EMERGENCY INTERVENTION PLAN FOR 14 MW TRIGA - PITESTI RESEARCH REACTOR

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Introduction

The site:

- INR (Institute for Nuclear Research Pitesti)
- FCN (Nuclear Fuel Factory)
- ANDRAD (National Agency for Radwaste Management)

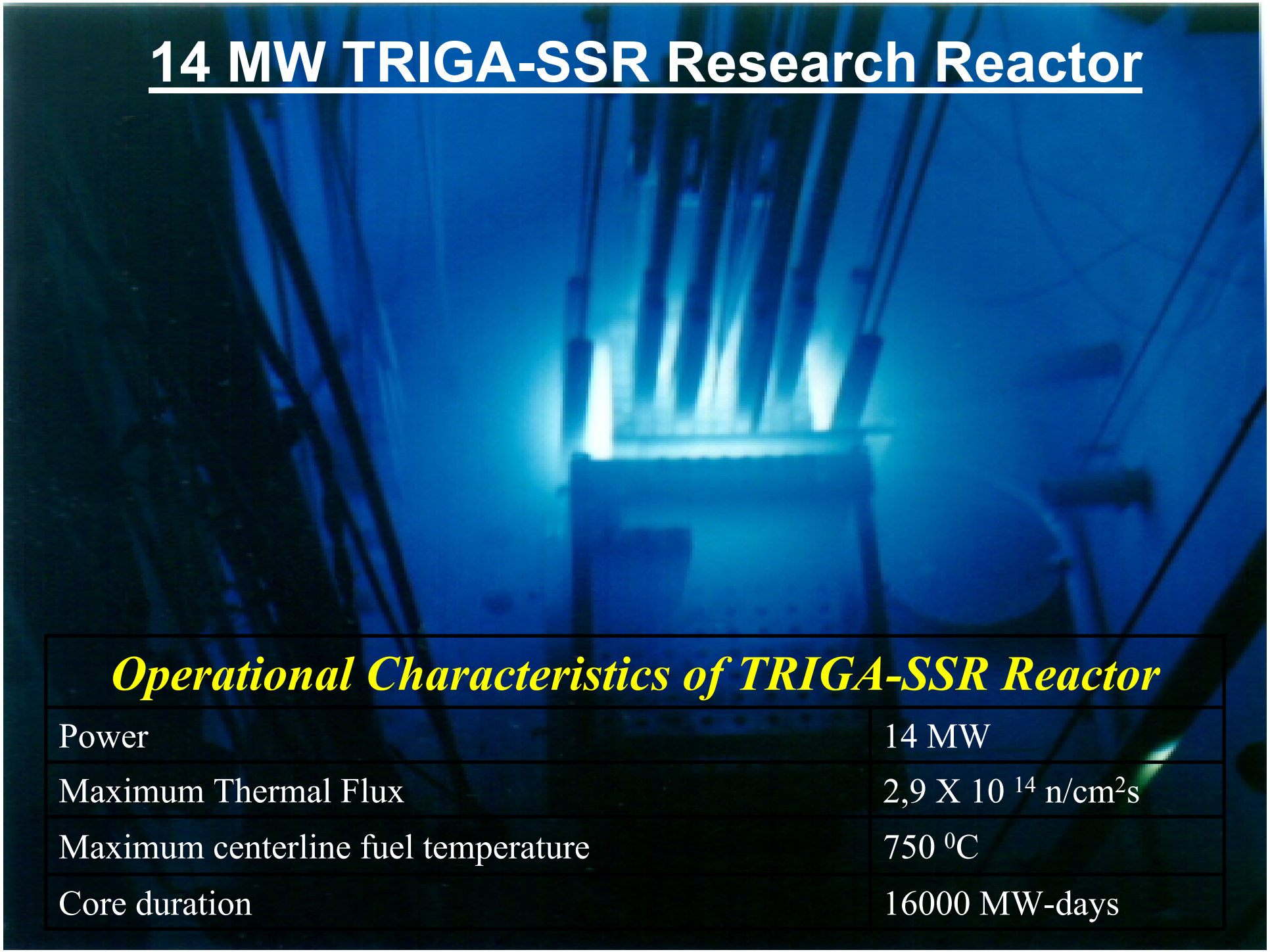
Introduction

NUCLEAR RISK SOURCES:

- TRIGA Research Reactor
- Post Irradiation Experiments Laboratory
- Radwaste Treatment Station
- Out of Pile Testing Facility
- Power Gamma Irradiation Facility

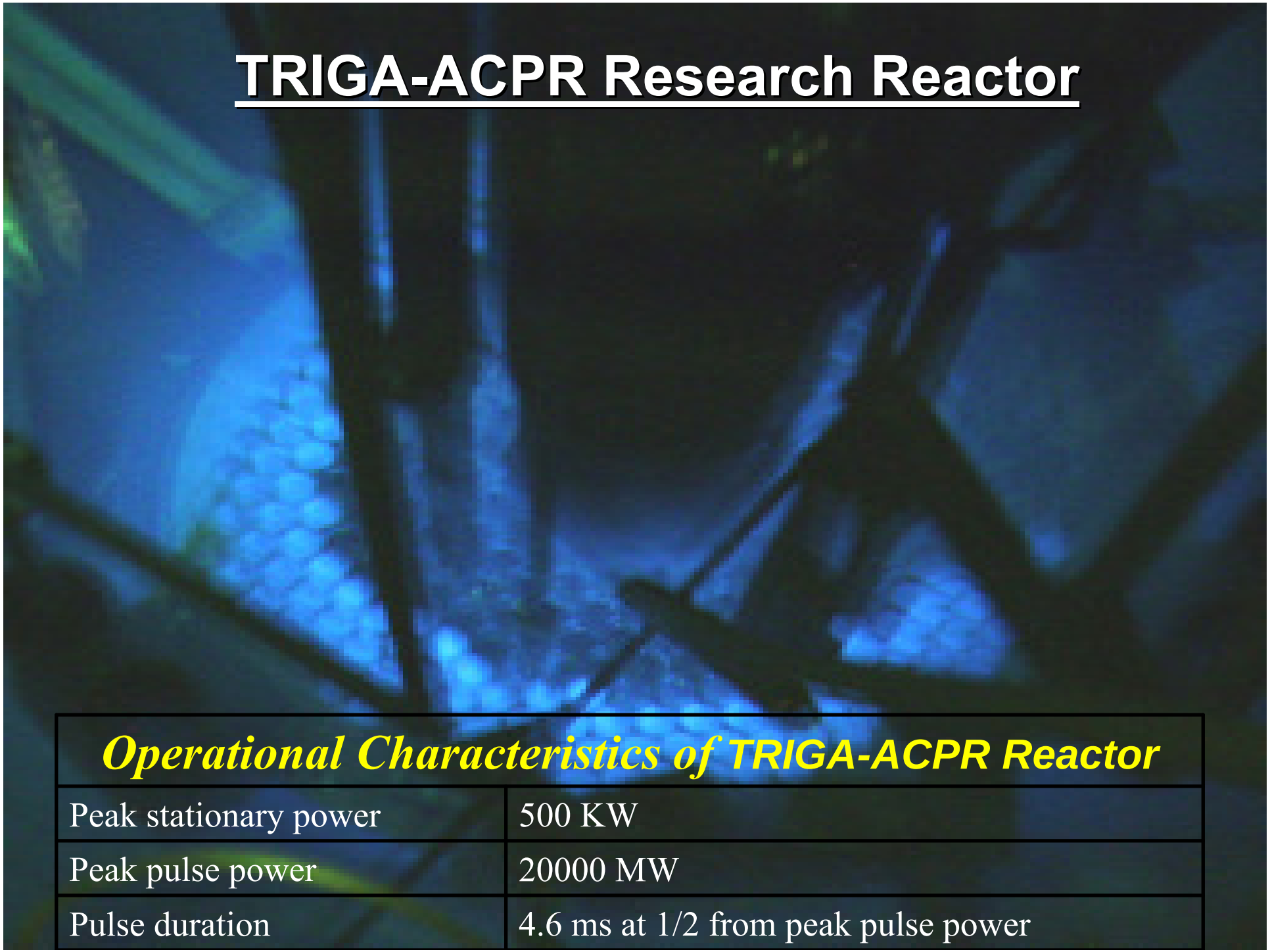
- Nuclear Fuel Factory

14 MW TRIGA-SSR Research Reactor



Operational Characteristics of TRIGA-SSR Reactor	
Power	14 MW
Maximum Thermal Flux	2,9 X 10 ^{14} n/cm^{2}s
Maximum centerline fuel temperature	750 ^{0}C
Core duration	16000 MW-days

TRIGA-ACPR Research Reactor



Operational Characteristics of TRIGA-ACPR Reactor	
Peak stationary power	500 KW
Peak pulse power	20000 MW
Pulse duration	4.6 ms at 1/2 from peak pulse power

Introduction

Post Irradiation Experiments Laboratory – LEPI

Activities performed:

- **Nondestructive and Destructive Fuel examination**
- **Irradiated material examination**
- **Radioisotopes production**

HYPOTHESES FOR INTERVENTION

Defense in depth. Safety barriers

1. Fuel matrix,
2. Fuel cladding
3. Primary loop
4. Reactor building
5. Distance between reactor building and exposed factor (population, environment).

As long as the integrity of safety barriers are maintained, the core radioactive inventory is contained.

HYPOTHESES FOR INTERVENTION

Events:

- **internal**
  - Design Basis Accidents (DBA)
  - Beyond Design Basis Accidents (BDBA)
  - Fire
- **external**
  - Earthquake
  - Airplane crash
  - Terrorist attack
  - Armed Conflicts (terrestrial or aerial)

HYPOTHESES FOR INTERVENTION

Design Basis Accidents (DBA)

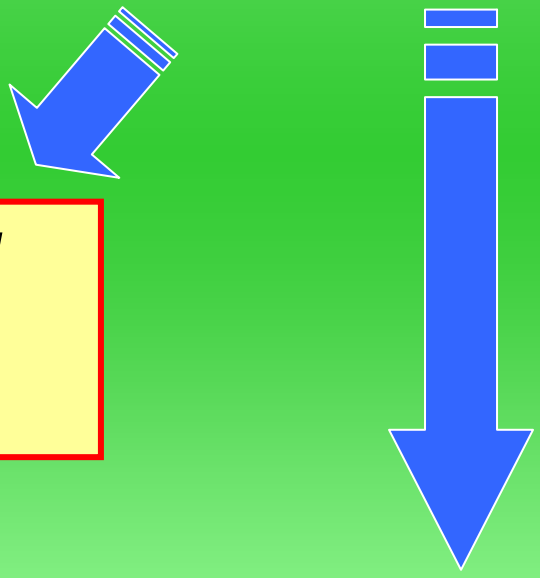
Damage of a single pin fuel in water with TRIGA specific release factors

Fraction of the core involved:		**1 pin (0.14% from core)**
Fraction of the fission products released:		**6.3×10^{-4}**
Fraction of the fission products released in the pool:		
	- noble gases	**100%**
	- halogens	**25%**
Fraction of the fission products released in the reactor hall:		
	- noble gases	**100%**
	- organic halogens	**25%**
	- elemental or particulate halogens:	**1%**
Condition of the ventilation system:		**normal**
Stack release rate:		**24,360 m^3/h**
Estimated dose:		
	- in reactor hall	**- effective dose : 0.1 mSv**
		- thyroid dose :18 mSv
	- at 250m downwind direction	**- effective dose : 9.8×10^{-2}mSv**
		- thyroid dose : 1.1×10^{-2}mSv

HYPOTHESES FOR INTERVENTION

Design Basis Accidents (DBA)

Without radiological consequences



Accidental reactivity insertions

Loss of flow due to the damage of main coolant loop pump

Interaction between the 2 cores

HYPOTHESES FOR INTERVENTION

Beyond Design Basis Accidents (BDBA)

Damage of a 25 pin fuel bundle in water with total release

Fraction of the core involved:	**1 bundle (3.4% from core)**
Fraction of the fission products released in the pool:	
- noble gases	**100%**
- halogens	**25%**
Fraction of the fission products released in the reactor hall:	
- noble gases	**100%**
- organic halogens	**100%**
- elemental or particulate halogens:	**1%**
Condition of the ventilation system:	**emergency**
Stack release rate:	**6000 m3/h**
Estimated dose:	
- in reactor hall	**- effective dose : 56 mSv**
	- thyroid dose :7.9x10+3 mSv
- at 250m downwind direction	**- effective dose : 26 mSv**
	- thyroid dose : 4.2 mSv

PREMISES FOR INTERVENTION

LEGAL FRAMEWORK

1. ***International regulations***

2. ***National regulations***

3. ***Internal regulations (accepted by CNCAN)***

PREMISES FOR INTERVENTION

Regulatory control

The regulatory authority is CNCAN which exercises the statutory and legal activities related to the safety of the TRIGA research reactor in Pitesti.

- For the TRIGA R.R. CNCAN established safety principles, associated criteria, regulations and standards upon which the regulatory activity is based.
- The regulatory authority CNCAN issues licenses for the specific activities of interest for the nuclear power industry, including R.R. starting, from the initial/ conceptual design, through siting, construction, commissioning, operation, maintenance, modification, decommissioning.

PREMISES FOR INTERVENTION

- Knowledge of human contamination pathways
- ALARA Principle (As Low As Reasonable Achievable)
- Averted Dose Criterion
- Emergency intervention plan on SCN site
- Public Authorities Notification – Alarm Procedure
- Link with Emergency Intervention Plans of:
  - *Local Authorities*
  - *Central Authorities*

PREMISES FOR INTERVENTION

1. JUSTIFICTION
Necessity to justify the doses based on benefit

3. LIMITATION
Necessity to apply dose limits

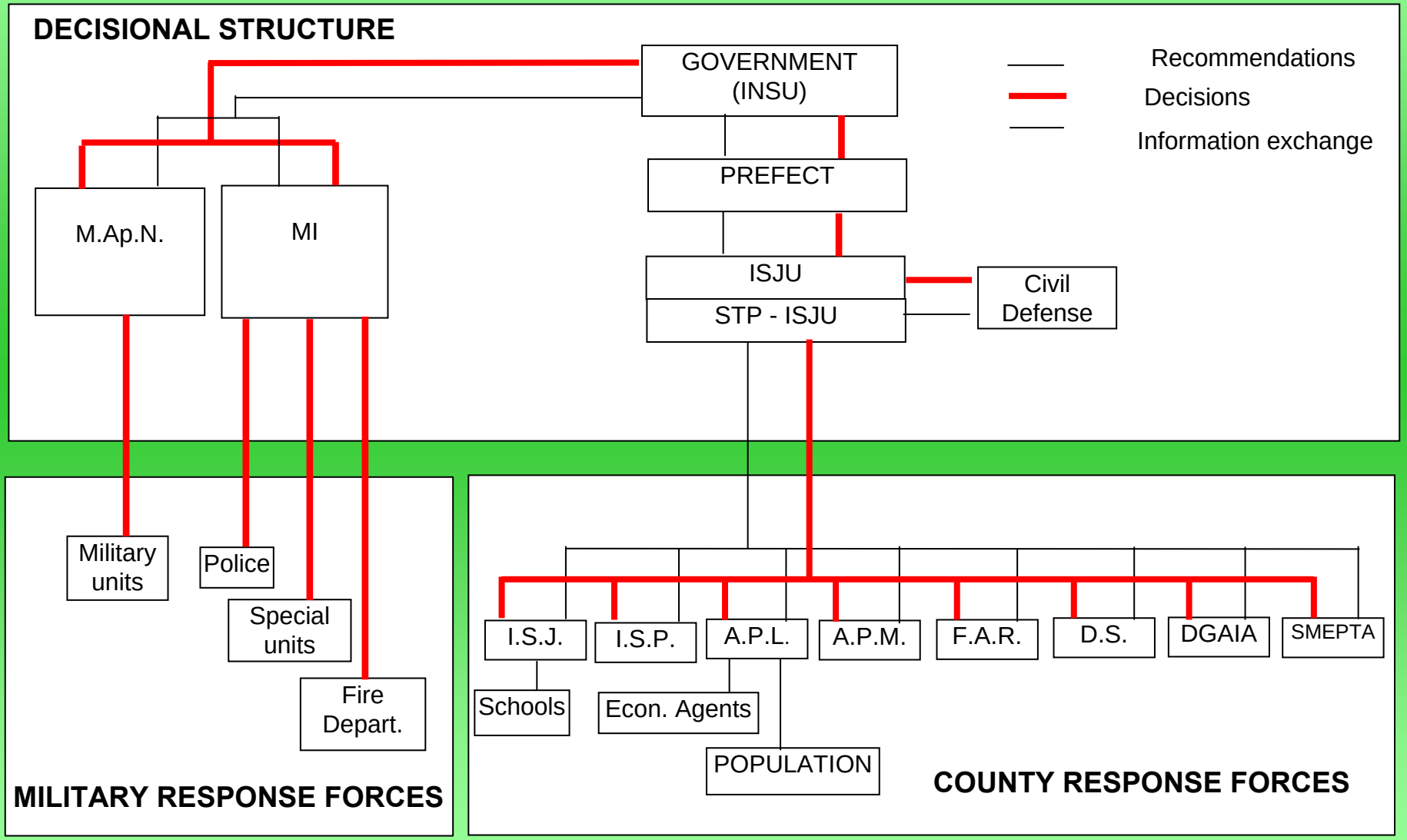
FUNDAMENTAL PRINCIPLES

2. OPTIMIZATION
Necessity to ensure maximum benefit (ALARA)

Taking into account aspects:

- technical
- economical
- practical
- social
- political

PREMISES FOR INTERVENTION



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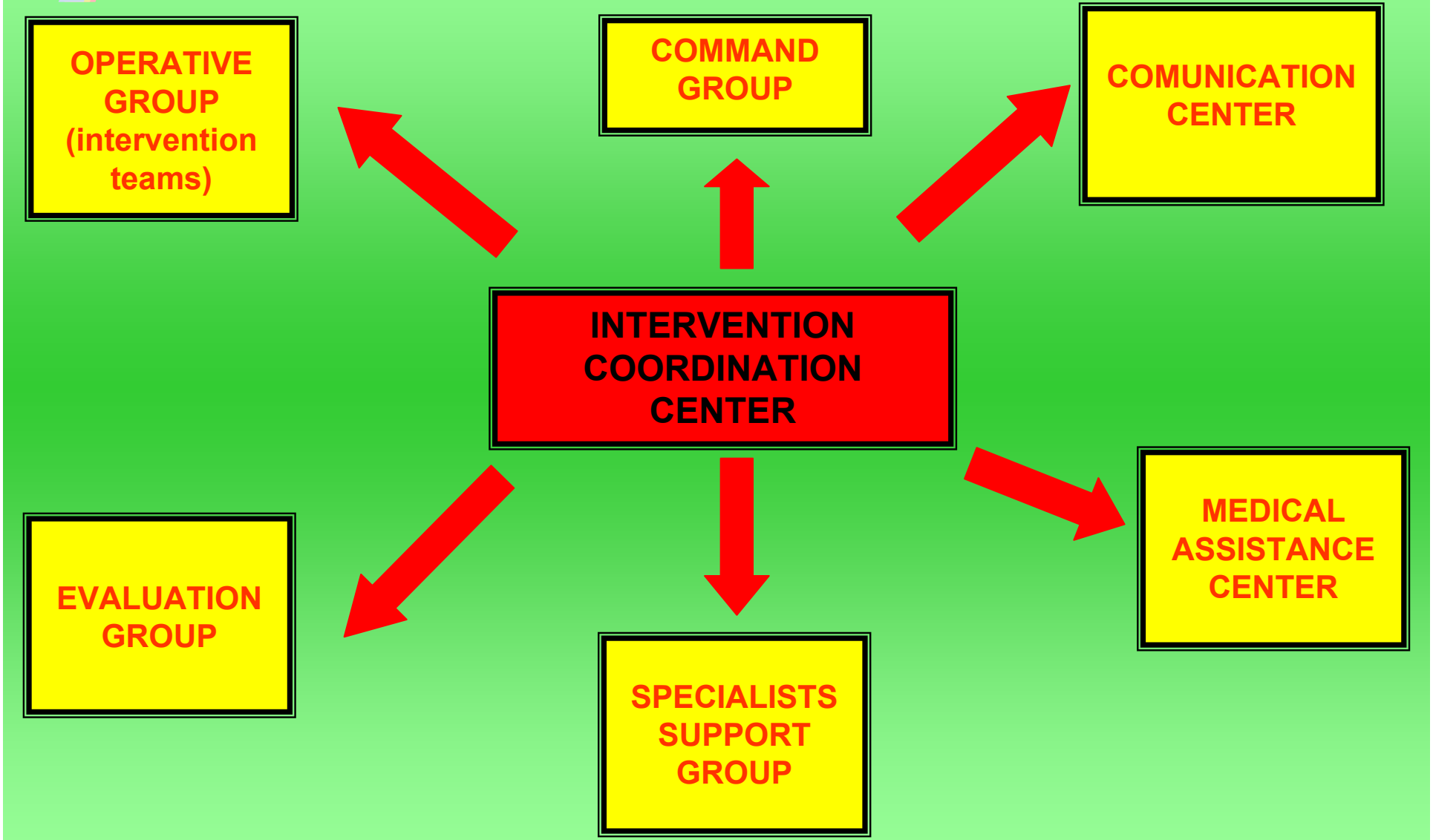
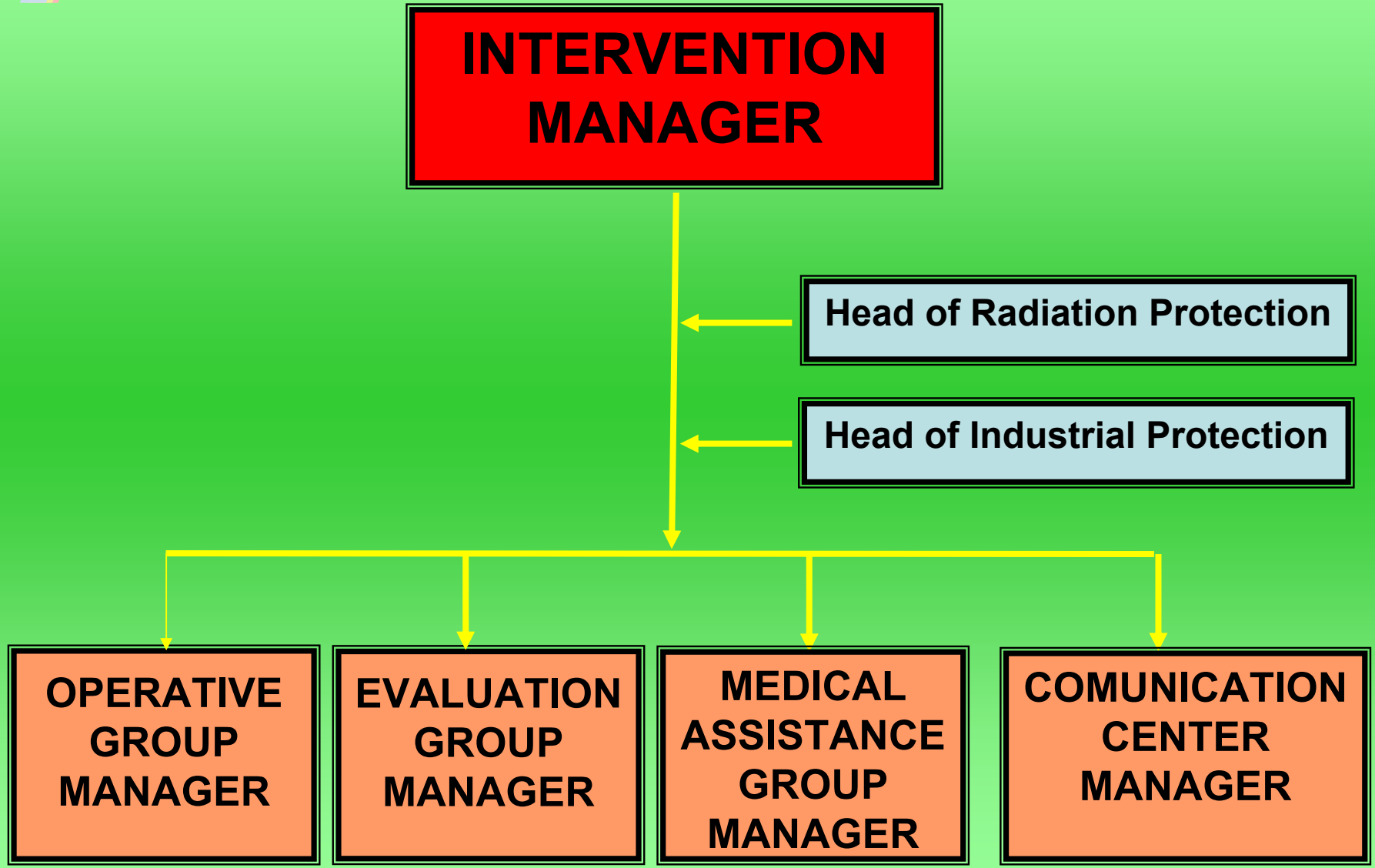


PREMISES FOR INTERVENTION



Computer codes

- *DOZIM (developed in ICN)*
- *COSYMA (EU)*
- *MACCS (USA)*

Computerized support for nuclear accident management

Site Specific Databases

- *Population*
- *Meteorological*
- *Agricultural production*
- *Animal production*
- *Consumption rates*

PREMISES FOR INTERVENTION

Training:
- personnel
- general public

Training center

Training:
- general
- specific

Emergency intervention exercises:
- on site
- off site

CONCLUSIONS

- TRIGA Reactors– 45 years of operation without accidents or incidents potentially dangerous for radiological safety
- TRIGA Reactors installed in 24 countries, installed powers 20 kW ↔ 16 MW
- UZrH fuel– life time in reactor 3 – 4 times longer than other fuels
- UZrH fuel – better retention of fission products
- DBA Rate ~ 1 at 100.000 years
- TRIGA Reactors– safe for personnel, population and environment

TRIGA Reactors– "intrinsic safety" guaranteed by natural laws

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