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WANO continues to work closely with the International Atomic Energy Agency (IAEA) in the area of performance indicators. Cross-checking the data between the two organisations improves data quality and provides a better understanding of data reporting issues.

Beyond the five key performance indicators that are discussed in this trifold, there are several more non-key indicators. Results can be found in the Quarterly reports and on the WANO website. For information, the definitions are as follows:

- **Unplanned Automatic (UA7) Scrams per 7,000 Hours Critical**: This indicator is defined as the number of unplanned automatic scrams (reactor protection system logic actuations) that occur per 7,000 hours of critical operation (which is approximately one year of operation). It provides an indication of success in improving plant safety by reducing the number of undesirable and unplanned thermal-hydraulic and reactivity transients.

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**Fuel Reliability (FRI)**
For this indicator, fuel reliability is inferred from fission product activities present in the reactor coolant. Due to design differences, this indicator is calculated differently for different reactor types. Overall, the purpose of this indicator is to monitor industry progress in achieving and maintaining high fuel integrity, and to foster a healthy respect for preservation of fuel integrity. Failed fuel represents a breach in the initial barrier preventing offsite release of fission products, has a detrimental effect on operating cost and performance, and increases the radiological hazard to plant workers.

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<thead>
<tr>
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New Long-Term Objectives for 2020

In 2007, the WANO Governing Board approved the establishment of worldwide targets for key performance indicators that were to be achieved by 2015. In developing the targets, the WANO regional directors selected four performance indicators to monitor for each reactor type (FLR), collective radiation exposure (CRE), industrial safety accident rate (ISAR), and system safety performance indicator (SSPI). For each performance indicator, two targets were established – industry-level targets and individual unit or station targets. As can be seen below, the industry targets are aimed at improving overall industry performance, and are based on 75% of the industry achieving the median values from the previous target period. Individual performance targets, on the other hand, are based on all units (100%) achieving results that are better than the lowest quartile values from the previous target period.

Based on a review of progress to date, new long-term targets for 2020 were proposed by the Performance Indicator programme and approved by the WANO Executive Leadership Team. In addition, a fifth key performance indicator was added – unplanned total scrams per 7,000 hours critical (US7) indicator – and individual and industry targets for 2020 were established based on historical performance by reactor type. Tracking the long-term targets for 2020 began in the first quarter of 2019.

Forced Loss Rate (FLR)

This indicator is the area under the curve of all unplanned forced energy losses to the reference energy generation minus energy generation losses corresponding to planned outages and any unplanned outage extensions during a given period of time, expressed as a percentage. Unplanned energy losses are either unplanned forced energy losses or unplanned outage extensions of planned outage energy losses. Planned energy losses are those corresponding to outages or power reductions which were planned and scheduled at least four weeks in advance.

Collective Radiation Exposure (CRE)

This indicator is the total external and internal whole body exposure determined by primary dosimeter, and internal exposure calculations. It includes all measured exposure reported for personnel working onsite that result in one supplemental personnel, and all other non-utility plant personnel, including all staff, contractors, and personnel visiting the site or station on official utility business.

Industrial Safety Accident Rate (ISAR)

This indicator is the number of accidents for all plant personnel, including all staff, contractors, supplemental personnel, and all non-utility personnel working onsite that result in one or more days away from work (excluding the day of the accident) or fatalities per 200,000 (TISA2) or per 1,000,000 (TISA1) hours worked.

Safety System Performance Indicator (SSPI)

This indicator is the ratio of all unplanned forced scrams to the reference energy generation. Units that have met all the individual targets for SSPI, the lower graph shows the percentage of units that have met all the individual targets for the different safety systems (SP1, SP2, and SP5). For this percentage, the industry objective is 100%.

Unplanned Total Scrams per 7,000 hours critical (US7)

This indicator is the sum of the number of unplanned automatic scrams (reactor protection system logic actuating) and unplanned manual scrams for approximately one year (7,000 hours) of operation. Full worldwide data collection for the US7 indicator did not begin until 2015.

**INDICATOR** | **UNIT** | **INDIVIDUAL TARGET** | **INDUSTRY TARGET**
--- | --- | --- | ---
Operating Period Forced Loss Rate (FLR) | Percent (%) | 5.0 | 2.0
Collective Radiation Exposure (CRE) | Man·Sv/yr | 1.0 | 0.5
| Man-Sv/yr | 0.5 | 0.2
Total Industry Safety Accident Rate (TISA) | Number per 200,000 hours worked | 0.50 | 0.20
Safety System Performance Indicator (SSPI) | Unavailability | SPI1 and SPI2 (0.02) (SPI3) 0.005 | 100% of worldwide units achieve the individual targets
| SPI5 | 0.005
Unplanned Total Scrams per 7,000 hours critical (US7) | Rate | WWER: PWR: AGR: 1.0 | WWER: PWR: AGR: 1.0

Most of the long-term targets for 2020 are the same as those for 2015, with the following exceptions:
- Collective radiation exposure targets for advanced gas-cooled reactors (AGR) have been updated due to changes in operational plant conditions.
- Personnel safety performance will be compared to targets for the new total industry safety accident (TISA) rate indicator, which replaces the ISAR indicator used for the 2015 targets.
- The SSPI industry target is now based on the percentage of units achieving all the individual SSPI targets.

The 2020 long-term objective for FLR, CRE and TISA indicators are continued from 2015:
- As an industry: 75% of units shall have an indicator value better than achieved by 50% of units in 2007.
- Individually: 100% of units shall have an indicator value better than achieved by 75% of units in 2007.

The numerical targets corresponding to these objectives are summarised in the table above.
New Long-Term Objectives for 2020
In 2007, the WANO Governing Board approved the establishment of worldwide targets for key performance indicators that were to be achieved by 2015. In developing the targets, the WANO regional directors selected four performance indicators to monitor for the 2015 target, collective radiation exposure (CRD), industrial safety accident rate (ISAR), and system performance indicator (SPI).

The numerical target values corresponding to these objectives are summarised in the table above.

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<td>0.20</td>
</tr>
<tr>
<td>Collective Radiation Exposure (CRD)</td>
<td>Man-rem/yr</td>
<td>200,000</td>
<td>5.0</td>
</tr>
<tr>
<td>Total Industry Safety Accident Rate (TISA)</td>
<td>Rate</td>
<td>200,000</td>
<td>2.0</td>
</tr>
<tr>
<td>Safety System Performance Indicator (SPI)</td>
<td>Unavailability</td>
<td>200,000</td>
<td>1.0</td>
</tr>
<tr>
<td>Unplanned Total Scrams per 7,000 hours critical (US7)</td>
<td>Rate</td>
<td>200,000</td>
<td>1.0</td>
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Most of the long-term targets for 2020 are the same as those for 2015, with the following exceptions:

- Collective radiation exposure targets for advanced gas-cooled reactors (AGRs) have been updated due to changes in operational plant conditions.
- Personnel safety performance will be compared to targets for the new total industry safety accident rate indicator, which replaces the ISA indicator used for the 2015 targets.
- The SPI industry objective is now based on 100% of units achieving the different safety systems (SP1, SP2 and SP5).

For this percentage, the industry objective is 100%.

Collective Radiation Exposure (CRD)
This indicator is the sum of the number of unplanned forced energy losses (to the reference energy generation minus energy generation losses corresponding to planned outages or any unplanned outage exclusions during a given period of time, expressed as a percentage.

Unplanned energy losses are either unplanned forced energy losses or unplanned outage extensions of planned outage energy losses. Planned energy losses are those corresponding to outages or power reductions which were planned and scheduled at least a few weeks in advance.

Total Industrial Safety Accident (TISA)
This indicator is the number of accidents for all plant personnel, including all staff, contractors, supplemental personnel, and all non-utility personnel working onsite that result in one or more days away from work (excluding the day of the accident) or fatalities per 200,000 (TISA1) or per 1,000,000 (TISA2) hours worked.

Unplanned Total Scrams per 7,000 hours critical (US7)
This indicator is the sum of the number of unplanned automatic scrams (reactor protection system logic actuations) and unplanned manual scrams for approximately one year (7,000 hours) of operation.

Safety System Performance Indicator (SPI)
In 2007, the WANO Governing Board approved the establishment of worldwide targets for key performance indicators that were to be achieved by 2015. In developing the targets, the WANO regional directors selected four performance indicators to monitor for the 2015 target, collective radiation exposure (CRD), industrial safety accident rate (ISAR), and system performance indicator (SPI), and collective radiation exposure (CRD).
In 2007, the WANO Governing Board approved the establishment of worldwide targets for key performance indicators that were to be achieved by 2015. In developing the targets, the WANO regional directors selected four performance indicators to monitor: forced loss rate (FLR), collective radiation exposure (CRE), industrial safety accident rate (ISA), and safety system performance indicator (SSPI).

Collective Radiation Exposure (CRE)

This indicator is the total external and internal whole body exposure determined by primary dosimeter, and internal exposure calculations. It includes all measured exposure reported for plant personnel, including all staff, contractors, visiting the site or station on official utility business.

Total Industrial Safety Accident Rate (TISA)

This indicator is the number of accidents for all plant personnel, including all staff, contractors, supplemental personnel, and all non utility personnel working onsite that result in one or more days away from work (excluding the day of the accident) or fatalities per 200,000 (TISA2) or per 1,000,000 (TISA1) hours worked.

Safety System Performance Indicator (SSPI)

This indicator is the ratio of all unplanned forced energy losses to the reference energy generation minus energy generation losses corresponding to off-normal events or accidents. It also indirectly monitors the effectiveness of operations and maintenance practices in managing the unavailability of safety system components. A lower value for this system performance indicator indicates a greater margin of safety for preventing reactor core damage. The SSPI, SP1 and SP5 headings identify the specific safety systems monitored by the indicator. SFI usually refers to the high pressure safety injection system and SSPI is usually the auxiliary feedwater system or similar system. SP1 refers to the emergency power system. Other systems monitored vary according to reactor type.

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NOTE: Given the SSPI industry target definition for SFI, the lower graph shows the percentage of units that have met all the individual targets for the different safety systems (SFI, SP2 and SSPI). For this percentage, the industry objective is 100%.

Unplanned Total Scrams per 7,000 hours critical (US7)

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Reactor Types

<table>
<thead>
<tr>
<th>REACTOR TYPE</th>
<th>ACCIDENT SEVERITY SCALE</th>
<th>NOTATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWR: Pressurised water reactor</td>
<td>BWR: Boiling water reactor</td>
<td>Light water cooled graphite-moderated reactor</td>
</tr>
<tr>
<td>LWCGR: Light water cooled graphite reactor</td>
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<td>Heavy water reactor</td>
</tr>
<tr>
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WANO and its members will be worldwide leaders in pursuing excellence in operational nuclear safety for commercial nuclear power.
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