

Proposed Methodology for Standardization on Evaluating Radiological Protection System Implementation in Regulatory Inspections: One Researching Agenda

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I. Introduction

Regulatory assessments in radioactive installations are developed worldwide, based on IAEA safety standards, to check if the radiation protection system is implemented. Although the regulating safety is a national responsibility, each country has to fulfil its national and international undertakings and obligations, to guarantee that the radiation risks to workers, to the public and to the environment have to be assessed and, if necessary, controlled.

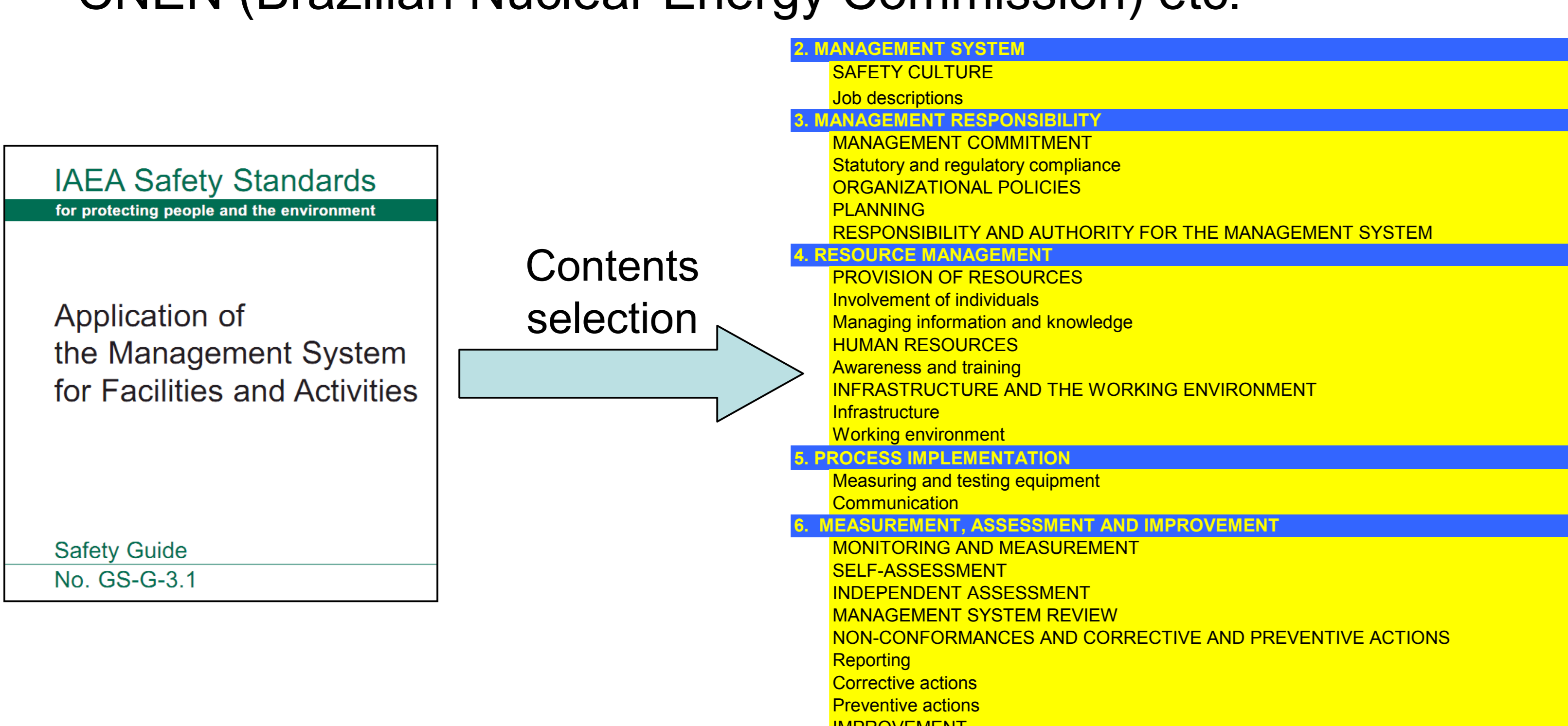
The Brazilian demand for regulatory assessments in radiation facilities and the size of Brazilian territory demonstrate the necessity of an optimization method, which permits evaluate precisely its security management systems, without any losing in terms of current safety culture levels.

II. Objectives

Establish a researching agenda in the Area of Evolution and Implementation of Management System of Radiological Protection, proposing the introduction of a standardization methodology that produces, to the regulatory inspections, a **numerical-accurate score**.

III. Method

(1) Analyse existent bibliographical sources, to guarantee the state of the art evaluation, in terms of radiation protection requirements, such as: IAEA Safety Standards, books, guides, recognized authors on radioprotection safety area, Brazilian rules, guidelines and inspection forms of safety and radiation protection, developed by CNEN (Brazilian Nuclear Energy Commission) etc.



#	DESCRIPTION
A.	Registered Data Checking (not included on scoring)
1.	LEADERSHIP AND COMMITMENT (2400 PTS)
2.	INFRASTRUCTURE AND WORKING ENVIRONMENT (800 PTS)
3.	EQUIPMENT (570 PTS)
4.	ACCIDENTS (2000 PTS)
5.	CHECKLISTS (1600 PTS)
6.	HUMAN RESOURCES (830 PTS)
7.	STRUCTURE AND ACTIVITIES OF RADIOPROTECTION (1300 PTS)

Main Topics list to be considered on a Management System for Regulatory Assessments

#	DESCRIPTION
A.	Registered Data Checking (not included on scoring)
1.	LEADERSHIP AND COMMITMENT (2400 PTS)
1.1.	SAFETY CULTURE
1.2.	MANAGEMENT LEADERSHIP AND COMMITMENT
1.3.	STATUTORY AND REGULATORY COMPLIANCE
1.4.	RADIOPROTECTION'S MANAGEMENT TEAM ATTITUDE DURING ASSESSMENT
2.	INFRASTRUCTURE AND WORKING ENVIRONMENT (800 PTS)
2.1.	WORKING ENVIRONMENT
2.2.	OFFICE
2.3.	TRAINING ROOM
2.4.	ACCOMMODATION
2.5.	STORAGE PLACE (EMERGENCY KIT and IRRADIATORS)
2.6.	X-RAY EQUIPMENT INSTALLATION PLACE
3.	EQUIPMENT (570 PTS)
3.1.	PORTABLE RADIATION METERS
3.2.	IRRADIATION EQUIPMENTS
3.3.	PREVENTIVE MAINTENANCE
3.4.	INDIVIDUAL DOSIMETERS
3.5.	EMERGENCY KIT
4.	ACCIDENTS (2000 PTS)
4.1.	ACCIDENT INVESTIGATION AND REPORTING
4.2.	CONTINGENCY PLAN
5.	CHECKLISTS (1600 PTS)
5.1.	SITE RADIATION MONITORING SYSTEM
5.2.	TRANSPORT DOCUMENTS
5.3.	WORKING PERMISSION FOR MAINTENANCE CLOSER TO X-RAY EQUIPMENTS
5.4.	RADIOMETRIC MEASURING IN THE IRRADIATORS STORAGE PLACE
5.5.	IRRADIATORS CHECKLISTS
5.6.	CHECK-LIST DE MEDIDORES NUCLEARES
6.	HUMAN RESOURCES (830 PTS)

(2) Define main topics to be evaluated in a regulatory inspection.

(3) Split each main topic, producing a tree model: this permits reproducing as many levels as the detailing of each main topic requires.

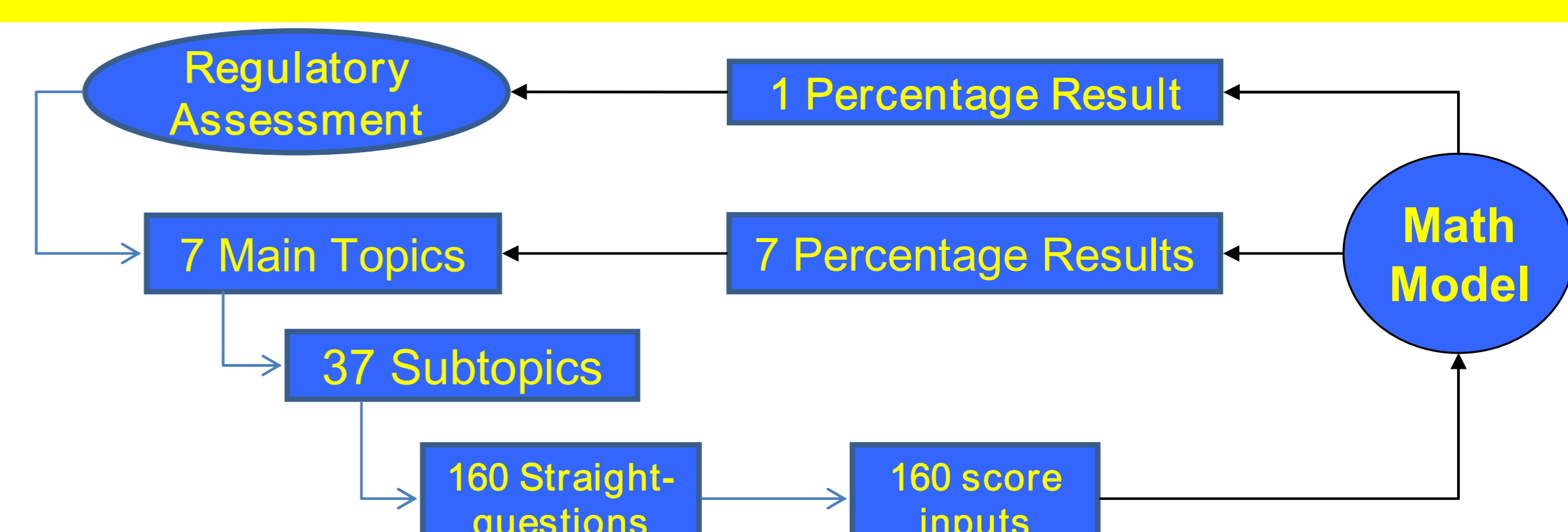
(4) Identify straight-questions, that will be argued during the regulatory assessment, defining for each of these:

(4.1) Weight, based on risks and criticality.

(4.2) Scale limits, establishing input data format.

IV. Results

(1) A tree model resultant from method's adoption.

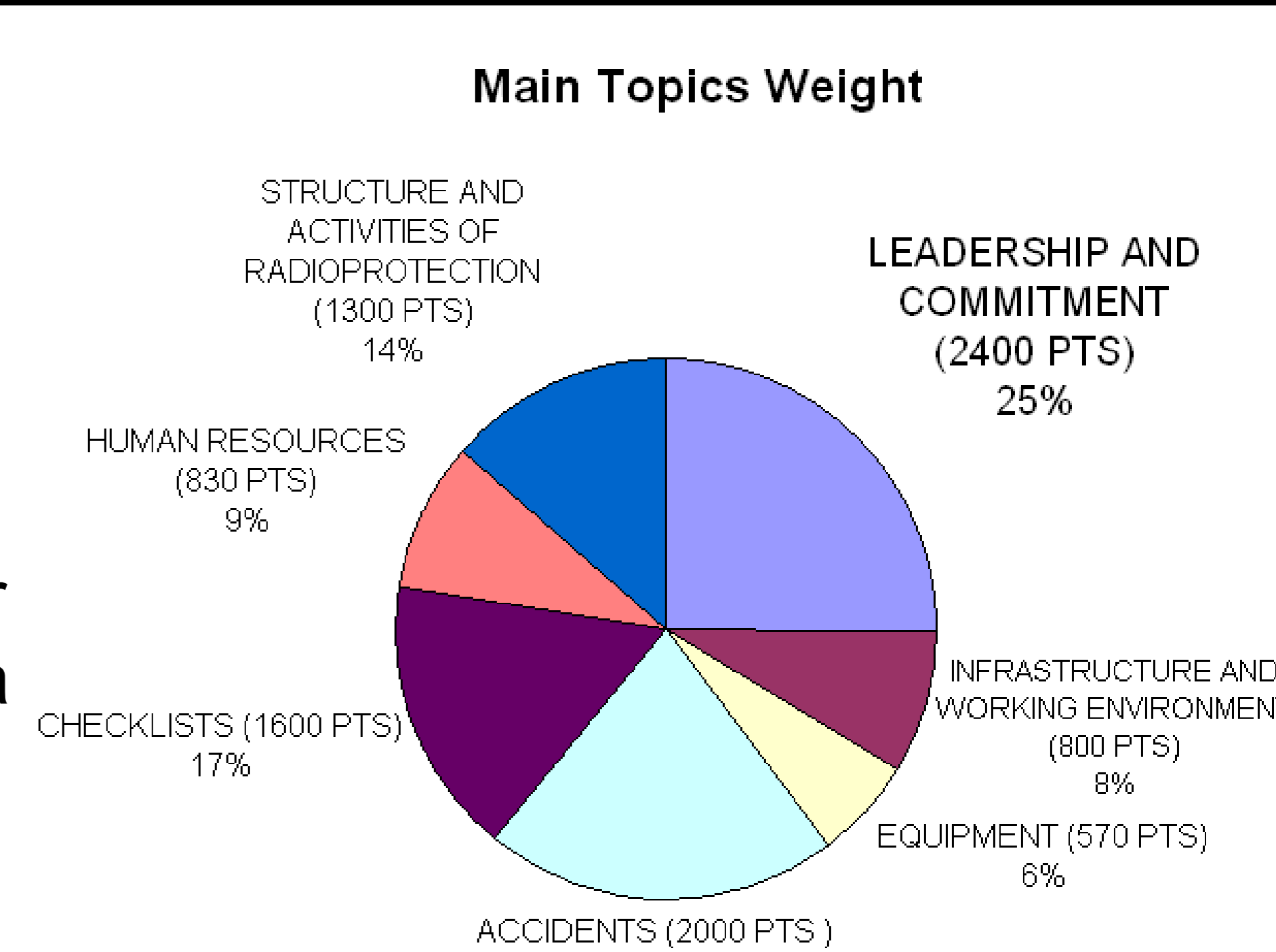


(2) One Numerical-Accurate Score

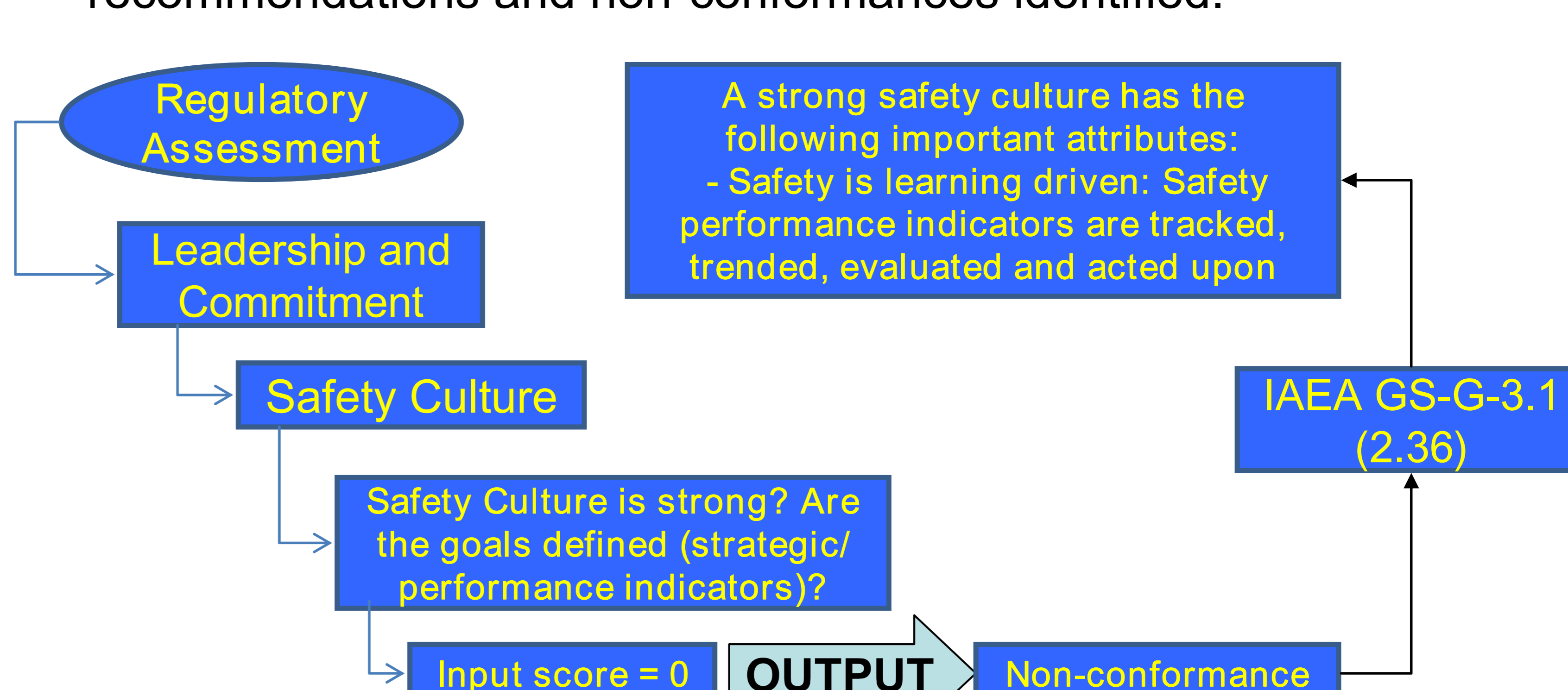
Completed all stages of previous method, we have simulated the role of an inspector, during a regulatory assessment. The system has generated a total numerical-accurate score for the whole inspection and also one percentage for each "main-topic". These scores are results from adoption of a mathematical model, which considers each applied note by the inspector, based on audit evidences, against its weight.

RESULTS	SCORE	%
1. LEADERSHIP AND COMMITMENT (2400 PTS)	1.200	50%
2. INFRASTRUCTURE AND WORKING ENVIRONMENT (800 PTS)	560	70%
3. EQUIPMENT (570 PTS)	290	51%
4. ACCIDENTS (2000 PTS)	1.700	85%
5. CHECKLISTS (1600 PTS)	1.440	90%
6. HUMAN RESOURCES (830 PTS)	755	91%
7. STRUCTURE AND ACTIVITIES OF RADIOPROTECTION (1300 PTS)	385	30%
TOTAL	6.330	67%

(3) A "Main Topics" resultant weight balance, based on risk and criticality, for each of those radiological protection requirements.



(4) An automatic action plan for each inspection, based on a data-base of the Brazilian Safety Rules and IAEA Safety Standards: Define clear distinctions between recommendations and non-conformances identified.



V. Conclusions

The main contributions achieved by this proposal methodology of standardization on evaluation of the radiological protection system implementation, are :

- Produce a score for each radioactive installation inspected in Brazilian Industry: The 67% resultant score of effectiveness, in the above simulated inspection translates, means that in 9,500 possible points to be achieved, the installation received actually 6,330 points.
- Establish a national ranking for each area of radioactivity applications.
- Develop ranges of acceptance to classify each installation based on its inspection score.
- Permit the Regulatory Agency to proceed the:
 - Review of the inspections frequency based on follow-up of previous results;
 - Produce automatically the action plan for each inspection, based on a data-base of the Brazilian Safety Rules and IAEA Safety Standards;
 - Performance's trend analyses, based on follow-up year-by-year;
 - Evaluate the improvement of each installation's radiological protection system, based on its comparison with a chronological sequence of the previous inspections' scores,
 - Penalize those installations that were scored into a non-acceptable band of the pre-defined range.

It is irrefutable the nature of a Research Agenda given to this work, because it is a methodology that once adopted, requires constant evaluation, to make necessary resultant adjustments based on scientific, document and literature research.

Therefore, the discussion is opened for other possible sources and most critical items, which require more attention from future interested researchers in this subject.

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