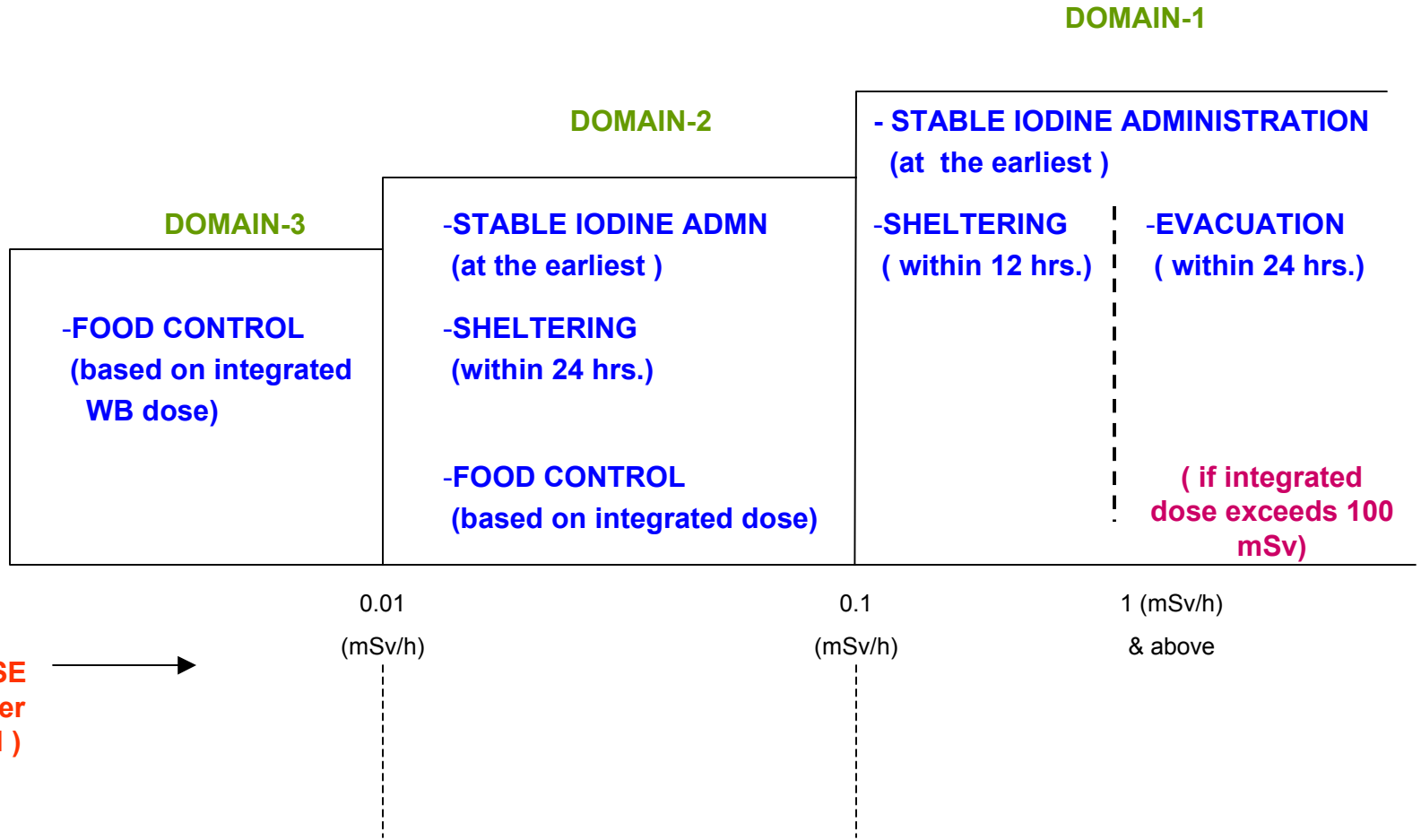
# DERIVED INTERVENTION LEVELS(DILS)

(DILS HELP DECIDE DOMAIN & COUNTER MEASURES)

- EXTERNAL GAMMA DOSE RATE AT 1m ABOVE GROUND
- ACTIVITY CONCENTRATION IN FOODSTUFF & WATER

DOMAIN	COUNTER-MEASURE	DIL DOSE RATE 1m ABOVE GR (mSv/hr)	PERIOD OF PERSISTENCE (HRS)	COMPLETION PERIOD (HRS)
1	ADM.STABLE IODINE SHELTER EVACUATE	> 0.1 0.1 – 2 1 - 3	- 4 10	12 24
2	ADM.STABLE IODINE SHELTER CONTROL OF FOODSTUFF	>0.01 0.01 – 0.1 ACT.CONC IN FOODSTUFF	- 10	24 >24 HRS
3	CONTROL OF FOODSTUFF	ACT. CONC. IN FOODSTUFF		>24 HRS

# COUNTERMEASURES TO BE IMPLEMENTED AT DIFFERENT GROUND GAMMA DOSE RATE IN THE OFF SITE AREAS





# SYSTEM OF INITIAL NOTIFICATION & OFFSITE RESPONSE (CONTD.)

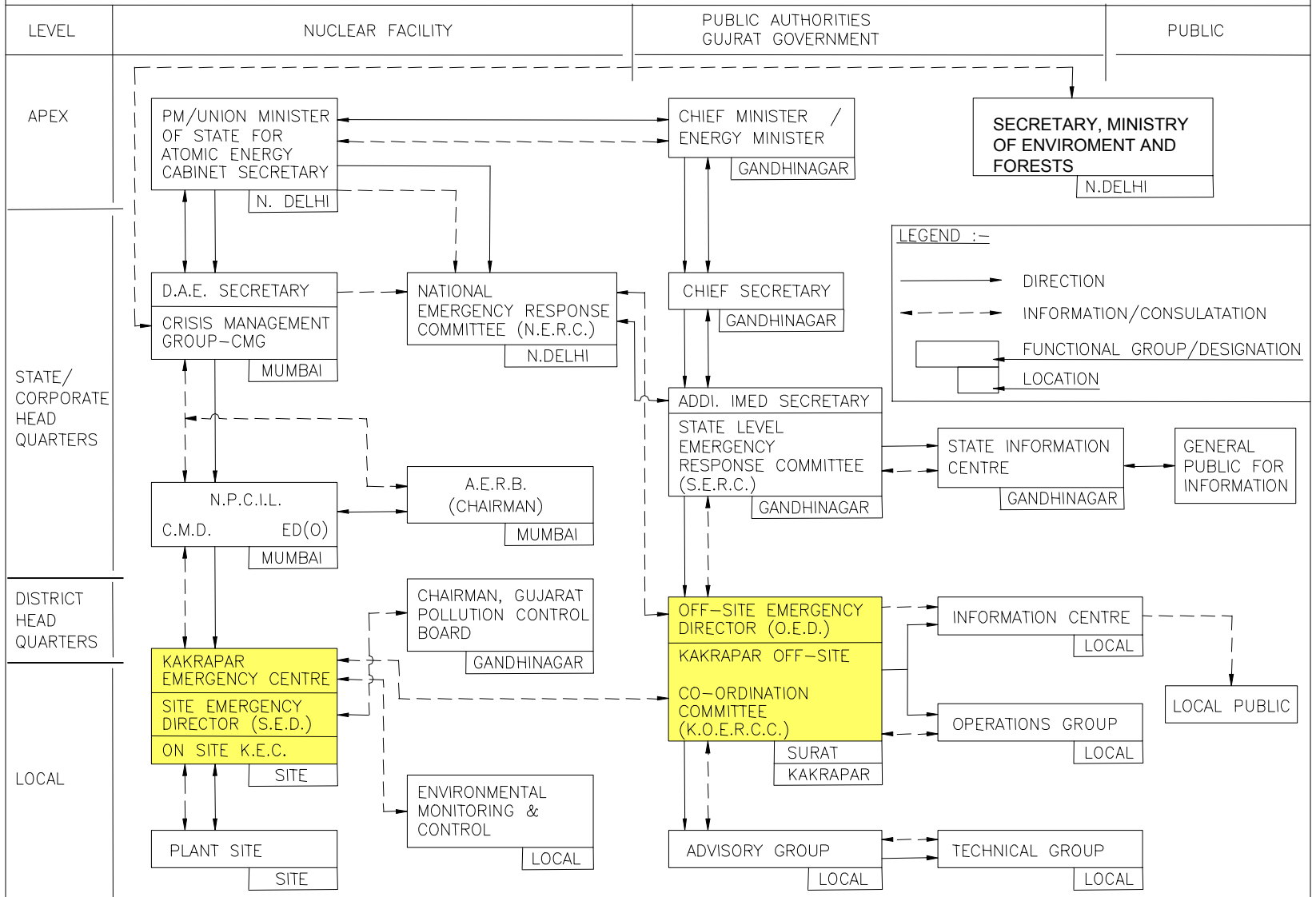
EMERGENCY TYPE (NOTIFICATION BY PLANT AUTHORITIES)	PLANT CONDITION EXAMPLES	PROJECTED DOSES/ INTERVENTION LEVELS	INITIAL OFF-SITE RESPONSE BY PUBLIC AUTHORITIES
SITE EMERGENCY	SUBSTANTIAL MALFUNCTION OF PROCESS & SAFETY SYSTEM (CONTAINMENT SYSTEM INTACT)		EMERGENCY ORGANISATION ON STANDBY
OFF-SITE EMERGENCY <ul style="list-style-type: none"> <li>• SHELTERING</li> <li>• SHELTERING &amp; THYROID BLOCKING</li> <li>• EVACUATION</li> </ul>	SUBSTANTIAL MALFUNCTION OF PROCESS SYSTEM, SAFETY SYSTEM & CONTT SYSTEM	AS PER IL GUIDELINES	EMERGENCY ORGANISATION ACTIVATED TO IMPLEMENT PROTECTIVE MEASURES

# OFFSITE EMERGENCY PREPAREDNESS

## RESPONSIBILITIES OF PUBLIC AUTHORITIES

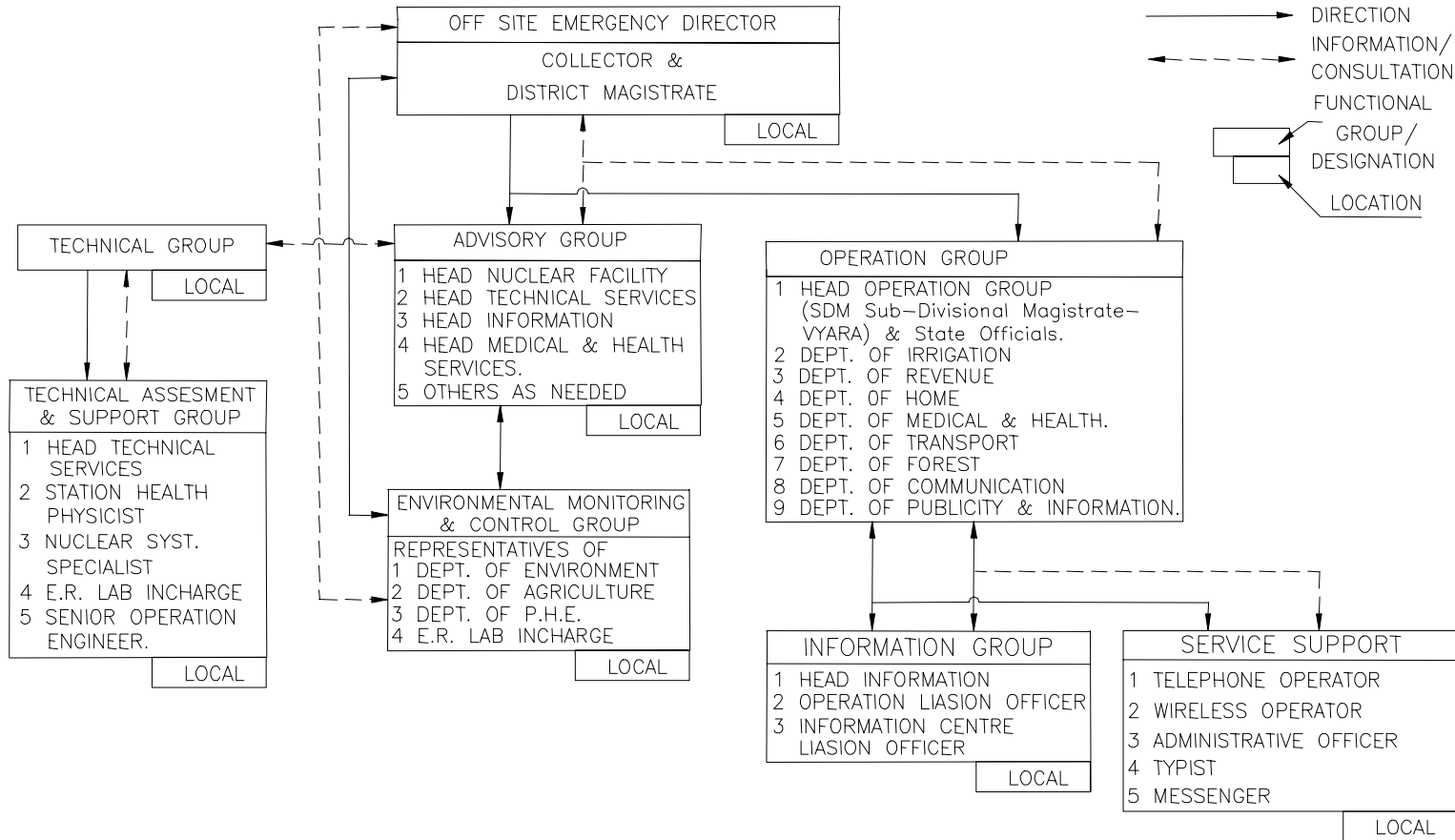
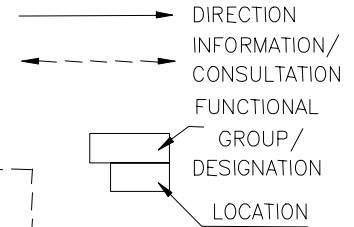
- ASSISTING PLANT AUTHORITIES FOR ENVIRONMENTAL MONITORINGS/ASSAYS OF FOOD SAMPLES
- NOTIFYING/ADVISING AFFECTED POPULATION REGARDING REQUIRED ACTIONS
- SHELTERING
- DISTRIBUTION OF STABLE IODINE
- EVACUATION – ARRANGING TRANSPORT, SUPPLIES OF FOOD & ESSENTIALS
- REHABILITATION
- ENFORCING ACCESS CONTROL TO AFFECTED AREAS
- IMPOUNDING OF CONTAMINATED FOOD STUFF
- ENFORCING LAW & ORDER/SECURITY/TRAFFIC CONTROL MEDICAL CARE
- LIVESTOCK MANAGEMENT
- COMMUNICATIONS
- PUBLIC INFORMATION.

# NUCLEAR OFF SITE EMERGENCY MANAGEMENT ORGANISATION (BASIC CONCEPT)



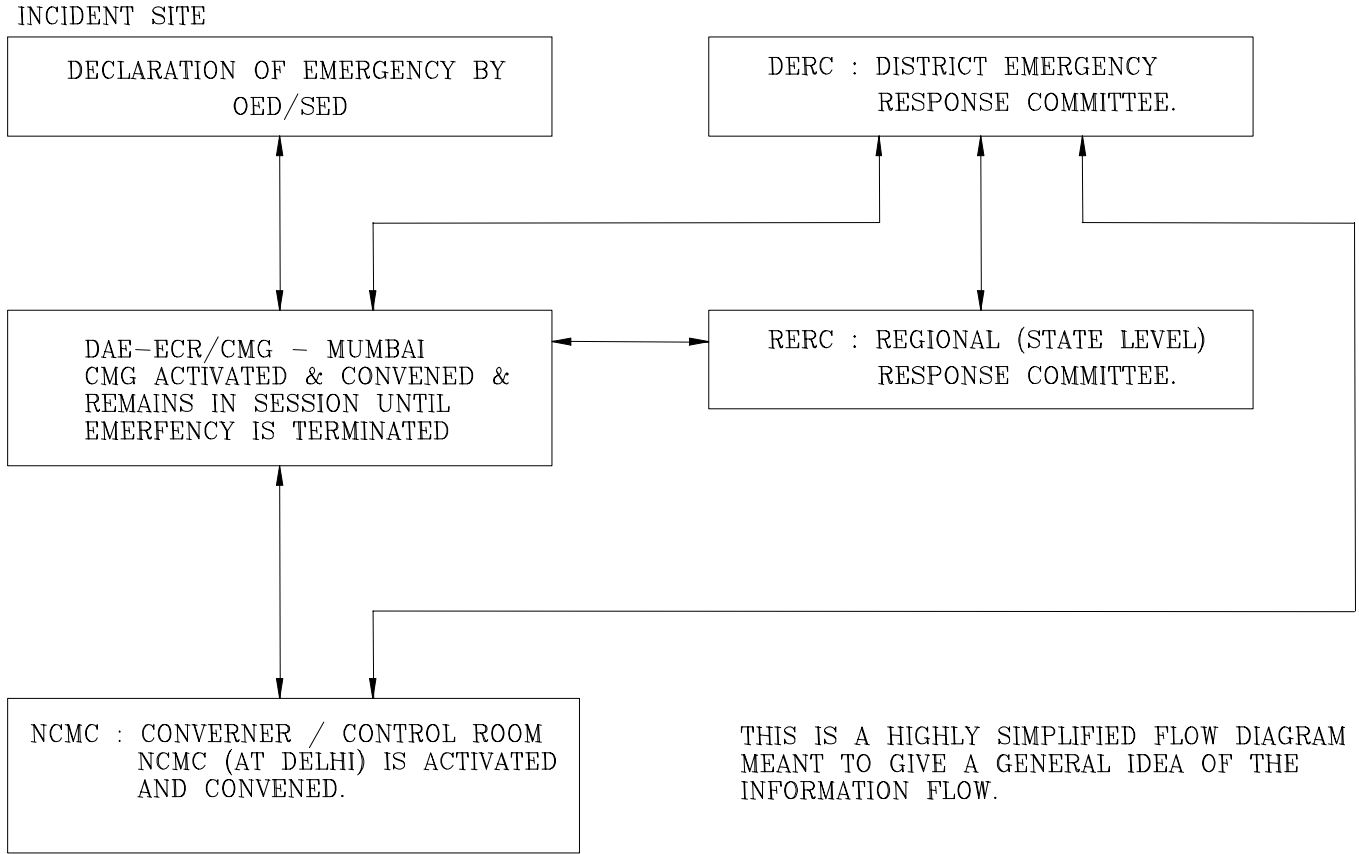
# NUCLEAR OFF SITE EMERGENCY RESPONSE CO-ORDINATION COMMITTEE

## LEGEND:



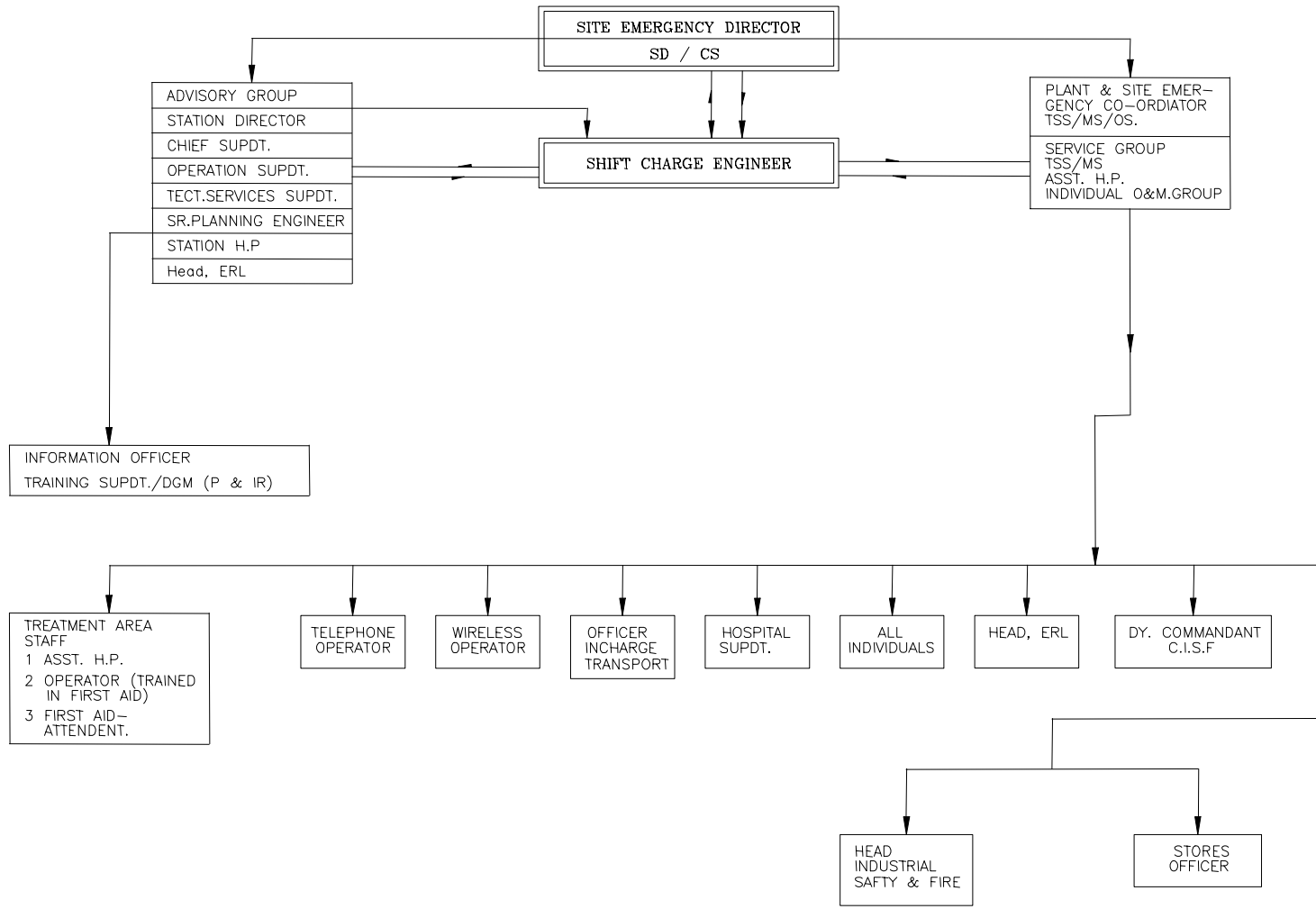


FLOW OF INFORMATION DURING AN OFF SITE EMERGENCY AT A NUCLEAR FACILITY



THIS IS A HIGHLY SIMPLIFIED FLOW DIAGRAM MEANT TO GIVE A GENERAL IDEA OF THE INFORMATION FLOW.

# KAKRAPAR EMERGENCY COMMITTEE ITS ORGANISATION AND FUNCTIONS



# SCOPE OF EMERGENCY PREPAREDNESS PLAN

- **DEFINES:**
  - ✓ EMERGENCY TYPES, PROTECTIVE ACTIONS, INTERVENTION LEVELS
  - ✓ EMERGENCY ZONES AND SECTORS
  - ✓ OFFSITE EMERGENCY ORGANISATION & RESPONSIBILITIES TO ESTABLISH, MAINTAIN AND IMPLEMENT EMERGENCY PLAN
  - ✓ ACTION PLANS FOR INDIVIDUAL FUNCTIONARIES
  - ✓ FACILITIES & EQUIPMENT REQD FOR HANDLING THE EMERGENCIES
- **DOES NOT COVER EMERGENCIES SUCH AS CYCLONE, FLOOD, SABOTAGE**  
**RESULTING RADIATION EMERGENCY IS IN SCOPE OF THIS PLAN**
- **PLAN COVERS AREA UPTO 16KM RADIUS;**  
**(IF NECESSARY EMERGENCY ACTIONS COULD BE EXTENDED BEYOND 16 KM)**

# TYPICAL DATA IN EMERGENCY RESPONSE PLAN DOCUMENT

- **DEMOGRAPHIC DATA**
  - ✓ **SECTOR/DISTANCE-WISE LISTING OF VILLAGES, POPULATION (HUMAN AND CATTLE), TYPES OF HOUSES, MILK COLLECTION CENTRES**
  - ✓ **SECTOR/DISTANCE-WISE POPULATION CENTRES AND SHELTERING FACILITIES (SCHOOLS, REST HOUSES, HOSPITALS, COMMUNITY HEALTH CENTRES ETC.)**
- **METEOROLOGICAL DATA (HISTORICAL)**
  - ✓ **SECTOR-WISE WIND SPEED, DIRECTION, SECTORS LIKELY TO BE AFFECTED, WIND ROSES**
- **FOOD INTAKE PATTERNS**
- **ROADS/ROUTES FOR EVACUATION; & TRAFFIC DIVERSIONS**
- **MEDICAL FACILITIES – SECTORWISE LISTINGS**
- **KEY PERSONNEL – LIST & CONTACT DETAILS**
- **LIVESTOCK POPULATION DATA**
- **VEHICLES AVAILABLE – PUBLIC/PRIVATE (SECTOR-WISE)**
- **REQUIREMENT OF POLICE DEPLOYMENT**

# **RESOURCES & FACILITIES**

- **MANPOWER**  
FOR MANAGEMENT, HEALTH PHYSICS SURVEYS,  
DECONTAMINATION, FIREFIGHTING, FIRST AID, DRIVERS,  
TECH STAFF FOR RESCUE/RELIEF, MEDICAL,  
COMMUNICATIONS
- **SIREN, EMERGENCY SURVEY VEHICLES**
- **EMERGENCY EQUIPMENT:**  
RADIATION/ACTIVITY MONITORS PROTECTIVE EQPT,  
EMERGENCY LIGHTS
- **COMMUNICATION FACILITIES**
- **MEDICAL FACILITIES, INCL. HOSPITAL, AMBULANCE,  
HANDLING OF CONTAMINATED PERSONNEL**
- **ENVIRONMENTAL MONITORING & SAMPLING NETWORK &  
DATA PROCESSING SYSTEM**
- **EMERGENCY SHELTERS**
- **EMERGENCY CONTROL CENTRE**

# MAINTENANCE OF EMERGENCY PREPAREDNESS

- **EMERGENCY EXERCISES:**
  - PLANT EMERGENCY : ONCE IN A QUARTER
  - SITE EMERGENCY : ONCE IN A YEAR
  - OFFSITE EMERGENCY : ONCE IN TWO YEARS
- **EMERGENCY EQPT : PERIODIC CHECKS**
- **TRAINING : SITE/OFFSITE PERSONNEL, TARGET PUBLIC**
- **REVISE/UPDATE DOCUMENT EVERY 5 YRS**

# REQUIREMENTS RE EXCLUSION ZONE

- **MINIMUM 1.5 KM RADIUS**
- **CALCULATED DOSES FOR LIMITING DBAs SHALL NOT EXCEED 'REFERENCE DOSE LEVELS'**
  - ✓ **100 mSv WHOLE BODY**
  - ✓ **500 mSv THYROID**
- **LIMITING DBSs : INITIATING EVENT SIMULTANEOUS WITH IMPAIRMENT OF A MITIGATING SAFETY SYSTEM**  
**VIZ : LOCA + FAILURE OF ECCS**  
**LOCA + FAILURE OF CONTAINMENT ISOLATION**
- **ASSUMPTIONS RE DOSE CALCULATION**
  - ✓ **EXPOSURE PERIOD : INDEFINITE**
  - ✓ **EXPOSURE PATHWAY : EXTERNAL + INHALATION (INGESTION EXCLUDED)**
  - ✓ **WORST METEOROLOGICAL CONDITIONS FOR FIRST TWO HRS, FOLLOWED BY AVERAGE METEOROLOGICAL CONDITIONS**

# PROPOSED REVISIONS IN EXCLUSION ZONE REQUIREMENTS

- **REF. DOSE LEVELS:**
  - SAME AS BEFORE: 100mSv WB; 500mSv Thyroid
- **HOWEVER INGESTION DOSES FOR FIRST FEW HOURS TO BE CONSIDERED (MILK ROUTE)**

**CONSEQUENTLY THYROID DOSE OF 500mSv  
APPORTIONED AS**

**INGESTION : 300 mSv**

**EXT + INHALATION : 200 mSv**

**MINIMUM RADIUS : 1.0 KM**



**THANK YOU**