

Nuclear Regulatory Bodies carry out various regulatory processes such as development of regulations, licensing, safety review & assessment, inspection and enforcement. Safety review & assessment includes review of licensing application, modifications, operating & regulatory experience, and follow up of regulatory actions emanated from the reviews. For effective, efficient & consistent regulation, it is necessary that guidance is made available to the regulatory staff to conduct the safety review & assessment process in a graded manner.

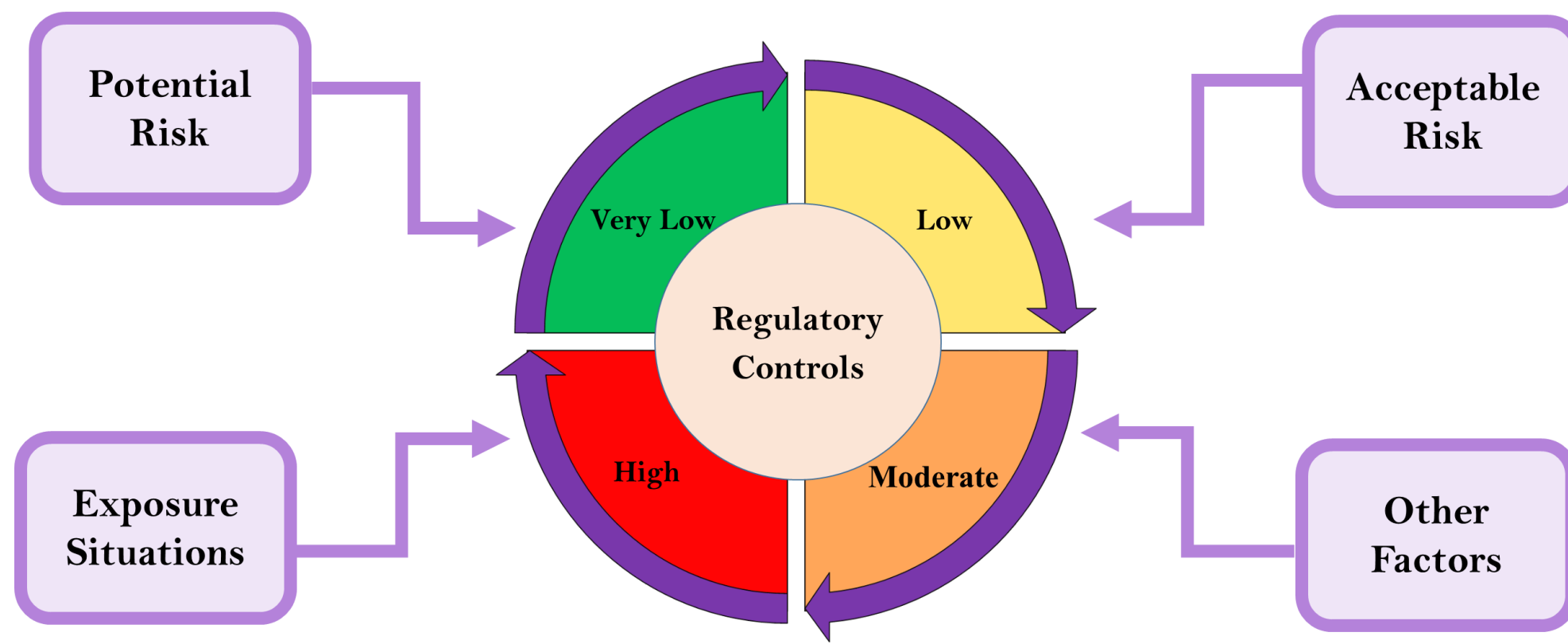
- Considering this, the Atomic Energy Regulatory Body (AERB) of India has developed the following:
- Guidance & tools for application of graded approach in various safety review & assessment processes such as review of modifications, operating & regulatory experience; follow up of regulatory action items.
 - Methodology for safety performance assessment of operating Nuclear Power Plants (NPPs) for integrated safety assessment.

Implementation of graded approach

The use of graded approach in regulation allows regulatory bodies to decide the scope & stringency of controls over the facilities & activities based on their potential risks and other relevant factors such as stage, design, complexity, experience, public concern, etc.

The Atomic Energy Regulatory Body (AERB) of India developed detailed guidance document for its staff for application of graded approach in regulation of facilities & activities in following stages:

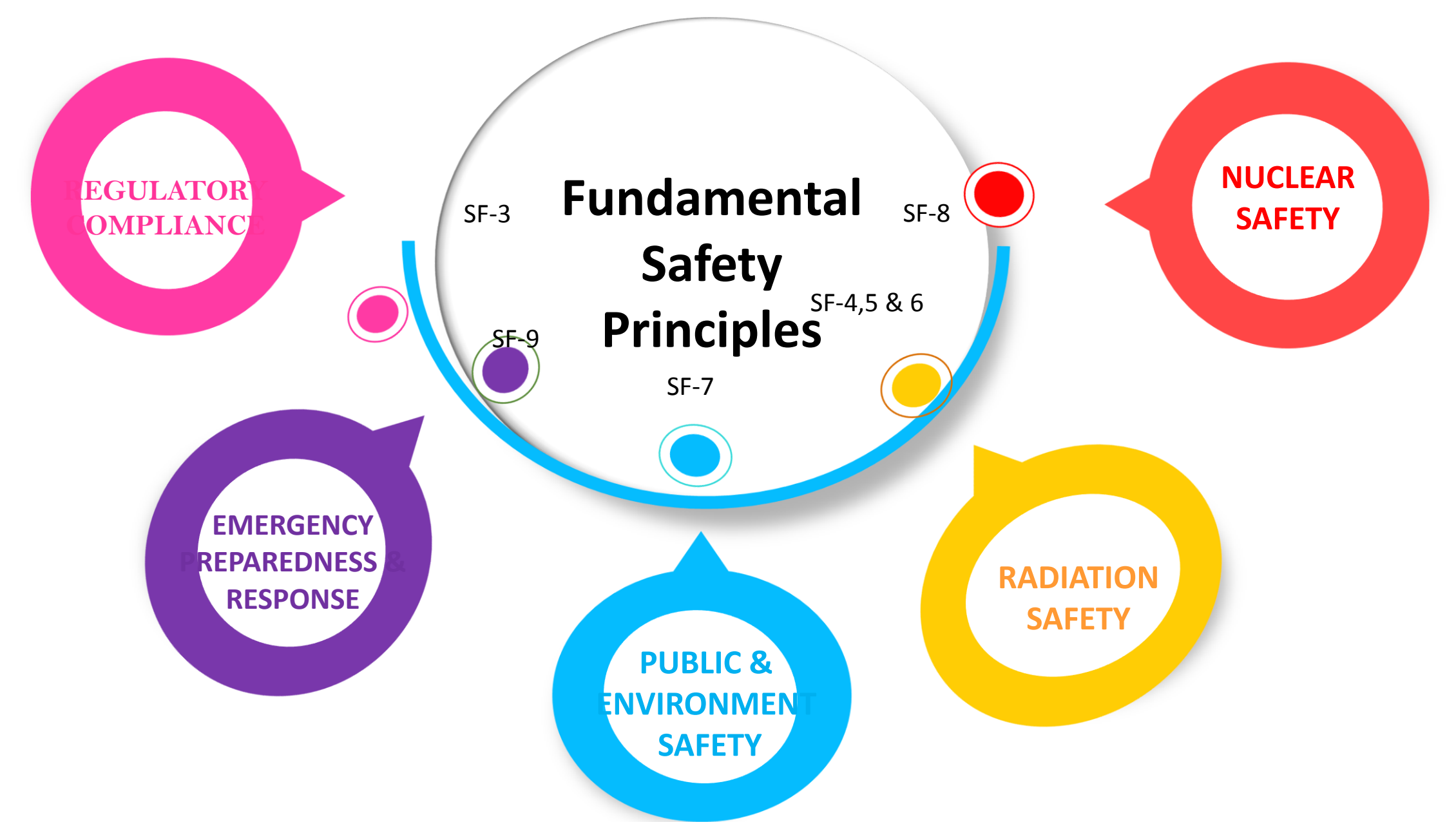
- Materialization of concepts of exclusion, exemption & clearance
- Identification of 'Elements of Control'
- Identification of 'Influencing Factors'
- Gratation of 'Elements of Control' considering 'Influencing Factors'



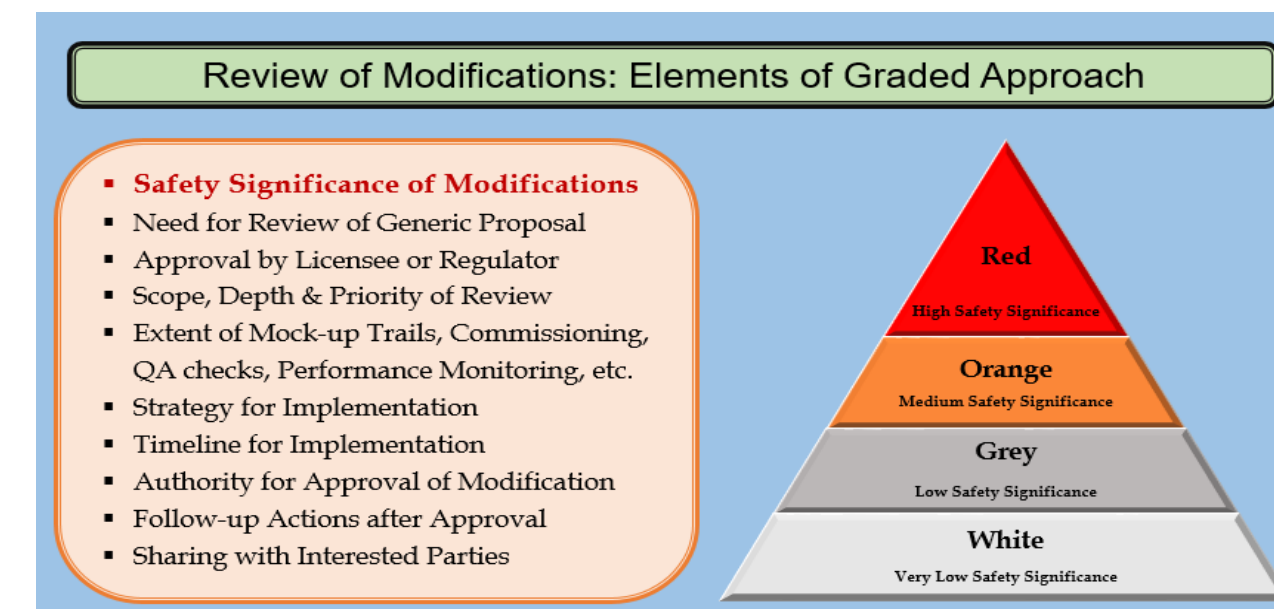
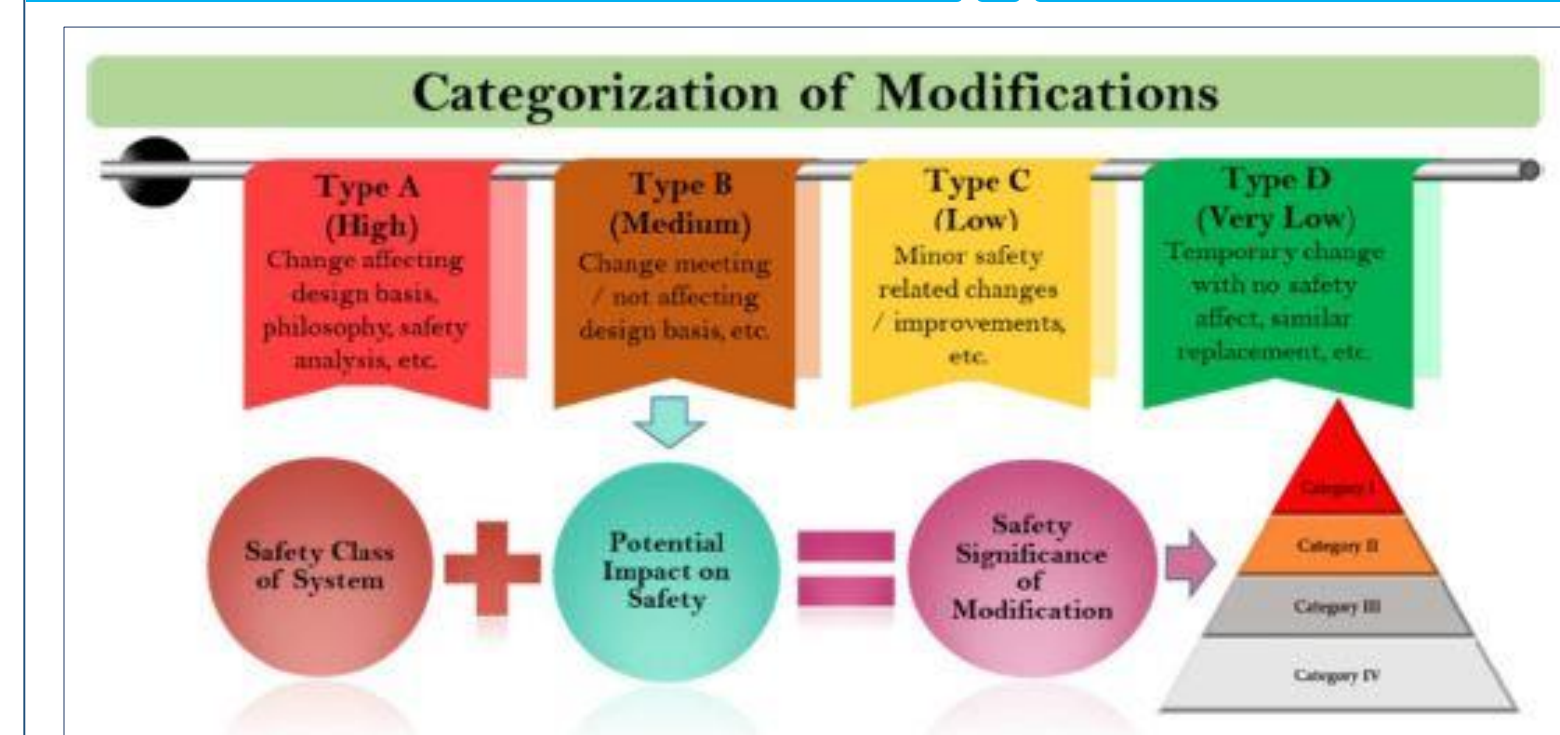
Safety Performance Assessment

Safety Performance Indicators (SPIs) are used for monitoring and assessing the safety performance of operating NPPs in a quantified manner. The Atomic Energy Regulatory Board (AERB) of India developed a methodology for safety performance assessment of operating NPPs based on a comprehensive set of SPIs. This methodology facilitates comparison of safety performance of operating NPPs irrespective of their designs and vintage, thus enabling monitoring, trending & comparison of performance. Further, it provides inputs for regulatory processes & integrated safety assessment of NPPs and serves as a means for effective communication with public, media & technical community in a clear, consistent and coherent manner.

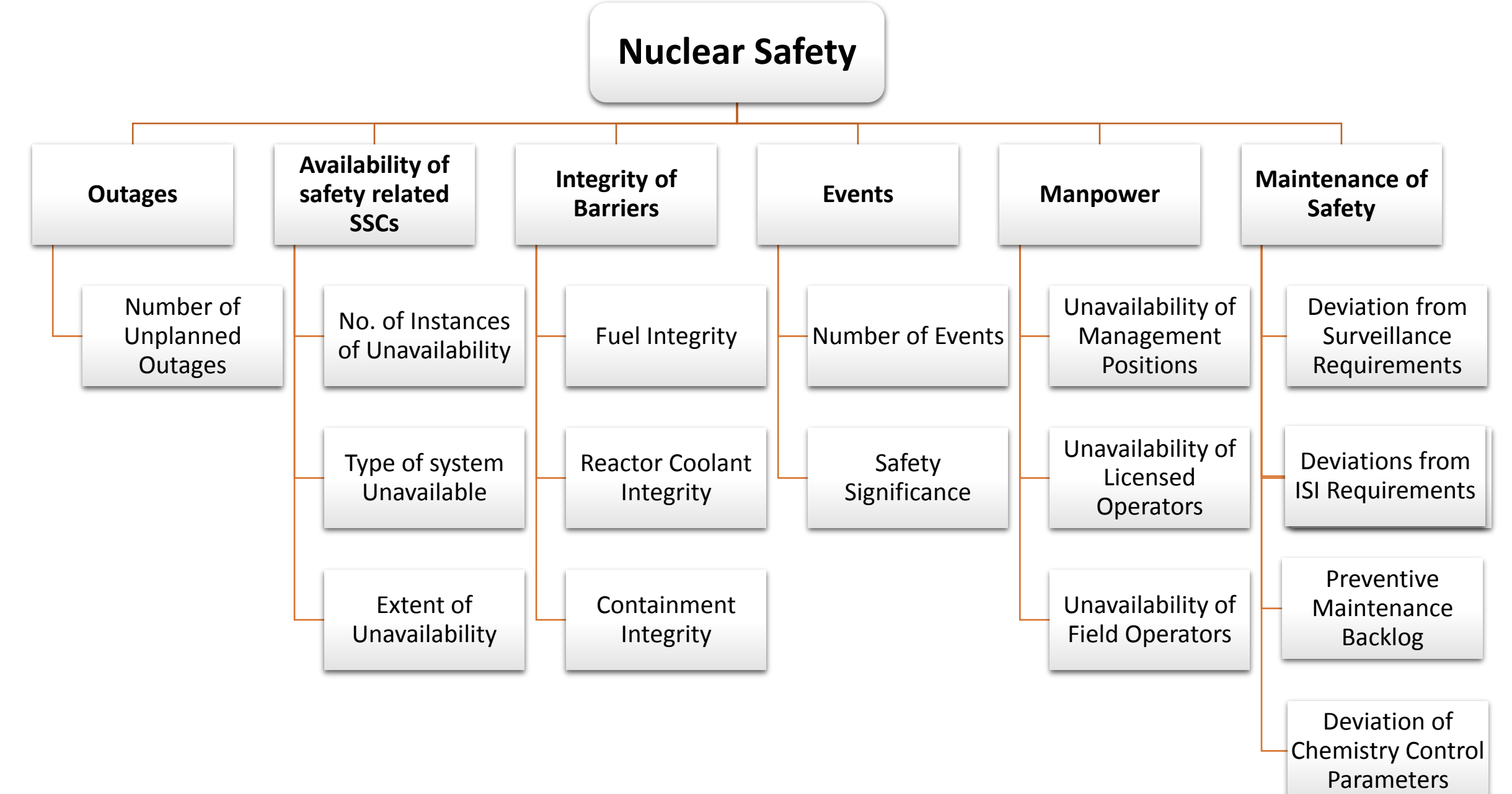
Step 1: Identification of Safety Performance Areas



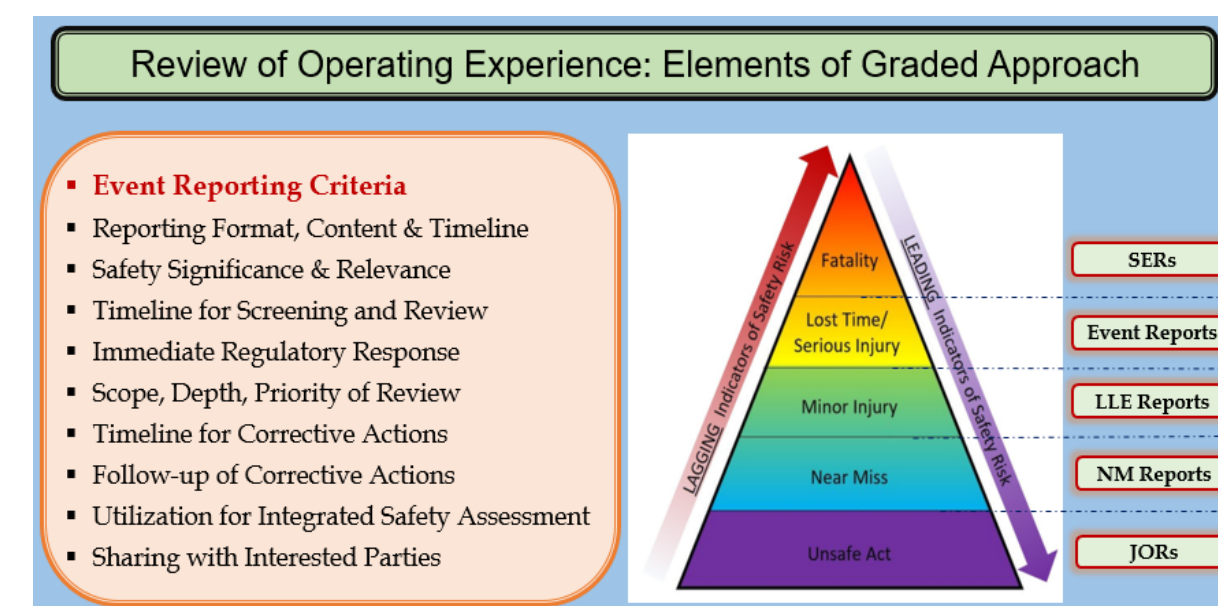
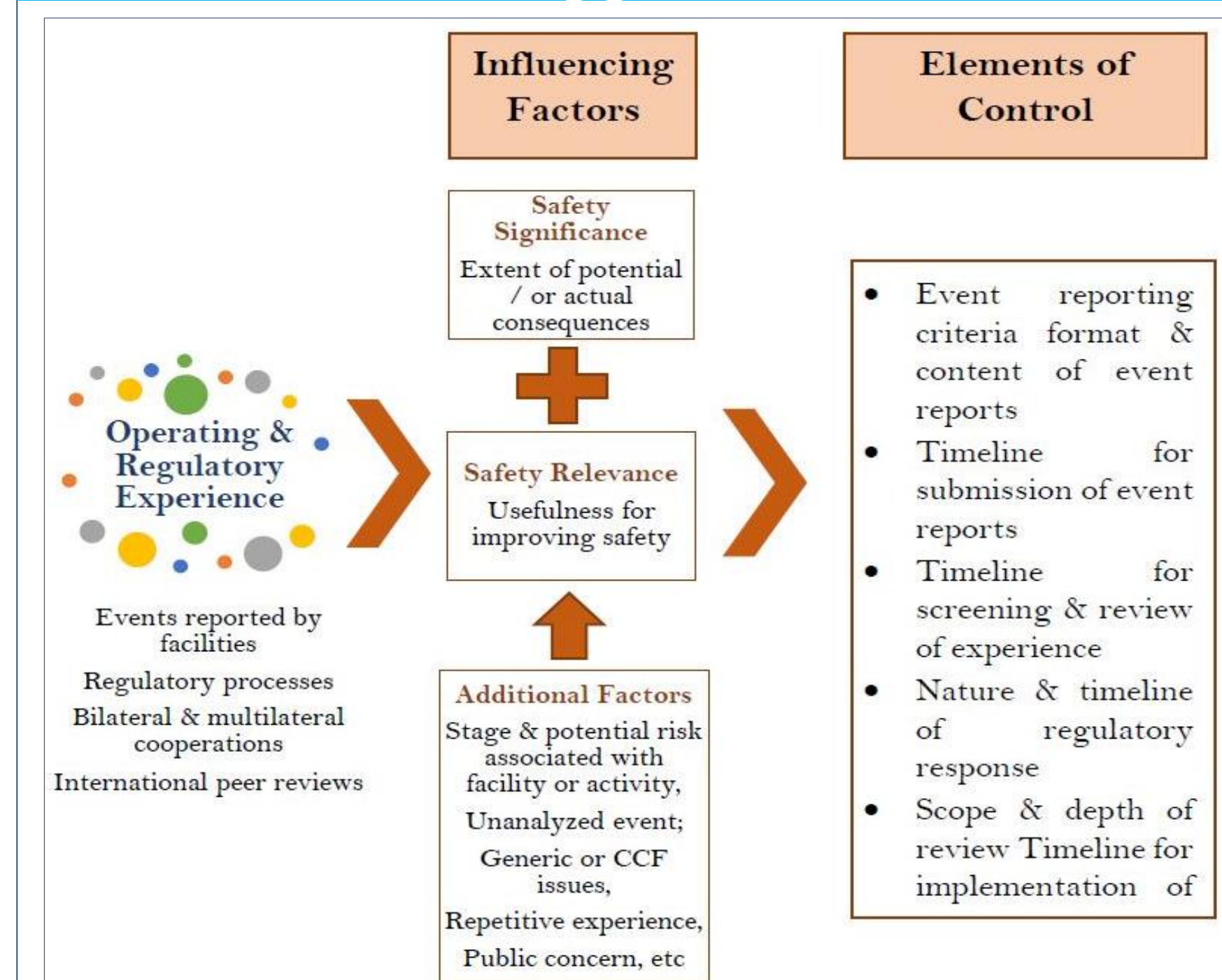
Graded Approach in Review of Modifications



Step 2: Selection of Performance Indicators & Attributes



Graded Approach in review of operating experience



Step 3: Benchmarking of Attributes

Benchmarks were derived coherently in a graded manner considering

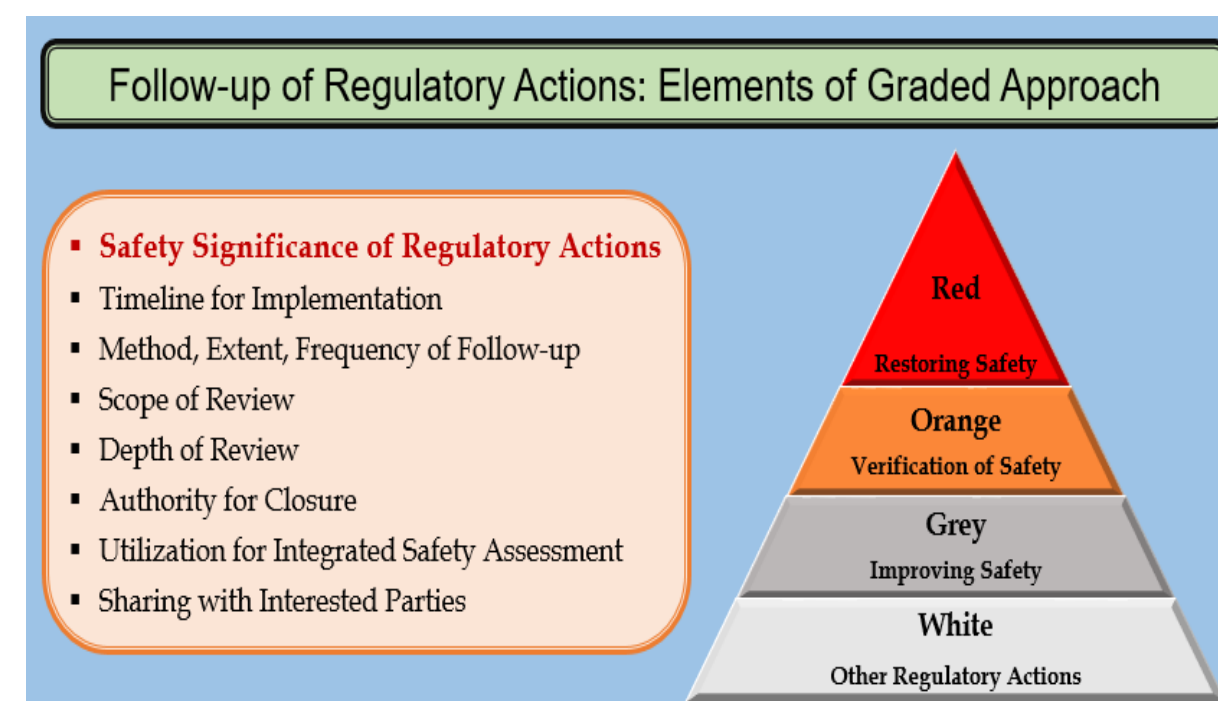
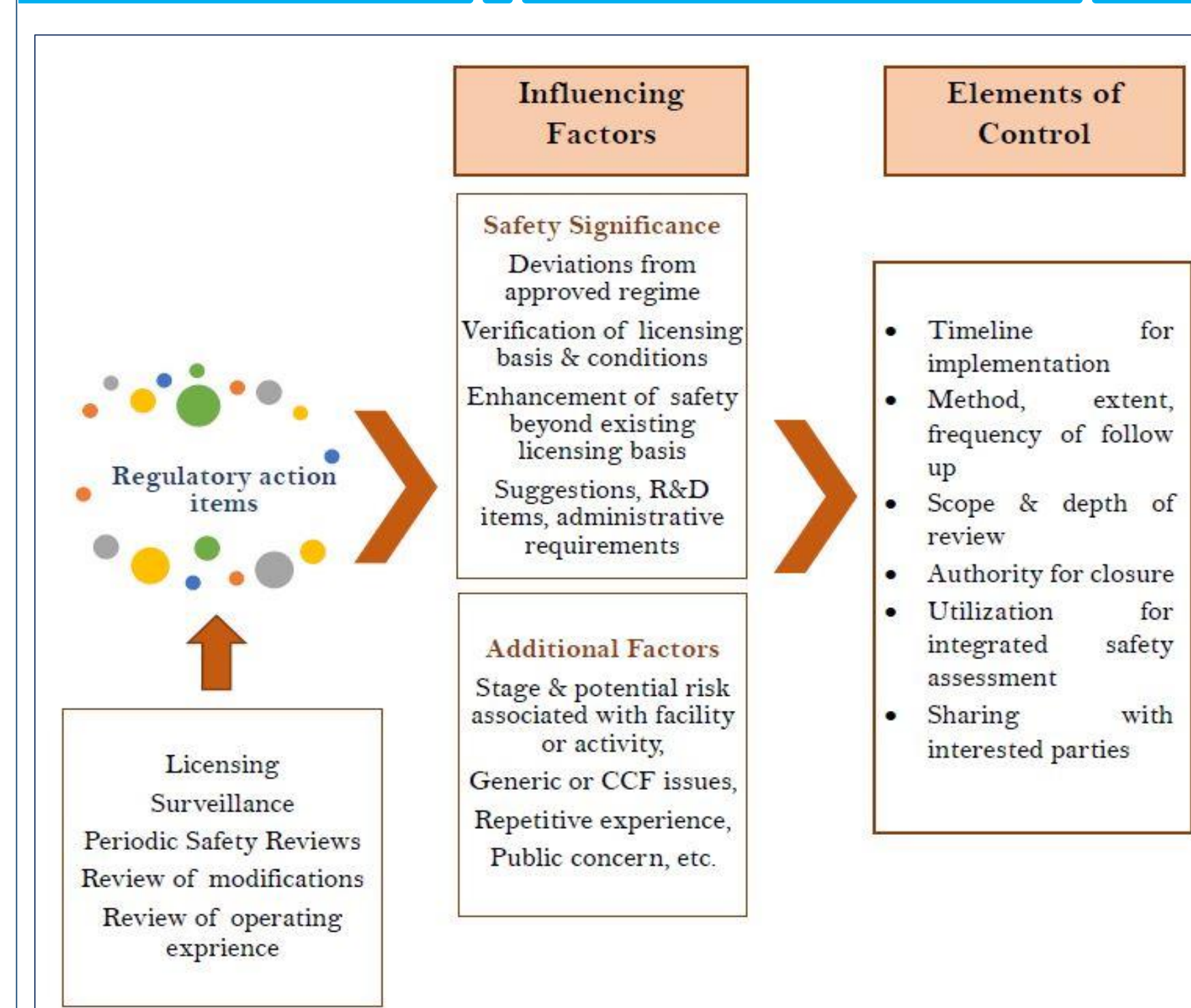
- Established regulatory limits & constraints,
- Technical specification requirements & safety reports,
- Safety significance of attributes,
- Industry performance, operating experience, etc.

$$SPI \text{ Benchmark} = \sum_{i=1}^N W_i A_i$$

Where,
 W_i = Weightage assigned to attribute 'i' (based on 'Graded Approach')
 A_i = Value of attribute 'i'
 N = Total number of attributes defining the indicator

Benchmarks	Colour Code	Basis
Scope for Improvement	Red	Regulatory / technical specification limit exceeded Performance well below industry average
Satisfactory	Yellow	Regulatory / established constraint exceeded Performance below industry average
Good	Blue	Regulatory / established constraint not exceeded Industry average performance respected
Very Good	Green	Performance well within regulatory / established constraint Performance better than industry average
Excellent	Dark Green	For comparison among NPPs whenever their performance is 'Very Good' and to identify the areas for further improvements and achieve the highest level of safety in NPPs.

Graded Approach in follow up of regulatory action items



Step 4: Data Collection & Assessment

Relevant data for each attribute is collected from submissions made by the utility as part of regulatory oversight. The data is processed using assigned weightages to arrive at quantified results. The results obtained are compared against established benchmarks and presented on a five level scale.

Safety Performance Area	PHWRs										BWRs		LWRs		
	RAPS-1&2	U-1	U-2	U-1	U-2	U-1	U-2	U-1	U-2	U-1	U-2	TAPS-1&2	U-1	U-2	KNPP-1&2
Nuclear Safety	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Radiation Safety	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Public & Environment Safety	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Emergency Preparedness & Response	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Regulatory Compliance	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Conclusion

Implementation of graded approach facilitates determination of the safety significance of regulatory processes & activities and enables risk informed & consistent decision making. Safety performance assessment provides inputs for integrated safety assessment, and for sharing the safety status of operating NPPs with members of public & other stakeholders, to imbibe trust & credibility regarding the use of nuclear power in India. The implementation of above regulatory tools has rationalized AERB's regulatory efforts, provided inputs for safety performance improvement, optimized resource utilization and brought effectiveness & efficiency in regulation without compromising safety.