

# EFCOG Best Practice #87

**Best Practice Title:** Safety Performance Index

**Facility:** Salt Waste Processing Facility Project, Savannah River Site

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## **Brief Description of Best Practice:**

The Safety Performance Index (SPI) is a facility or project-level performance indicator. The SPI scales safety incident reports based on a semi quantitative risk determination. Inputs include recordables, "near misses" and first aids. Near miss risk analysis is the key element of the SPI; therefore, a "zero threshold" incident reporting process must be implemented to use this tool. The set of near misses include those reported in ORPS as well as more minor events that did not meet the reporting threshold.

Near misses are commonly conceptualized as a homogeneous set of events (e.g., the safety pyramid) and assigned a qualitative consequence level below recordable injuries, ignoring the significance of both luck and implemented hazard controls. The safety pyramid can also be conceptualized as a continuum of risk that increases from zero at the base to 1 towards the endpoint consequence of interest (i.e., risk of minor injury, risk of irreversible injury, risk of fatal injury) The SPI scales all incidents by assigning a risk value. Risk is the product of the consequence (C) and probability (P). Relative consequence is assigned values (C) for scaling: 4 = Near miss to a fatality or a realized irreversible injury, 3 = Near miss to an irreversible injury or a realized recordable but recoverable injury, 2 = Near miss recordable but recoverable injury, 1 = Near miss to first aid or a first aid. The professional judgment of line management and subject matter experts is used to assign C. The worst case consequence is used since this is a leading indicator. P is unknown; therefore, the number of barriers ( $N_b$ ) preventing an injury is used as a proxy. Risk is inversely proportional to the number of barriers and a variety of other factors that are commonly unknown. For simplicity and since P is poorly known, the severity level of each event (SL) is scaled as

$$SL_{\text{Single Event}} = C - N_b.$$

For example, if a 500 lb load drops adjacent to a worker ( $C=4$ ) and there are no barriers ( $N_b=0$ ), then the event is SL-4. If the flight path and area where the load dropped was barricaded ( $N_b=1$ ), then the event is SL-3. The monthly or quarterly SPI is the ratio of high severity events relative to the total number reported or

$$SPI_{\text{Month}} = \frac{\sum n_{SL-4} + \sum n_{SL-3}}{\sum n_{\text{All Events}}},$$

where  $n_{SL-1,2,3,4}$  = the number of events of a particular SL level.

Performance data from our project's internal reporting system for the past two years were characterized using this approach. The attached figure shows the SWPF project SPI from October 2009, the month of a Type B injury, and a year thereafter. The SPI dropped for several months after the incident as corrective actions were implemented and has remained relatively unchanged since. Significant changes to the SPI are used to alert management to potential changes to the overall safety posture.

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## **Why the best practice was used:**

Near misses are events recognized by management and workers to have challenged the established hazard controls without deleterious outcomes. Candid analysis of the barriers by management is the most important aspect of the SPI. The SPI monitors how well the project or facility's work control processes performed when challenged. Recordable Injuries includes a broad range of injury types that may or may not reflect deteriorating or improving safety management since the range of consequences can be very broad (i.e., back sprains to loss of limbs). Simply tracking near misses and first aids loses the information on how well the facility or project's safety management system performed when challenged. The SPI provides a semi-quantitative, risk-based approach to monitoring the effectiveness of an organization's safety performance, and can provide a leading indicator of deteriorating safety management performance.

## **What are the benefits of the best practice:**

The SPI should drive improved reporting and analysis of minor events and, if embraced by line management, should improve the work control process. The SPI can also be used as a leading indicator of deteriorating safety management performance.

## **What problems/issues were associated with the best practice:**

The SPI depends on a robust safety conscious work environment. It requires a zero threshold reporting process. Management must encourage reporting through incentives and positive reinforcement.

## **How the success of the Best Practice was measured:**

The attached graphic show how the SPI was used to support and monitor improvement of the performance of the project's safety management system after an injury in October 2009.

## **Description of process experience using the Best Practice:**

The SPI should be used with statistically based thresholds that alert management to significant changes to safety management performance. These thresholds should be defined using a statistical approach appropriate for the dataset, e.g., various confidence limit methods. The SPI value for SWPF showed a gradual and consistent improvement subsequent to an injury in October 2009 and exhibited no significant variation over the past six months. The data are not normally distributed; therefore, a median, a 75<sup>th</sup> percentile and 95<sup>th</sup> percentile were established as SPI values marking significant change. An SPI exceeding the 75<sup>th</sup> percentile coincides with SPI values measured just as corrective actions were initiated after an injury and is considered the threshold marking a significant change in performance, warranting management attention. A value exceeding the 95<sup>th</sup> percentile requires immediate management attention.

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