Contents

Introduction

The Fukushima accident

- Raised technical issues upon which actions have been taken
- Confirmed the importance of safety culture

But, a question remained

- To what extent should the consideration of individual, contextual, organizational, systematic and societal factors be taken into account ?
  - From a practical point of view, there are rapidly diminishing returns on pursuing the more remote influences. (Dr. J. Reason, 1999)
  - From a standpoint of changeability and controllability, there would be no regulatory role in correcting cultural failures.

❖ While necessary actions for safety culture are being explored from the Fukushima accident, a cover-up event occurred in Korea to renew the regulatory views on safety culture.

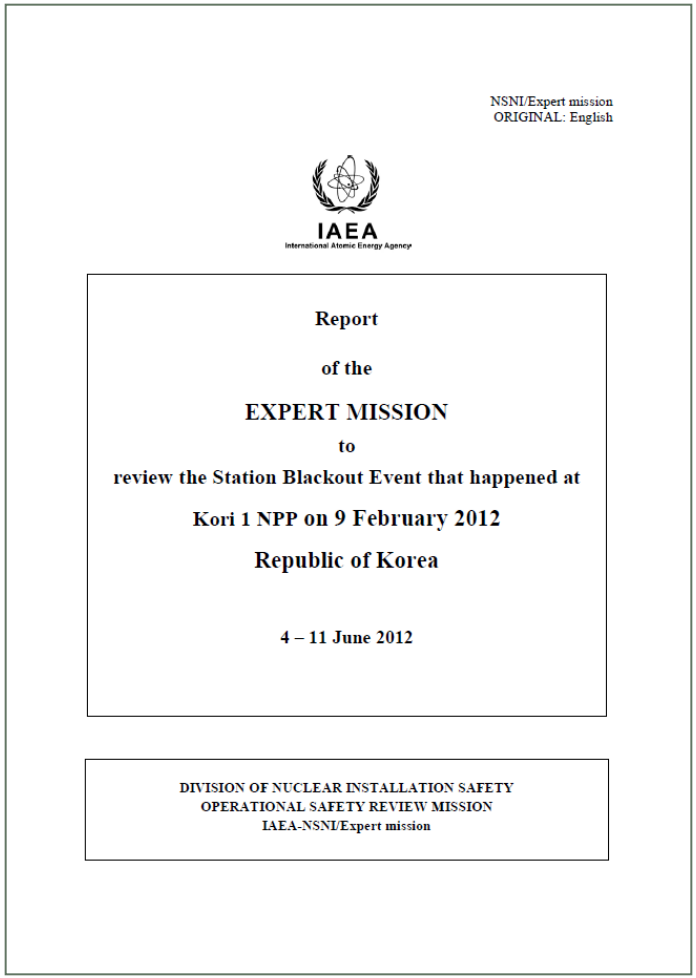
1. The Occurrence of a Cover-up Event, Its Implications and Effects

Overview of the SBO Event at Kori-1

- **Kori unit 1**
  - Korea's 1st nuclear power reactor (April 29, 1978)
  - Owned and operated by KHNP
  - Design life of 30 yrs and a 10-year extension until July 2017

- **The SBO event (9 Feb., 2012)**
  - Occurred during the 29th refueling outage in the evening
  - Initiated by LOOP caused by human error and the subsequent failure of an EDG start

- **Cover-ups and Violations**
  - To conceal the initial decision by the plant manager not to report it



NSNI/Expert mission
ORIGINAL: English

IAEA
International Atomic Energy Agency

Report

of the

EXPERT MISSION

to

review the Station Blackout Event that happened at

Kori 1 NPP on 9 February 2012

Republic of Korea

4 – 11 June 2012

DIVISION OF NUCLEAR INSTALLATION SAFETY
OPERATIONAL SAFETY REVIEW MISSION
IAEA-NSNI/Expert mission

Backdrop of the Event

- **Plausible impacts of the Fukushima accident on nuclear workers' mindset**
  - Reassurance that there is no room for complacency in endeavoring to improve safety
  - Disappearance of the excitement coined by 'Nuclear Renaissance' and a renewed focus on safety

  ❖ If external pressures are not managed properly, the burden of safety and blame can work negatively to hide wrongdoings.

- **Escalation of critical views and burden on safety**
  - Fukushima accident (March 2011)
  - Ten incidents in Korea (Apr. 2011 ~ Jan. 2012)
    - 8 reactor trips and 2 abnormal outage events
  - Announcement of industrial ministry's plan for 'No Defects in Operation' (in the morning of the event day)

Main Issues of the SBO Event

- **Cover-ups**
  - Initial concealment and subsequent cover-ups
    - Kori-1 plant manager and his operating staffs decided not to record LOOP and SBO and not to report the event to regulatory body.
  - Revelation by an outside person and late reporting (32 days after)
- **Violations of Legal (Regulatory) Requirements**
  - Did not declare emergency action level (“White Alert”) upon SBO
  - Did not report SBO event to regulatory authority
  - Did not keep record of SBO and subsequent EDG “B” failure
  - Did not comply with technical specifications
- **Regulatory Actions and Enforcement**
  - Nuclear Safety and Security Commission (NSSC) ordered immediate shutdown of Kori Unit 1
  - NSSC reported willful violations to government prosecution office. The criminal litigation is underway.
  - NSSC imposed administrative fines and penalty surcharges.

Investigation Findings (related to safety culture)

- **Human errors and equipment failure**
  - Problem of not adhering to procedures
  - Recurring valve failures not corrected in a complete, timely manner

- **Less-than-adequate management for safety culture**
  - Inconsistency in safety culture model and program
  - No evaluation of the safety leadership of the plant top management
  - Plant evaluation and rewards system to stress stable productions
  - No explicit 'Employee Concerns Program'
  - Corrective action program not to focus on implications for safety
  - Human resource not analyzed in detail to reflect the uniqueness
  - Inadequate root cause analysis
  - Low quality self-assessment of safety culture

Change of Regulatory Position on Safety Culture

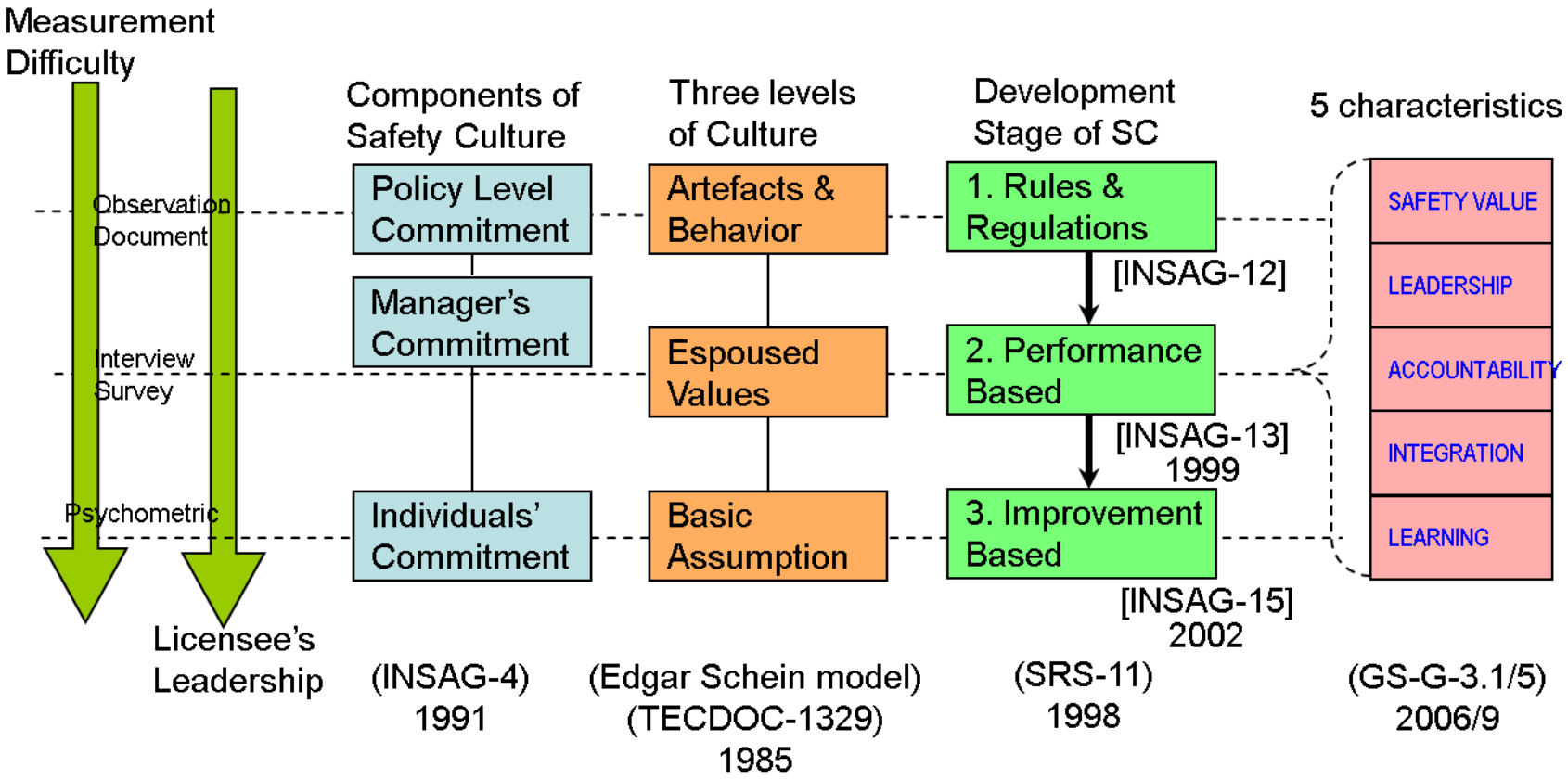
- **Before the event**
  - Assumed that managerial aspects of safety culture have been addressed within the existing regulatory requirements of
    - Human factors management (HF Mgmt.), technical capabilities for operation and quality assurance system
  - Deferred regulatory evaluation of attitudinal aspects such as attitudes, values or beliefs
    - Until a valid methodology to assess them is developed
  - Focused on the promotion of safety consciousness among nuclear employees through:
    - safety charter, campaigns, safety days;
    - developing safety culture assessment tools and transferring them; and
    - conducting a few special inspection of safety culture on an ad hoc basis
- **After the event**
  - Assumes that the operating organization could have little interest or capacity to manage its own safety culture.

⇨ **New Initiative for Regulatory Oversight of Safety Culture**

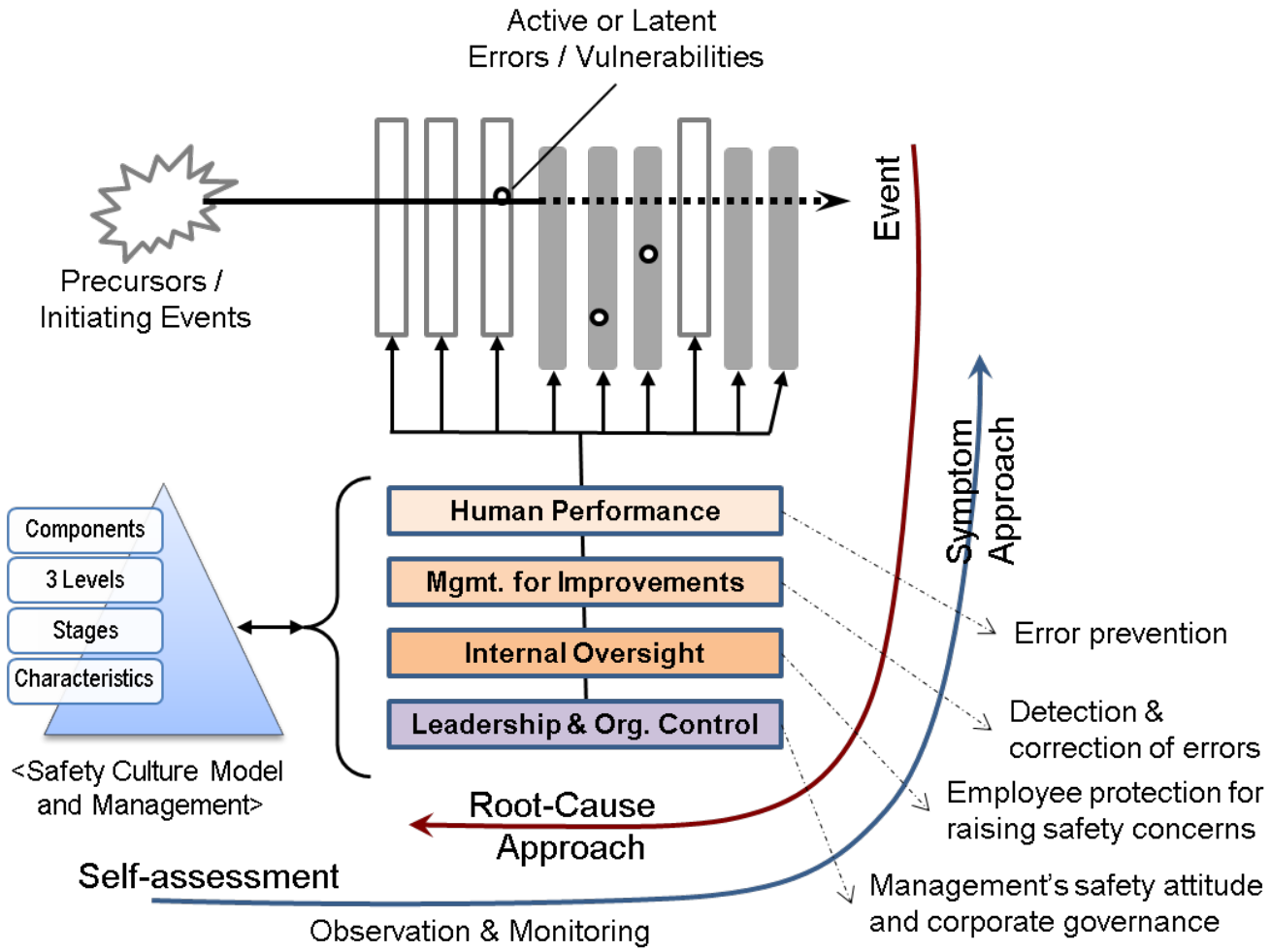
2. Korea's Approach to Regulatory Oversight of Safety Culture

Safety Culture

Components, Three Levels, Stages and Characteristics



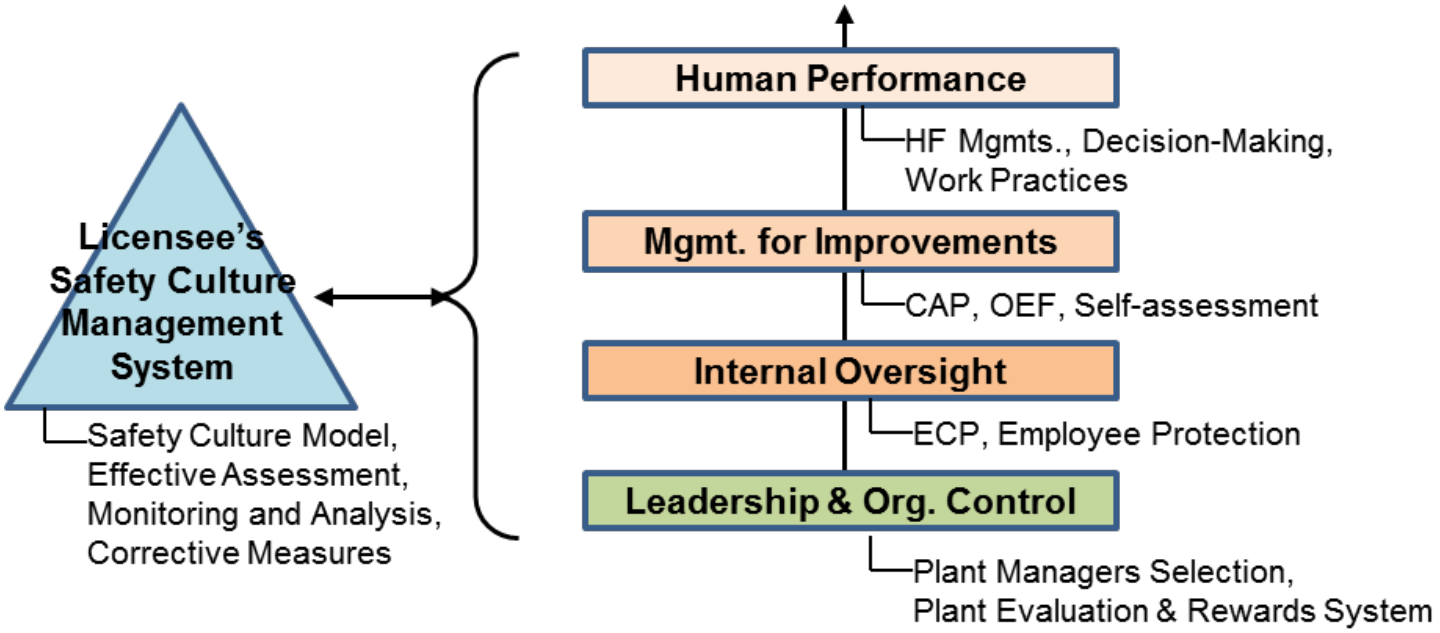
Basic Concept of Regulatory Oversight



A Basic Prerequisite for Defense-in-Depth
with Multiple Levels of Organizational Precautions

Selection of Components

- **To maintain, recover or strengthen the defenses**
  - From other nations' regulatory practices, major documents of IAEA and OECD/NEA and Korea's own experience



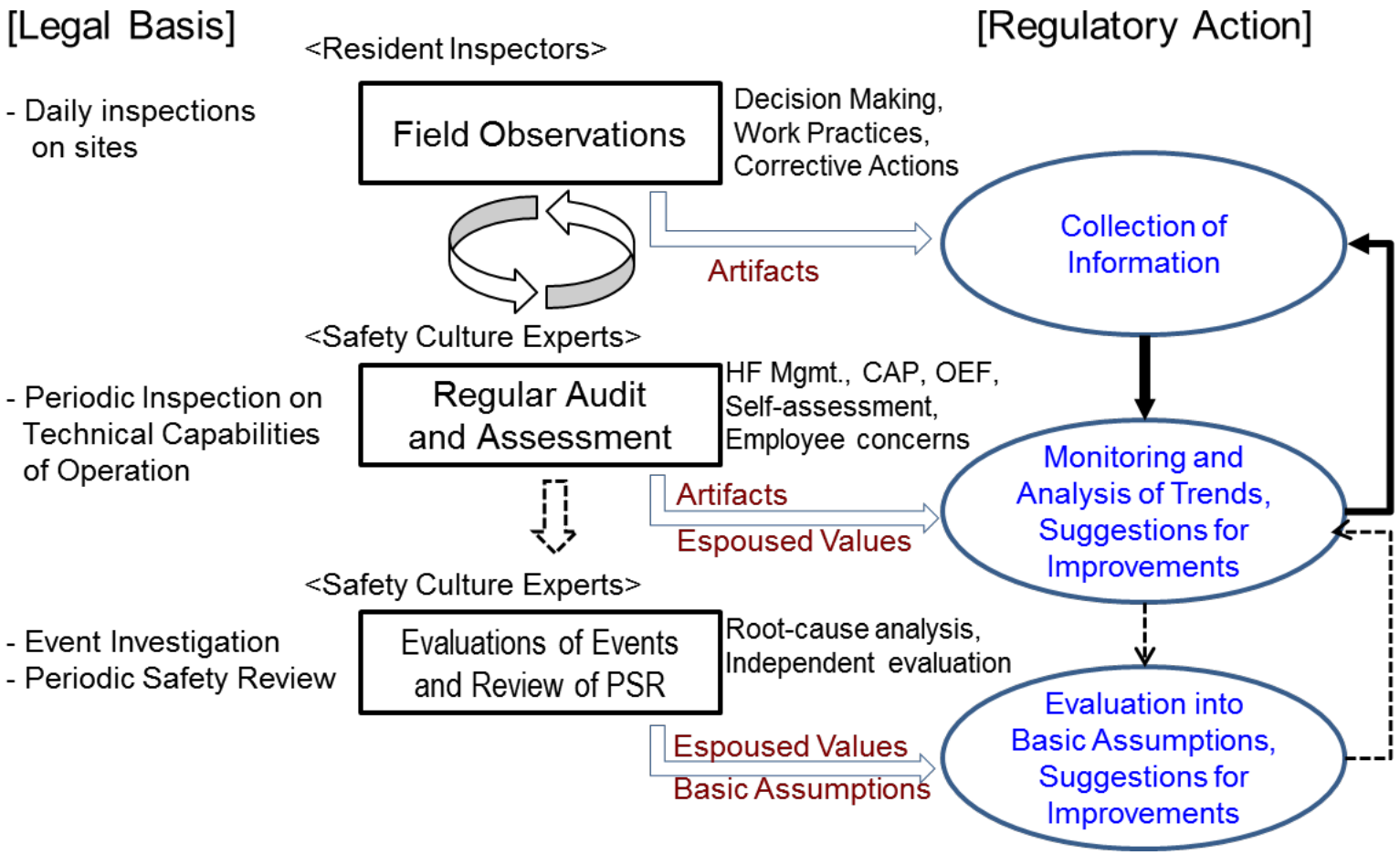
* CAP: Corrective Action Program, OEF: Operating Experience Feedback, ECP: Employee Concerns Program

Consideration of Three Levels and Development Stage

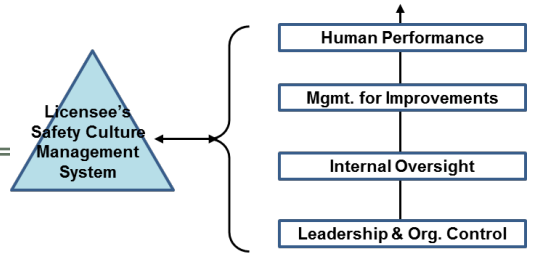
- **Three Levels: Adoption of multiple methods of oversight**
  - 1st level (Artifacts) ➡ Audit
    - Regular audits on the licensee's system and implementation
  - 2nd level (Espoused Values) ➡ Field observations and interviews
    - Observation of behaviors by resident inspectors
    - Interviews based on the observation results
  - 3rd level (Assumptions) ➡ Event investigation and long-term trend
    - Only when considered necessary to probe into deep causes of events
    - Periodic Safety Review (PSR)

- **Development Stage: Encouragement for the licensee to arrive and stay at the final stage of development**
  - Regulatory expectations were set so that
    - Licensee's system should embody the philosophy of "Continuous Improvements with Best Practices"
  - Licensee's voluntary efforts reassured and promoted using a graded approach

Overall Structure

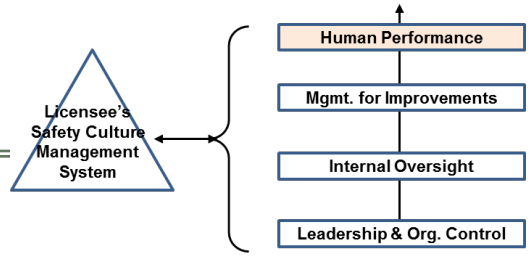


Setting Goals: SC Management System



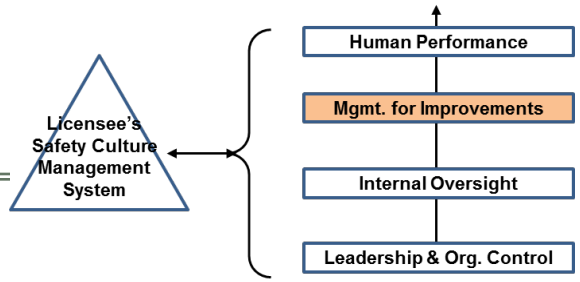
- **Regulatory expectations**
  - A management system shall be established and implemented to promote a strong safety culture in the organization.
  - The implementation framework consists of regular assessments, monitoring and analysis, and corrective actions.
    - Monitoring to detect early signs of decline in safety culture
    - Analysis to assess the trends and to identify causal factors which are related to potential safety culture issues.
- **Basis or reference**
  - IAEA GS-G-3.1, Para. 2.32 ~ 2.45
  - IAEA GS-G-3.5, Para. 2.12, 2.22, 2.27, 6.35 ~ 6.39
  - IAEA NS-G-2.11, Para. 6.1 ~ 6.13
- **Licensee's Action**
  - Incorporation of the agreed expectations into a licensing document and procedure revisions or new development
  - Technical cooperation to develop monitoring and analysis methods

-: Human Performance



- **Human Factors (HF) Mgmt.: an important area of safety regulation**
  - Human errors would remain a major portion of contributions to abnormal events
  - HF Mgmt. could be an effective leverage to promote safety culture
- **Basis : HF Mgmt. regulatory requirements**
  - Regulation on Technical Standards, Article 45 (Human Factors) for design stage and Article 57 (HF Management) for operation stage
  - New HF requirements to be introduced
    - Configuration management with regard to HF
    - Certification requirements on licensee's simulators
- **Additional regulatory expectations**
  - Systematic decision-making, conservatism, communication
  - Procedure adherence, supervision, contractor control
- **Licensee actions**
  - Continuing and improving existing HF activities

-: Mgmt. for Improvements



Existing requirements

- Regulation on Technical Standards, Article 58 (Operating Experience) and Article 85 (Corrective Action)

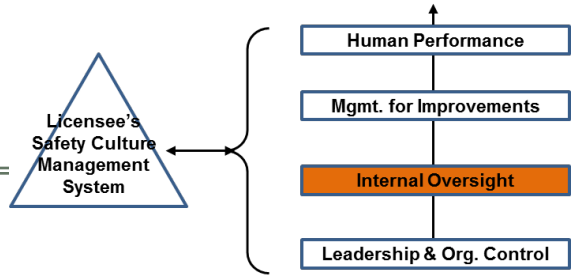
Regulatory expectations (for field observation)

- Corrective action program should be more used to identify safety implications from plant operations.
- Safety significant events should be analyzed in-depth to identify causal factors which are related to potential safety culture issues.
- Corrective actions should be completed in a timely manner.

Licensee's action

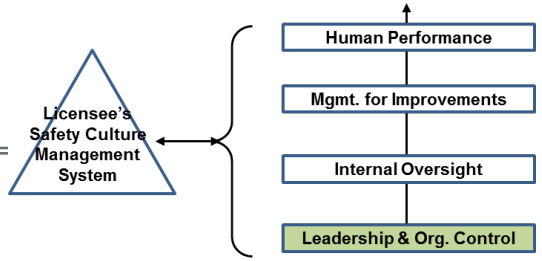
- Revision of CAP system and procedures
- Revision of the Manager's Observation procedure for additional analysis into safety culture implications

-: Internal Oversight



- **Regulatory expectations**
  - The management system shall establish, as a key element of safety culture, a working environment in which staff can raise safety concerns or issues freely.
- **Legal basis**
  - Nuclear Safety Act, article 22 (Protection of Employees), "The nuclear enterpriser shall not discriminate employees who have performed compliance, whistleblowing and testimony."
  - Act on the Protection of Public Interest Whistleblowers
- **Reference**
  - IAEA GS-G-3.1
  - SCWE Policy and Guidance of the U.S. NRC
- **Licensee's actions**
  - Launched the 'Employee Concerns Program' and issued a new procedure to implement the program
  - Incorporated it into education courses for newcomer and refresher

-: Leadership & Org. Control



Regulatory expectations

- The plant managers shall be selected with a due consideration of leadership for safety.
- Safety performance shall be explicitly incorporated into a company rule as a criterion of plant performance evaluation and the evaluation system should be controlled to have nothing with negative effects on safety.

Basis and reference

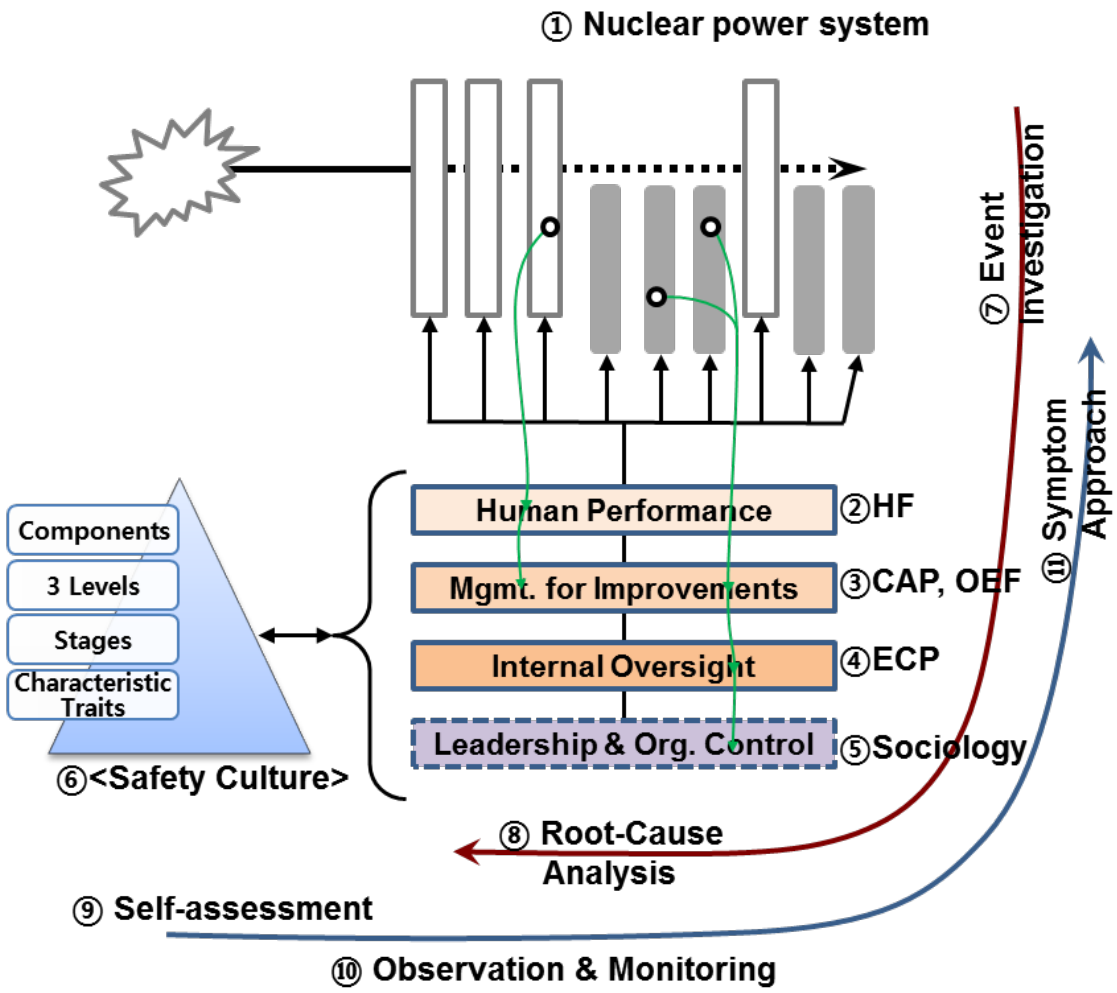
- Panel discussion on "Nuclear Safety in the Future: the Role of Leadership" held at the 3rd Review Meeting of the CNS (2005)
- IAEA GSR Part 2 (draft), Requirement 13 and NS-G-2.8, Par. 2.18

Licensee's actions

- Development and incorporation of leadership evaluation into selection process
- Revision of the company rules and renewal of evaluation system

On-going Efforts - Competence Building

- **Knowledge and Experience Areas necessary for oversight**



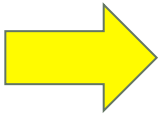
-: Enlarging the Concept of Safety Regulation

Comparison

- *Regulatory Inspection* to ensure the NPP operation is within the acceptance criteria and to enforce corrective actions based on the performances at periodic points
- *Regulatory Oversight* to require improvements based on the continued observations and evaluations of long-term trends

Reactive Enforcement
- Verification
- *Ex-post* Action

Specific Issues
- To confirm the performance of SSCs



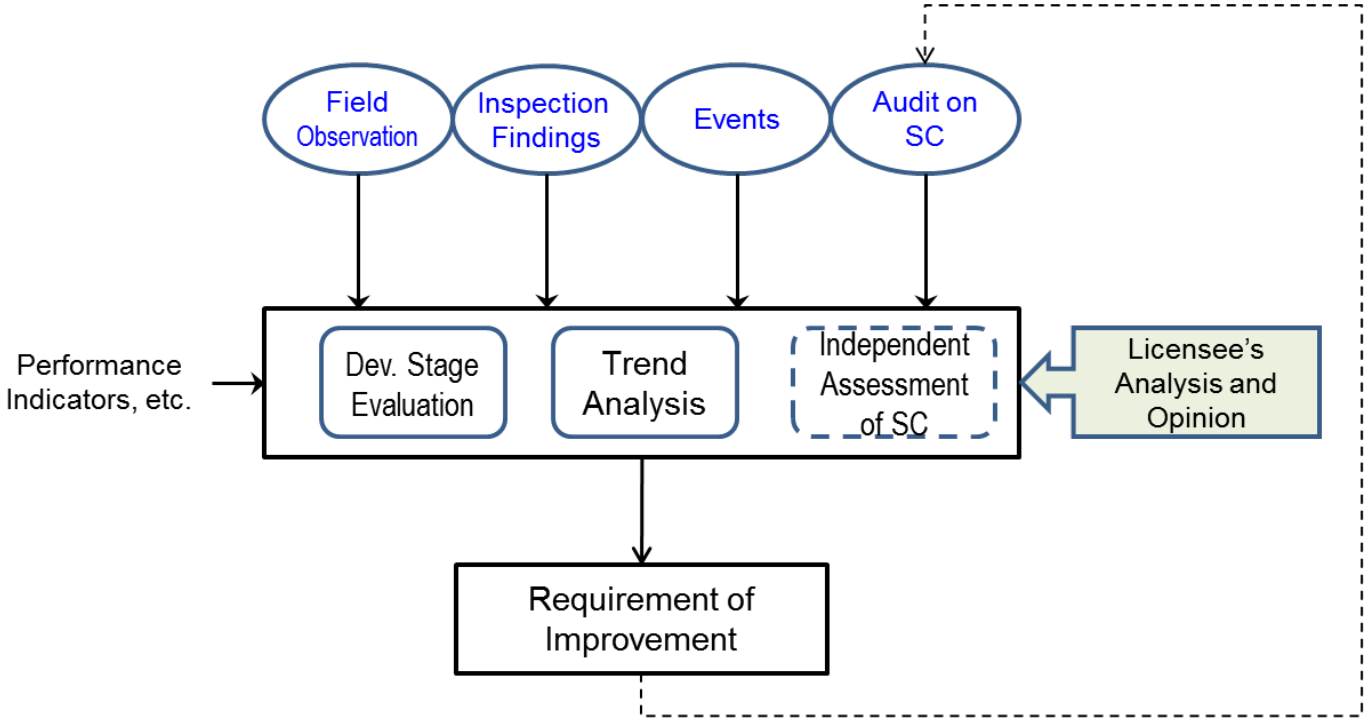
Proactive Influence
- Prediction
- *Ex-ante* Response

Big Picture
- To understand the dynamics of organization, system and culture

-: Systematic Assessment

Final stage

- Field observation framework and guidance manuals
- Development stage evaluation and trend analysis
- Database development



➢ Conclusions

- **Lesson: Substantial consideration should be given at least up to systematic factors of culture.**
  - The causes fell in the areas of not only human performance but also management, environment, leadership and governance.

- **A new oversight scheme should be developed and adopted.**

- **International Cooperation**
  - Experience sharing of regulatory or industry oversights on SC
  - Education and training for regulatory or industry organizations
  - Comparison of national cultures and identification of characteristics that may affect the functioning of safety culture
    - To take advantage of the unique characteristics, if any, for strengthening SC
  - Accumulation of cases with SC implications and issuing more generic reports with a perspective to SC through IAEA/NEA IRS

*IRS : International Reporting System for Operating Experience

Thanks for your attention