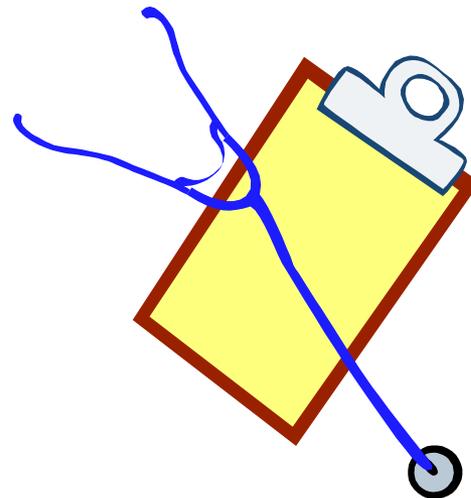




Nuclear Safety

Chronic vs. Acute

What are chronic and acute hazards with respect to radiation in nuclear power plants?



Chronic Radiation Hazard

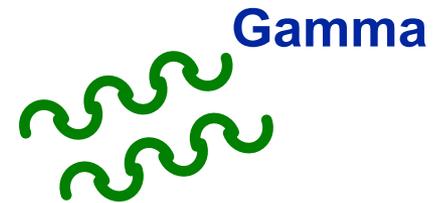
- ◆ Naturally Occurring
 - Cosmic rays, atoms in earth, building materials
 - 202 mrem /year
- ◆ Man Made
 - Medical -- 110 mrem/year
 - Weapons fallout -- 2 mrem/year
 - Occupational -- 4mrem
 - Consumer products -- 2 mrem/year
 - Nuclear power -- 0.3 mrem /year



Alpha



Beta



Gamma

Typical Dose

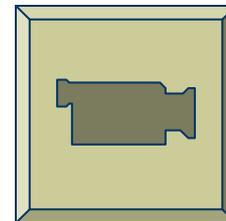
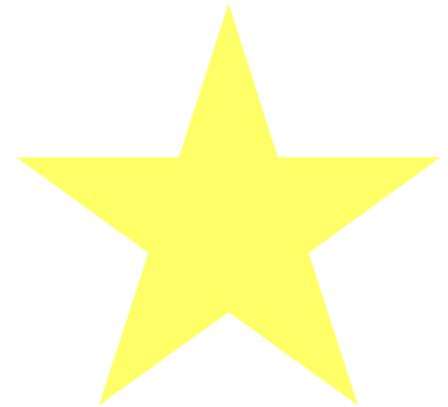
- ◆ Operating staff 400 mrem/year (average)
- ◆ Office staff 20 mrem/year (some people)
- ◆ Person at station exclusion fence .3 mrem/year (maximum)
- ◆ Residential Area 1 kilometer from station .1 mrem/ year (maximum)

Accident Pyramid



Self-Checking

- ◆ Review Intended Action
- ◆ Review Expected Response
- ◆ Acronym STAR
 - Stop
 - Think
 - Act
 - Review



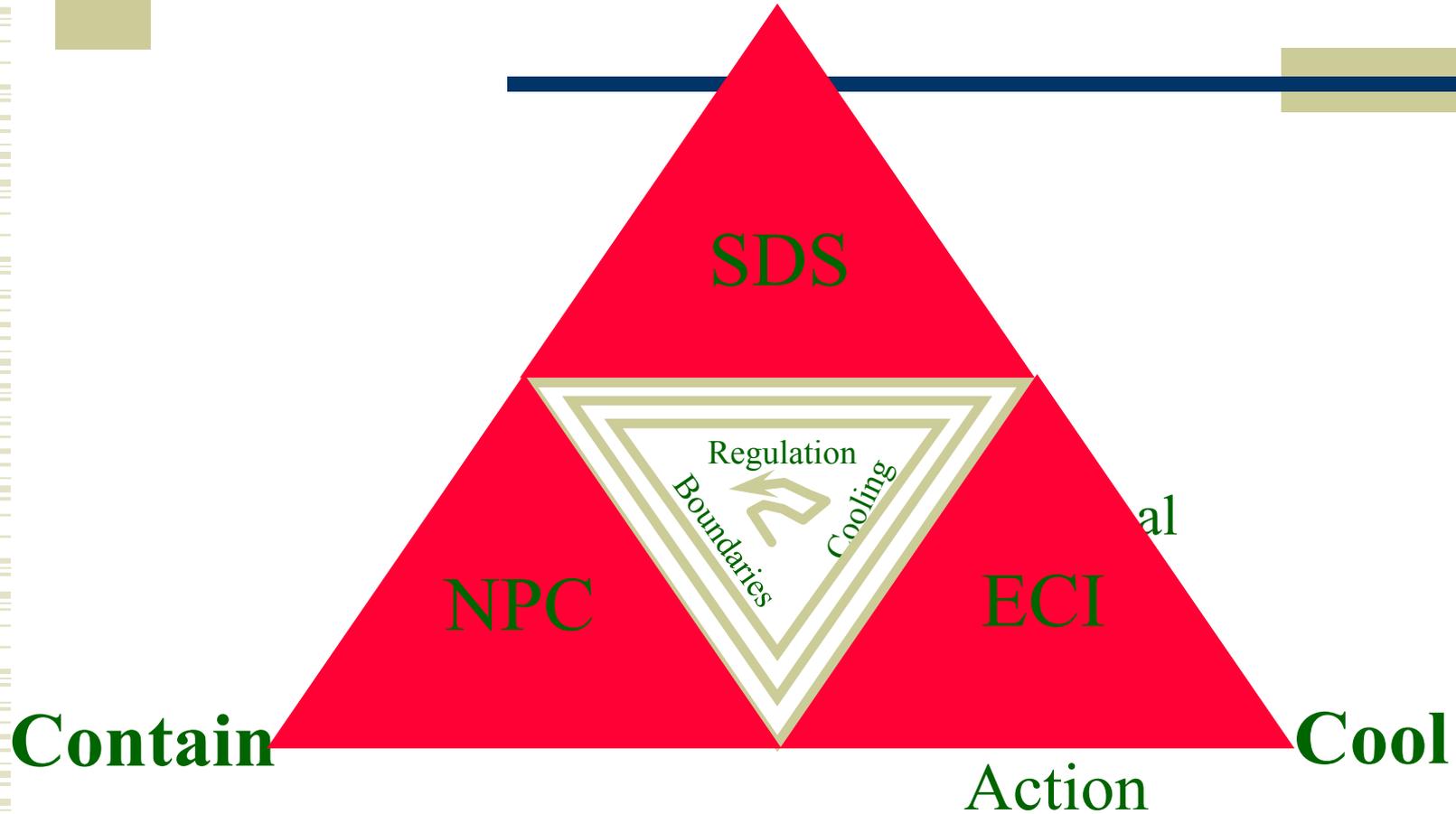


ALARA

- ◆ **As Low As Reasonably Achievable**

REACTOR SAFETY PHILOSOPHY

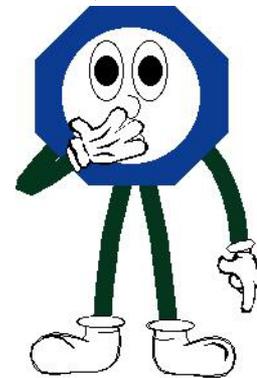
Control



Assumptions for Defense in Depth

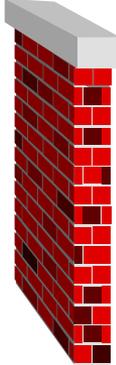
- ◆ **There will be errors in design**
- ◆ **Equipment will occasionally fail**
- ◆ **People will occasionally make mistakes**

How can we minimize the risk?



Protecting the Public

Defense in Depth



Multiple
Barriers

Reliable
Process
Systems

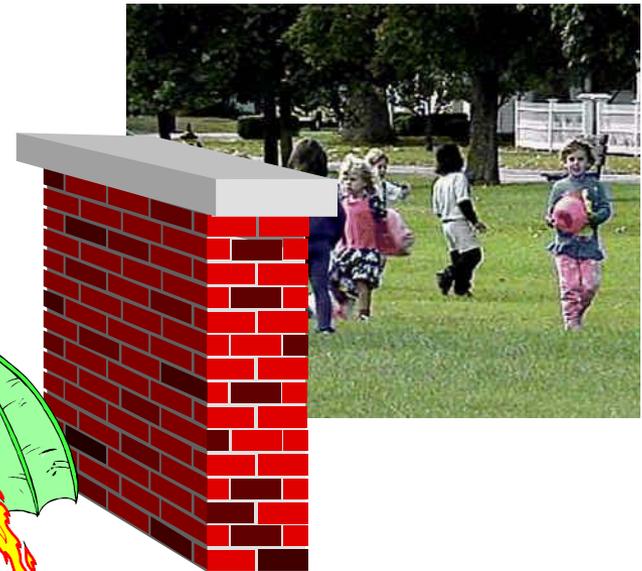
Reliable
Safety
Systems

Competent
Operating
&
Maintenance
Staff

Detect
and
Correct
Failures

What are the five barriers between the radioactive nasties and the public?

- ◆ **Ceramic Fuel**
- ◆ **Fuel Sheath**
- ◆ **Pressure Tube**
- ◆ **Containment**
- ◆ **Exclusion Zone**



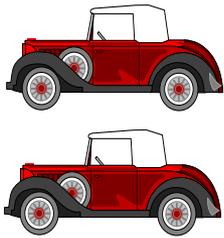
Reliability Concepts

- ◆ Reliability
 - the probability a device works for the period it is intended under the operating conditions encountered
- ◆ Availability
 - the fraction of time that a device is available to work if called upon to do

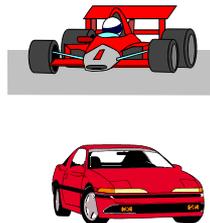


Reliability

- ◆ **Redundancy**
- ◆ **Independence**
- ◆ **Diversity**
- ◆ **Periodic Testing**
- ◆ **Fail Safe**
- ◆ **Operational Surveillance**
- ◆ **Preventive Maintenance**
- ◆ **Predictive Maintenance**



Redundant



Diverse

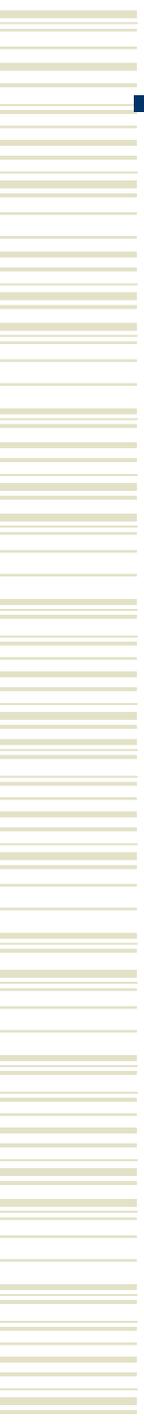


Diverse and Independent

Documentation

- ◆ **Canadian Nuclear Safety Commission (CNSC) is our regulator**
 - **Formerly the Atomic Energy Control Board (AECB)**
- ◆ **Hierarchy of documentation**
 - **Safety Report**
 - **Station Operating License**
 - **OP&P**
 - **Operating and Maintenance Procedures**
 - **Certificates of Approval (Ontario)**





Work Processes



- ◆ **Change Control Process**
- ◆ **Work Authorization Process**

Authorized Positions

- ◆ Authorized Positions
 - Shift Manager
 - Control Room Shift Supervisor
 - Authorized Nuclear Operator
- ◆ Protect the public
- ◆ Manage Work and Station Configuration
- ◆ Keep Within the Confines of the Operating License

