

PLANT PERFORMANCE MONITORING PROGRAM AT KRŠKO NPP

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ABSTRACT

A high level of nuclear safety and plant reliability results from the complex interaction of a good design, operational safety and human performance. This is the reason for establishing a set of operational plant safety performance indicators, to enable monitoring of both plant performance and progress. Performance indicators are also used for setting challenging targets and goals for improvement, to gain additional perspective on performance relative to other plants and to provide an indication of a potential need to adjust priorities and resources to achieve improved overall plant performance.

A specific indicator trend over a certain period can provide an early warning to plant management to evaluate the causes behind the observed changes. In addition to monitoring the changes and trends, it is also necessary to compare the indicators with identified targets and goals to evaluate performance strengths and weaknesses.

Plant Performance Monitoring Program at Krško NPP defines and ensures consistent collection, processing, analysis and use of predefined relevant plant operational data, providing a quantitative indication of nuclear power plant performance. When the program was developed, the conceptual framework described in IAEA TECDOC-1141 Operational Safety Performance Indicators for Nuclear Power Plants was used as its basis in order to secure that a reasonable set of quantitative indications of operational safety performance would be established.

Safe, conservative, cautious and reliable operation of the Krško NPP is a common goal for all plant personnel. It is provided by continuous assurance of both health and safety of the public and employees according to the plant policy stated in program MD-1 Notranje usmeritve in cilji NEK, which is the top plant program. Establishing a program of monitoring and assessing operational plant safety performance indicators represents effective safety culture of plant personnel.

Keywords

Operational Safety, Performance Indicators, Monitoring Program

1 INTRODUCTION

Plant Performance Indicators Program in Krško NPP defines operating indicators that in a broad sense demonstrate nuclear power plant operation in aspects of safety, reliability, installation performance, waste generation, personnel safety, etc. These indicators are intended principally for plant management use for trending performance and progress to set challenging goals for improvement, to gain additional perspective on performance relative to other plants, and to provide an indication of the possible need to adjust priorities and resources to achieve improved overall plant performance.

2 PLANT PERFORMANCE INDICATOR FRAMEWORK

In order to establish a reasonable set of quantitative indications of operational safety performance for the nuclear power plant, an IAEA conceptual framework [1] was used for developing the Krško NPP Performance Monitoring Program.

Operational safety performance is the top level of a performance structure where the next level below represents the operational safety attributes from which a reasonable set of operational safety indicators could be developed.

According to [1], in defining the key operational safety attributes the following three important generic aspects associated with plant safe and reliable operation were defined:

- ❑ Nuclear power plant normal operation,
- ❑ Nuclear power plant emergency operation and
- ❑ Attitude of nuclear power plant personnel towards safety.

On the basis defined by those three important aspects of plant safe and reliable operation, expanded with economic aspect of electrical energy production and supply, the four key attributes (areas) were defined:

- ❑ Plant operates smoothly,
- ❑ Plant operates with low risk,
- ❑ Plant operates with a positive safety attitude and
- ❑ Economic plant performance.

First three key attributes: Plant operates smoothly, Plant operates with low risk and Plant operates with a positive safety attitude are generic IAEA key attributes being composed of operational safety performance of the nuclear power plant. Economic aspect of electrical energy production and supply is a specific key attribute that is defined by the Krško NPP.

Since each of these key attributes cannot be measured directly, the indicator structure is further expanded until the level of easily quantifiable or directly measurable specific performance indicators is identified.

A level below each key attributes a certain number of overall indicators are established. They provide an overall evaluation of performance in various key areas of plant performance. Associated with each overall indicator is a lower level of strategic indicators. Strategic set of indicators is intended to be a bridge from overall to specific performance indicators in order to clarify their relationship. They help in the definition of specific indicators. Finally, each strategic indicator is supported by a set of specific indicators. They are sensitive to performance at the detailed, sub-system, or program level.

Each specific performance indicator is defined, goals are established, results are analyzed and corrective actions are proposed by its owner. Specific indicators should provide meaningful perspective of overall plant performance without a detailed knowledge of plant characteristics (Fig. 1).

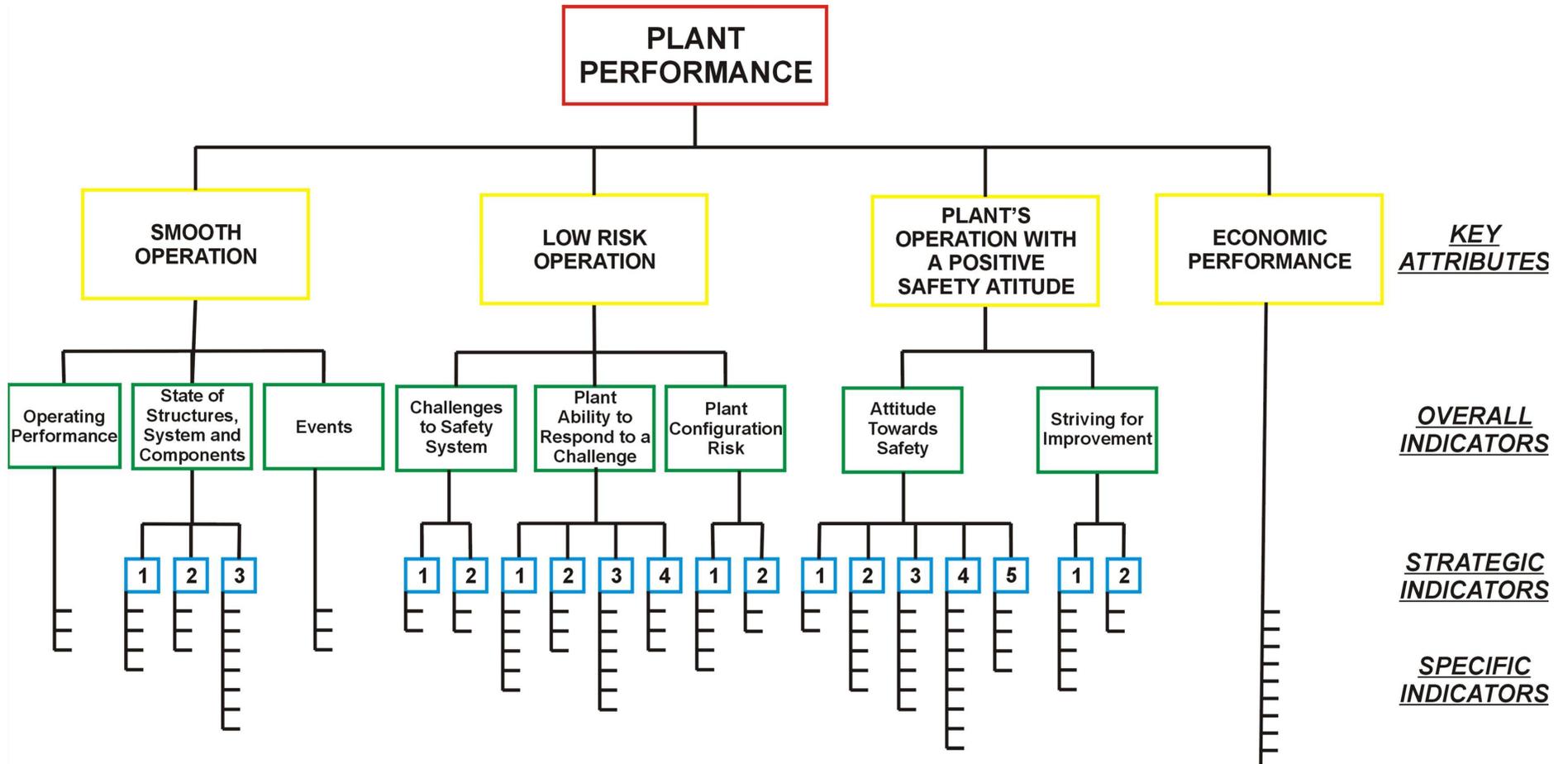


Figure 1. The Plant performance indicator framework

Specific indicators are used to analyze performance trends relative to the established goals which can be further aggregated for on a higher level until the operational safety performance as a top level of a performance structure is achieved. Aggregation is therefore a tool that allows the use of lower level indicator values to be combined and aligned to a common scale allowing the management to evaluate and compare higher level indicators. The aggregation allows the following benefits:

- ❑ Quantification of higher level indicator,
- ❑ Possible trending of higher level indicators and
- ❑ Objective comparability of higher levels indicators at a specified level, e.g. comparison between either strategic indicators or overall indicators.

3 THE CONCEPT OF OPERATIONAL SAFETY PERFORMANCE INDICATOR EVALUATION CRITERIA

The concept of the model for safety performance indicator evaluation is based on two regions for indicator values. These are satisfactory (acceptable) and unsatisfactory (unacceptable) values. The acceptability region is divided into three zones: excellent zone, operating zone and warning zone.

The unsatisfactory (unacceptable) zone is the zone beyond a limit that is deemed satisfactory performance by either the licensing documents or management. If the indicator is governed by Technical Specifications, USAR or Regulatory requirements the zone is termed “unacceptable“ otherwise it is termed „unsatisfactory“.

In order to keep performance level in the acceptable region, it is required that a warning be generated before the limit is reached. This warning zone is defined by the unsatisfactory limit and working (annual) goal. It is the goal that the management expects to achieve in a given year. It is therefore a short-term goal.

The company vision for an individual indicator is a long-term goal also called a strategic goal. The band between the working (annual) goal and the „vision“ defines the operating zone. The zone beyond the „vision“ represents excellent results. The operating zone will be color-coded such that unsatisfactory (unacceptable) zone is coded red, the warning zone is coded yellow, the operating zone is coded white and the excellent zone is coded green (Fig. 2).



Figure 2. Performance Indicators Goals and Threshold

It is noted that the annual goal may change from year to year as performance improves. The intention is to have an achievable short-term working goal which moves closer to the „vision“. The „vision“ on the other hand represents strategic goal which remains stable and is open to change only in the long term (for instance after 5 years).

4 THE USE OF THE NPP KRŠKO OPERATIONAL PLANT SAFETY PERFORMANCE INDICATORS

The operational plant safety performance indicators are principally used for trending plant performance, to set the challenging goals for improvement, to gain additional perspective on performance relative to other plants and to provide an indication of a possible need to adjust priorities and resources to achieve improved overall plant performance. However, each department is responsible to define, collect, analyze and trend its own set of strategic indicators in order to improve performance on a department level. Strategic performance indicators on a plant level as well as on a department level should be presented on the uniform predefined approach in clear, numerical terms.

It should be emphasized that great care should be exercised in the use of performance indicators so that they are not used in a manner that could encourage plant personnel to take nonconservative actions regarding plant safety in order to improve other than safety performance to achieve defined goal values that are based on the indicators.

In order to effectively satisfy the intention of this program, the following requirements should be met:

- ❑ Plant management are receiving reviews of the operational plant safety performance indicators regularly.
- ❑ Plant management are aware of the trends of the operational plant safety performance indicators and the reasons for the trends which could help in defining strategy of the safety policy of the plant.
- ❑ The results of the operational plant safety performance indicators reviews identifies weak points and define corrective actions for the adverse trend indicators.
- ❑ Mechanism for feedback of implemented corrective actions based on the results of the operational plant safety performance indicators' reviews is established via Corrective Action Program.
- ❑ The results of the plant operational safety performance indicator assessment is motivating continuous striving for the improvement as well as straightening safety culture of the plant personnel
- ❑ The results of the plant operational safety performance indicator review are easily accessible for all plant staff by displaying the framework on the INTRANEK page.
- ❑ Specific plant operational safety performance indicators that are not chosen for the plant level monitoring and assessment will be specified and used at different organizational levels and/or departments.
- ❑ In order to improve operational plant safety performance indicators, all plant staff should understand and routinely read the reports based on the operating experience.
- ❑ Particular strategic performance indicators is presented in the way of uniform type (Fig. 3).

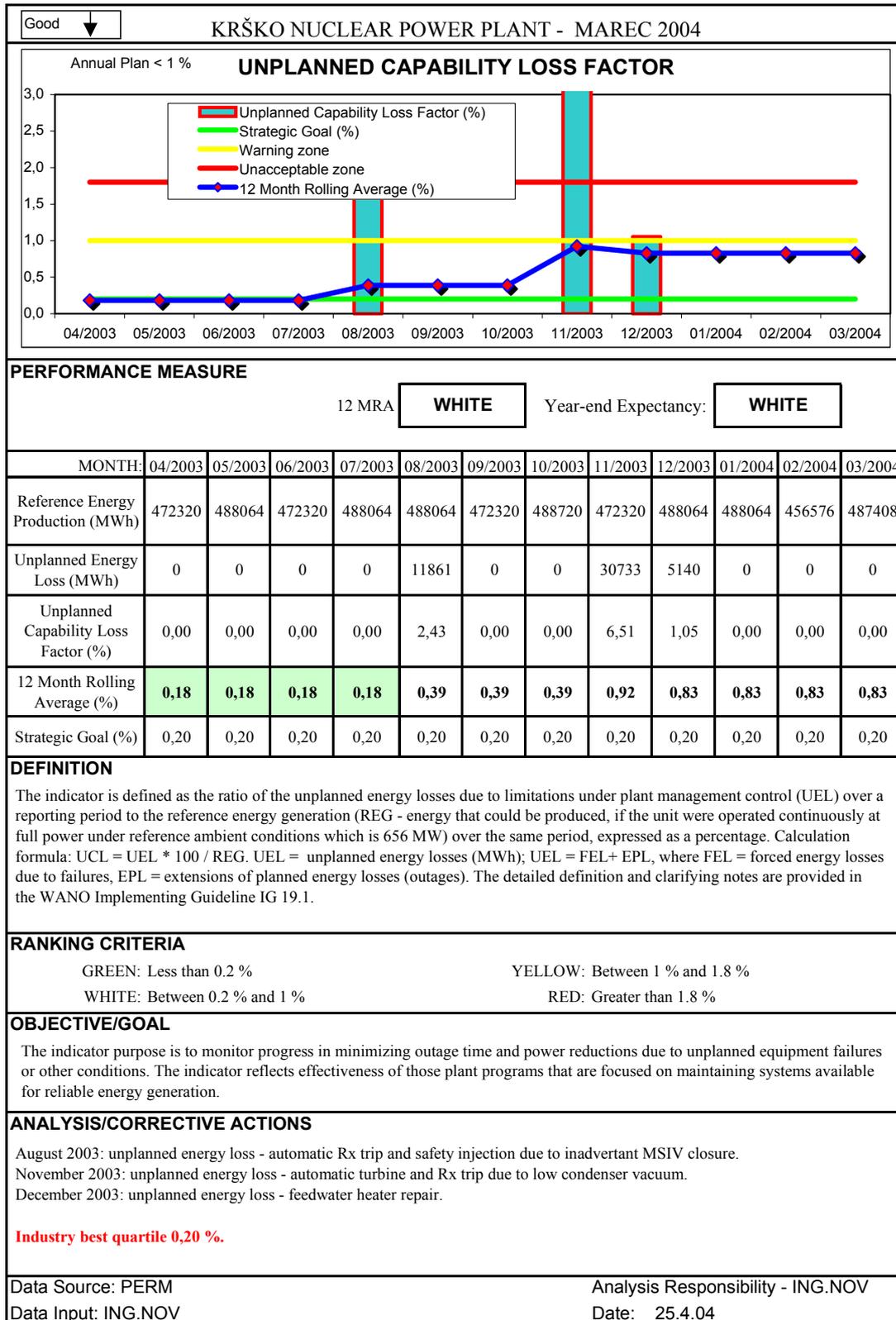


Figure 3. Example of strategic operational safety performance indicator worksheet

5 CONCLUSION

Safe, conservative, cautious and reliable operation of the Krško NPP is a common goal for all plant personnel. It is provided by continuous assurance of both health and safety of the public and employees according to the plant policy stated in program MD-1 Notranje usmeritve in cilji NEK, which is the top plant program. Establishing a program of monitoring and assessing operational plant safety performance indicators represents effective safety culture of plant personnel. This is the reason for establishing a set of operational plant safety performance indicators to enable monitoring of both plant performance and progress, to set the challenging targets and goals for improvement, to gain additional perspective on performance relative to other plants and to provide an indication of the possible need to adjust priorities and resources to achieve improved overall plant performance.

6 REFERENCES

1. NPP Krško program MD 1, "Notranje usmeritve in cilji NEK"
2. IAEA TECDOC-1141 Operational Safety Performance Indicators for Nuclear Power Plants
3. NPP Krško program MD 21, "Plant Performance Monitoring Program"