



**Acceptable level of
safety performance
(ALoSP)**

CONTENTS

- ✓ Definitions
- ✓ Why measure safety performance?
- ✓ Safety performance indicators
- ✓ Alert level
- ✓ Selecting the target
- ✓ SPI data template and trend graph
- ✓ Acceptable level of safety performance
- ✓ Questions

The background features a collage of business-related graphics. At the top, there are 3D bar charts in yellow, red, and blue. Below these, a blue semi-transparent overlay covers the middle section, containing the word 'DEFINITIONS' in white. The bottom part of the image shows a 3D pie chart in yellow and green, and a line graph with orange and yellow data points. Several data tables with numerical values are scattered throughout the background.

DEFINITIONS



Accident

- ✓ *an occurrence associated with the operation of an aircraft*
- ✓ *manned aircraft*
- ✓ *unmanned aircraft*
- ✓ *a person is fatally or seriously injured; or*
- ✓ *the aircraft sustains damage or structural failure; or*
- ✓ *the aircraft is missing or is completely inaccessible*



Serious incident

- ✓ an accident nearly occurred
- ✓ associated with the operation of an aircraft
- ✓ manned aircraft
- ✓ unmanned aircraft
- ✓ *Attachment C, Annex 13*



Incident

- ✓ associated with the operation of an aircraft
- ✓ other than an accident
- ✓ which affects or could affect the safety of operation.

ALoSP

The minimum level of safety performance of civil aviation in a State, expressed in terms of:

- ✓ safety targets; and
- ✓ safety performance indicators.

ALoSP

- As part of its SSP, the State **should establish an ALoSP** to define the overall level of safety it seeks to attain.



ALoSP

- **The performance of service providers contributes to the ALoSP of the State.**
- **It provides a measure of the efforts made as compared to the results achieved.**



Safety performance indicators (SPIs)



What is an SPI?

Data-based safety **parameter** used for **monitoring and assessing** safety **performance**.



Definitions

High-consequence indicators. SPIs pertaining to the monitoring and measurement of high-consequence occurrences, **such as accidents or serious incidents.** High-consequence indicators are sometimes referred to as **reactive indicators.**



Definitions

Lower-consequence indicators. *SPIs* pertaining to the monitoring and measurement of lower-consequence occurrences, events or activities such as **incidents, non-conformance findings or deviations**. Lower-consequence indicators are sometimes referred to as **proactive** indicators.

SPIs

High-consequence occurrences (accidents and serious incidents) focus only on outcomes and do not expose systematic issues, hazards or latent conditions that might lead to high-consequence occurrences.



Indicator validity

Can the SPI be measured?

Is there sufficient data to identify trends?

Is data quality reliable?

Is there a statistical relationship amongst processes, operational interactions, outcome indicators and accident indicators?

Is the SPI clearly defined, not open to interpretation?

Will changes in the SPI foster actions leading to improvement?

Validity

Is it easy to communicate SPI significance and calculation to top management?

Will the SPI respond quickly to change?

Do SPI benefits justify collection, analysis and reporting costs?

Does the SPI provide a measure that is meaningful and representative of the original purpose of the activity?

Does the SPI foster the desired behaviour (such as supporting incident reporting)?

Other definitions

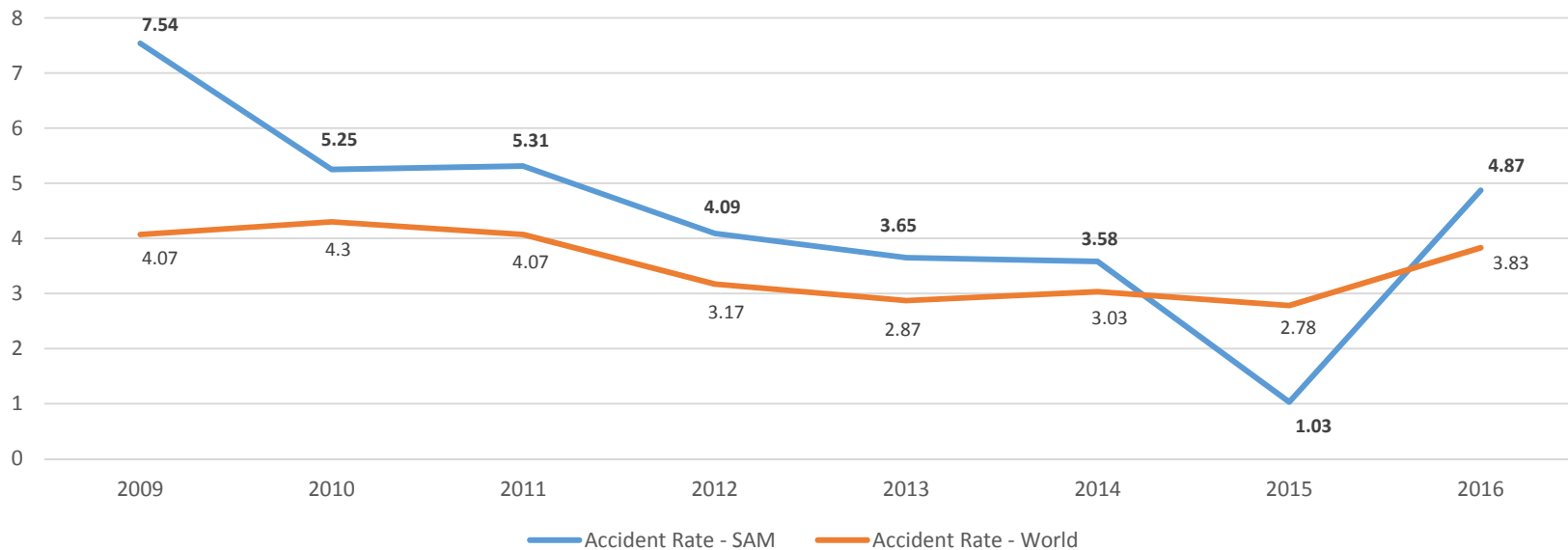
- ✓ An indicator is an **algorithm or formula** that expresses the qualitative or quantitative relationship between two or more variables and that serves to measure to what extent has the target been achieved.

$$\text{Acc/million departures} = \frac{\# \text{ accidents}}{\# \text{ departures}} \times 1.000.000$$

$$\text{Acc/million departures} = \frac{2 \text{ accidents}}{1.900.000} \times 1.000.000 = \mathbf{1.05}$$

SPI example

Accident rate per million of departures
Schedule commercial transport operations with aircraft above 5700 kg




How are SPIs expressed? Examples

High-consequence safety indicators					
<i>SI description</i>		<i>SI alert level criteria (for 2010)</i>	<i>Alert level breached (Yes/No)</i>	<i>SI target level criteria (for 2010)</i>	<i>Target met (Yes/No)</i>
1	CAA aggregate air operator monthly accident/serious incident rate (per 1 000 FH)	2009 average rate + 1/2/3 SD (annual reset)	Y	The 2010 average rate is <u>5%</u> better than the 2009 average rate	N
2	CAA aggregate aerodrome monthly ground accident/serious incident rate — Involving any aircraft (per 10.000 ground movements)	2009 average rate + 1/2/3 SD (annual reset)	Y	The 2010 average rate is <u>3%</u> better than the 2009 average rate	Y
3	CAA ATS monthly FIR serious incident rate — Involving any aircraft (per 100.000 air movements)	2009 average rate + 1/2/3 SD (annual reset)	N	The 2010 average rate is <u>4%</u> better than the 2009 average rate	N

How are SPIs expressed? Examples

High-consequence safety indicators - AIR					
<i>SI description</i>		<i>SI alert level criteria (for 2016)</i>	<i>Alert level breached (Yes/No)</i>	<i>SI target level criteria (for 2016)</i>	<i>Target met (Y/N)</i>
1	AMO monthly serious incident rate (per 1 000 H/H)	2015 average rate + 1/2/3 SD (annual reset)	Y	The 2016 average rate is <u>5%</u> better than the 2015 average rate	N



WHY MEASURE SAFETY PERFORMANCE?

**Why measure
safety
performance?**

**You can't manage what
you can't measure**

What is
needed for
measuring?

SDCPS: Safety data collection and
processing systems: **Databases**

- ✓ **Inputs;**
- ✓ **Processes; and**
- ✓ **Results**

SDCPS: Safety data collection and processing systems: Databases



Ecceair 5 CA, 03001850

Headline: Loss of control, impact with the ground, Fokker F28-4000, Quito, Ecuador

Occurrence filing information

File number: 03001850 Responsible entity: Ecuador CAI

Occurrence status: Data

Occurrence:

Add Topic

Narrative

Note

Link Topic

Runway (S)

Remove FOKKER - F28 - 4000, HC-8MD

South America

Location of: QUITO

Latitude of: 037:00 S

Longitude of: 78:28:00 W

Severity

Highest Damage: Substantial

Injury level: None

Third party damage: Yes

Damage aerodrome:

Object damaged:

Classification

Occurrence class: Accident

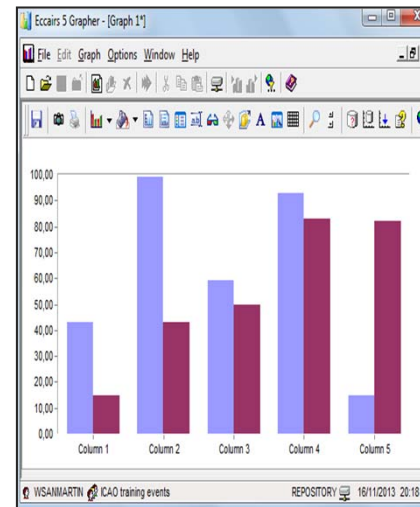
Occurrence: EIVAC: Evacuation FROST: Fire/smoke

Risk Grade:

ATN relation

ATN contribution:

Effect on ATN service:



Query: [Query by type of aircraft]

Report identification	File number	Occurrence class	Substance of	Local date	Makrtd/yr registration	Aircraft registration	Operator	Call sign	Total fatalities	Aircraft damage
NYC2LA100	02040778	Accident	United States	16/09/2002	CESNA - 421	N234	Unknown			
A03W0247	03002000	Accident	Canada	07/03/2003	BOEING - 300	C-PTL8	Unknown		0	
	03002003	Accident	Ecuador	07/03/2003	FOKKER - HC-8MD	F28-4000	Transportes Aereos Pilares Ecuadorianos S.A. PLAMP			
PROUS2002	03000889	Accident	Brazil	28/03/2003	MYTUBISHI	PFLW	Unknown			
ATL3LA1556	03000649	Accident	United States	08/03/2003	FOKKER - NT13FE		Unknown			
A03C0023	03000503	Accident	Canada	27/03/2003	F27-500		Wickma		0	
AWC03LA024	03000295	Accident	United States	24/03/2003	DE HAVILLAND	N209H	Always Ltd			
NYC03PA025	03000249	Accident	United States	06/03/2003	EMBRAER - BR	N6571	Dot Aircraft, Inc. DIBA Continental Express Air			
075CEN2P4	03000223	Accident	Brazil	04/03/2003	CESNA - E25-		Unknown		0	
	03000113	Accident	Bolivia	17/03/2003	BAE - CP-240A		Unknown		0	
A03AA030	03000108	Accident	Canada	04/03/2002	FAIRCHILD	C-PTTV	Unknown		0	
0403CEN2P4	02007185	Accident	Brazil	07/12/2002	OTHER	PF-05Y	Unknown	PF-05Y	2	
ATL3LA1023	02005603	Accident	United States	28/11/2002	SHARONNE	N227FA	Unknown		0	

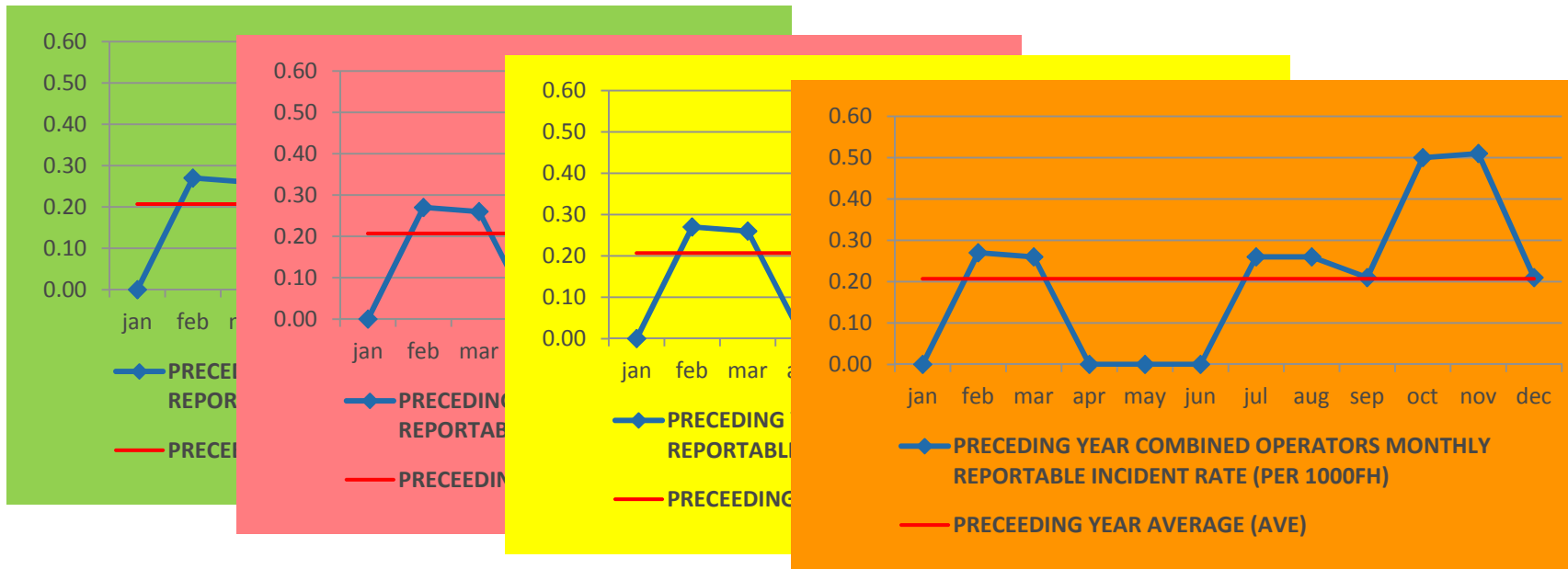
WSANMARTIN 1/22 ICAO training events

A person in a dark suit, white shirt, and patterned tie is pointing with their right hand towards a bar chart. The chart is overlaid on a blue background with a white upward-pointing arrow on the left and a white rightward-pointing arrow at the bottom. The chart consists of five vertical bars of increasing height, colored from left to right: purple, blue, teal, yellow-green, and red. The text 'SAFETY PERFORMANCE INDICATORS (SPIs)' is centered over the chart in white, bold, sans-serif font.

SAFETY PERFORMANCE INDICATORS (SPIs)

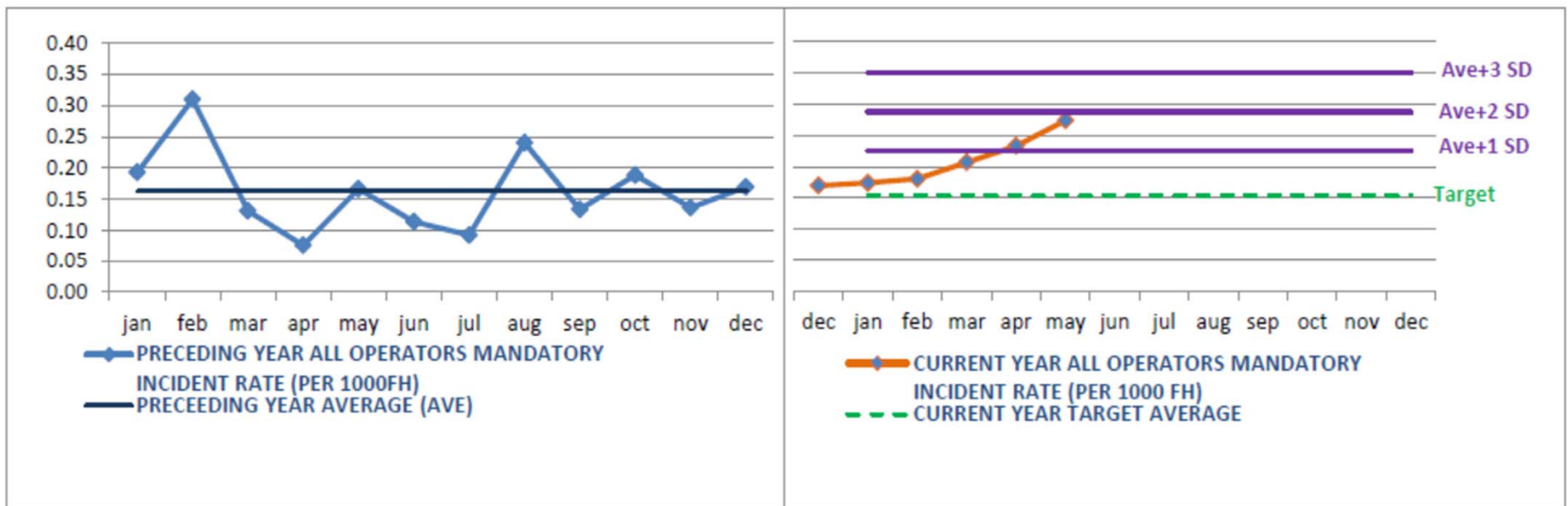
Safety performance indicators

- ☑ A set of SPIs must be developed to express and measure the safety performance of the State.
- ☑ SPIs refer to safety-related results.
- ☑ Accidents, serious incidents, incidents, non-conformities, etc.
- ☑ High-consequence and lower-consequence SPIs.
- ☐ Aggregate SPIs for each aviation service provider sector.



Two SPI performance markers

- ☑ Targets: The **target level** desired for the planned improvement should be set for each SPI
- ☑ Alerts: A high occurrence rate **alert trigger** must be set for each SPI.



A person in a dark suit stands with their back to the camera, looking at a large, semi-transparent blue screen. The screen is covered in white, hand-drawn business sketches and text. The sketches include a lightbulb, a laptop, a graph, and various business terms. The person's hands are in their pockets. The background behind the person is a bright, cloudy sky.

ALERT LEVEL

Business Plan

CONCEPT

RISKS?

THOUGHT
PROCESS

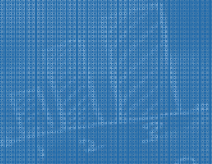
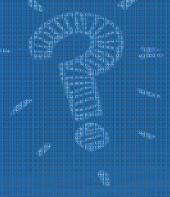
MARKET ANALYSIS

\$ £ } FINANCE

@ Web address

TEAM

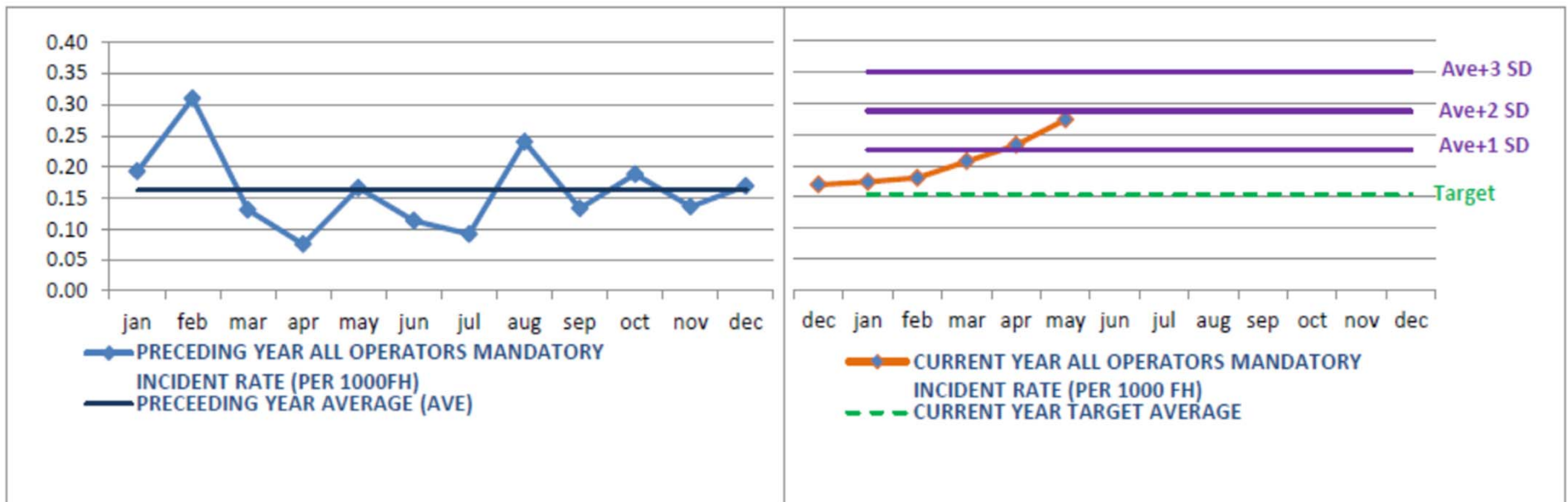
ADVANTAGE?



Alert level setting

- ✓ Statistical alarm warning (out-of-control criteria)
- ✓ Based on the preceding period's SPI data performance.
For example: average and standard deviation values

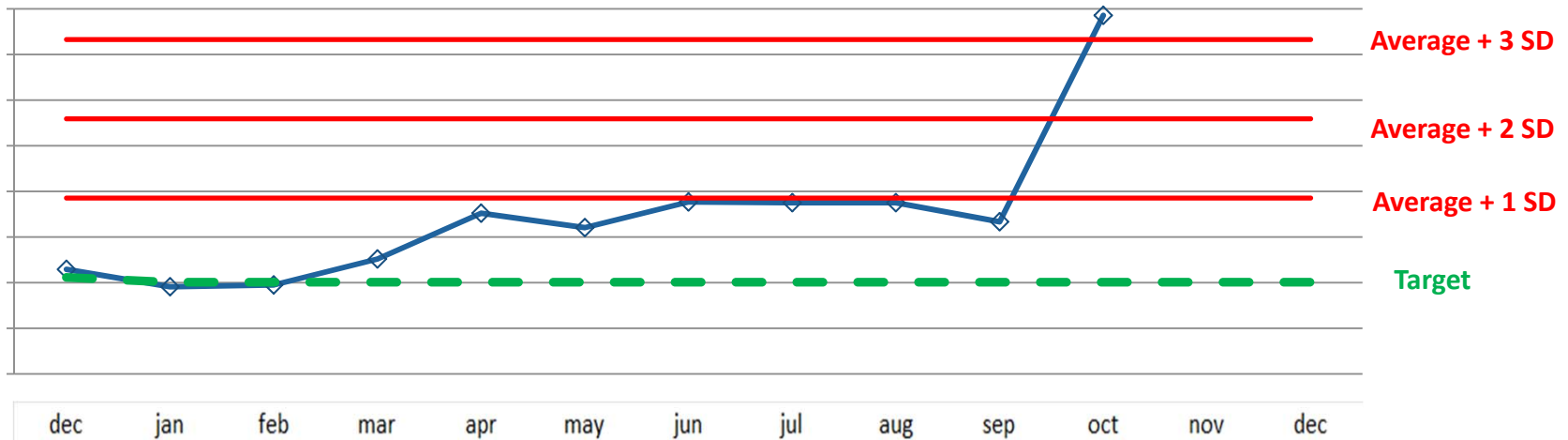
- ✓ Average + 1 SD; average + 2 SD; average + 3 SD
- ❑ Continuous monitoring of abnormal trends



Alert level setting

3 Criteria:

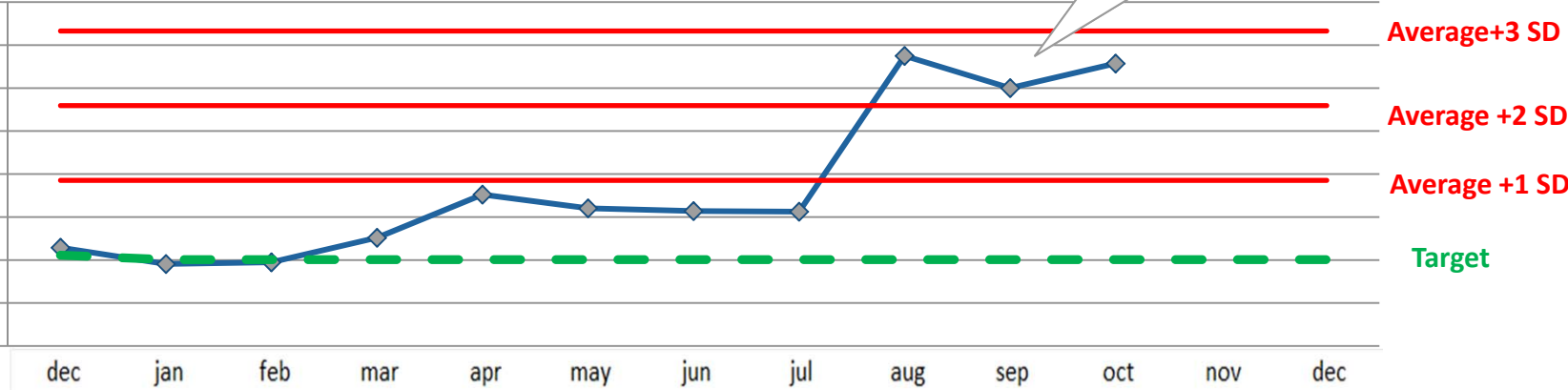
Any single point is above the 3 SD line



— Preceding Year Combined Operators Monthly Reportable Incident rate (per 1000FH)
- - - Preceding Year Average (Ave)

Alert level setting

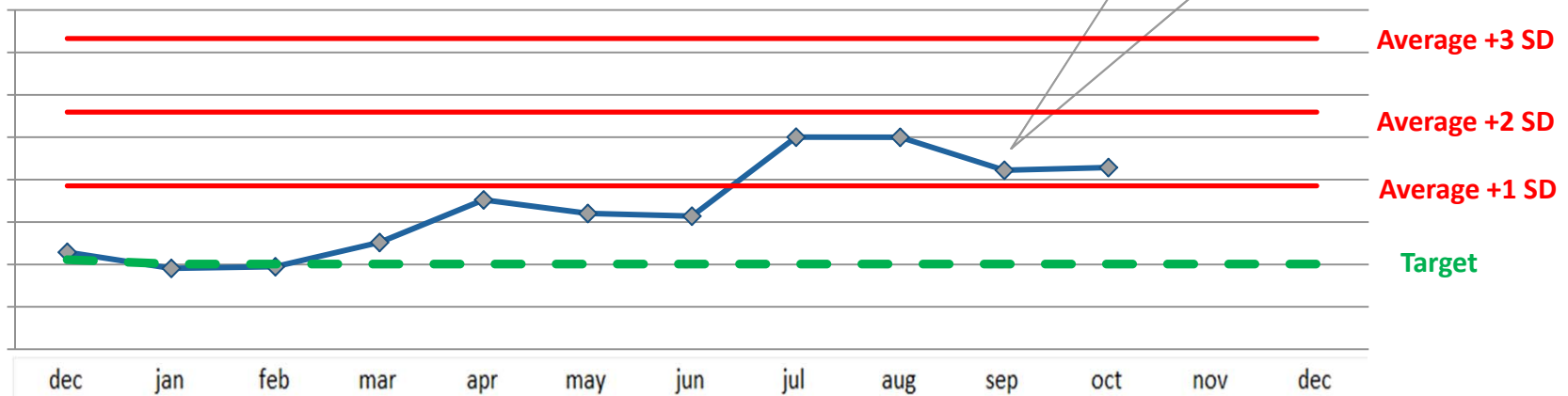
Two or more consecutive points above the 2 SD line



— Preceding Year Combined Operators Monthly Reportable Incident rate (per 1000FH)
- - - Preceding Year Average (Ave)

Alert level setting

Three or more consecutive points above the 1 SD line



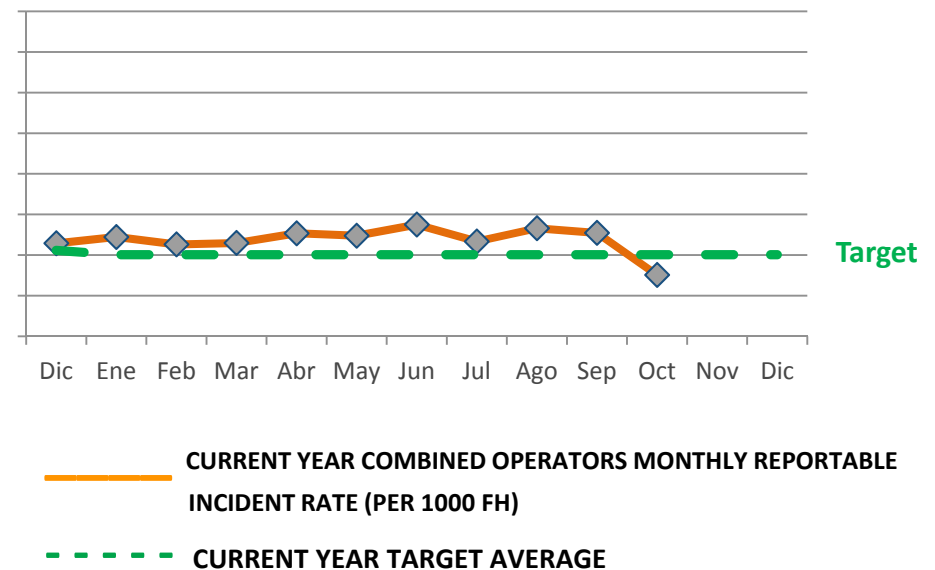
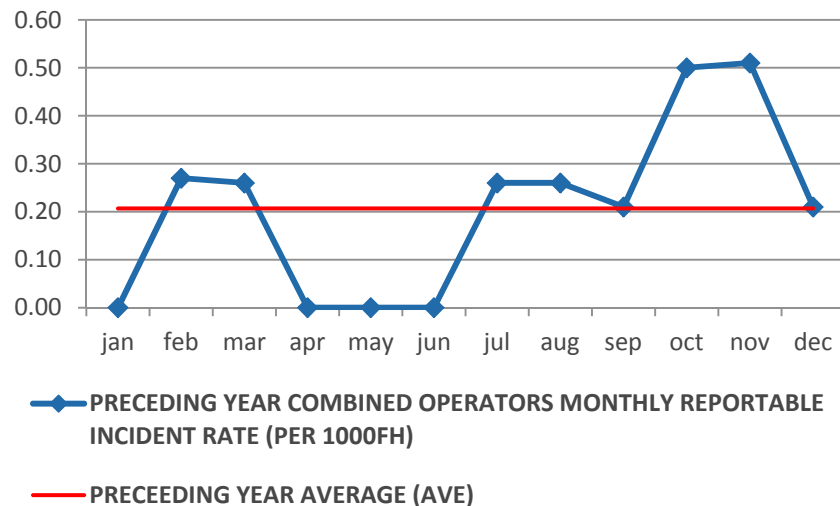
- Preceding Year Combined Operators Monthly Reportable Incident rate (per 1000FH)
- - - Preceding Year Average (Ave)




SELECTING THE TARGET

Target level setting

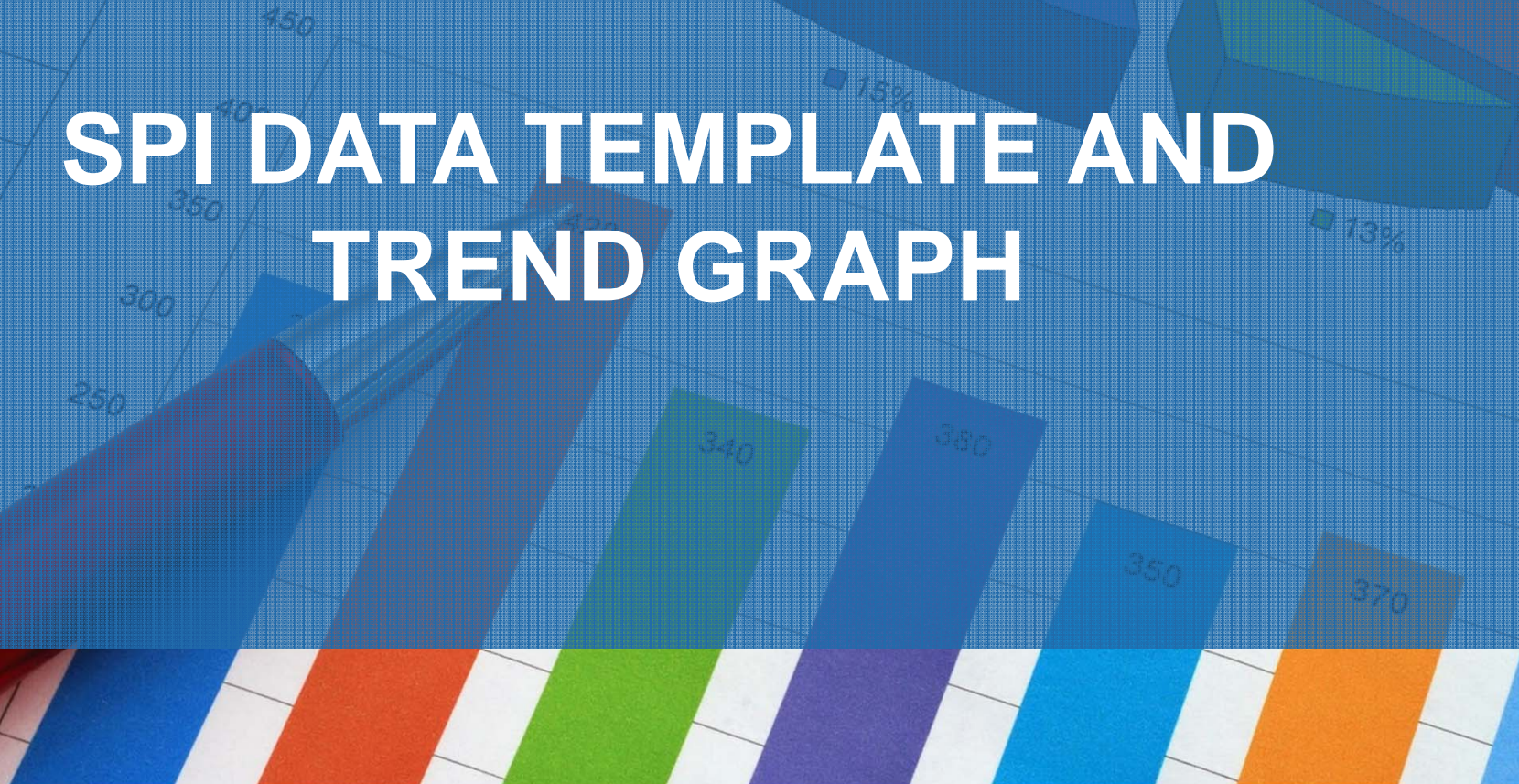
- ☑ An improvement in the (desired) planned incident rate for a new monitoring period.
- ☑ Reduction of the **current period's average** (for example, 5%), compared to the **preceding period's average rate**.
- ☐ Achieve the **target** at the end of each monitoring period.



The image features a collage of business data visualizations. In the top right, a 3D pie chart is shown with several slices in shades of blue, orange, and green, with percentage labels such as 15%, 14%, 15%, and 13%. In the bottom right, a bar chart displays six vertical bars in various colors (blue, orange, green, purple, light blue, orange) with numerical values 340, 380, 350, and 370. On the left side, a data table is visible with numerical values. The central text 'SPI DATA TEMPLATE AND TREND GRAPH' is overlaid on a blue grid background.

SPI DATA TEMPLATE AND TREND GRAPH

454,95
450
500,5
327,6
480,4
406,5
361,6
331,1
0,4



SPI data template and trend graph

- Use a standard SPI data template.
- Write down the **number of occurrences and movements** at relevant intervals
- Verify **Alert** and **Target** settings for planned improvements (example 5%)

SSP High Consequence Safety Indicator Example (with Alert and Target Setting Criteria)

Preceding Year				
Mth	All Operators Total FH	All Operators Incidents	Incident Rate*	Ave (line)
jan	51,837	10.00	0.19	0.16
feb	48,406	15.00	0.31	0.16
mar	53,354	7.00	0.13	0.16
apr	52,513	4.00	0.08	0.16
may	54,037	9.00	0.17	0.16
jun	52,673	6.00	0.11	0.16
jul	54,086	5.00	0.09	0.16
aug	54,043	13.00	0.24	0.16
sep	52,383	7.00	0.13	0.16
oct			0.19	0.16
nov			0.14	0.16
dec	53,000		0.17	0.16
			Ave	0.16
			SD	0.06

Alerts

Ave+1SD	Ave+2SD	Ave+3SD
0.23	0.29	0.35

Current Year Alert Level setting criteria is: Preceding Year Ave + 1/2/3 SD

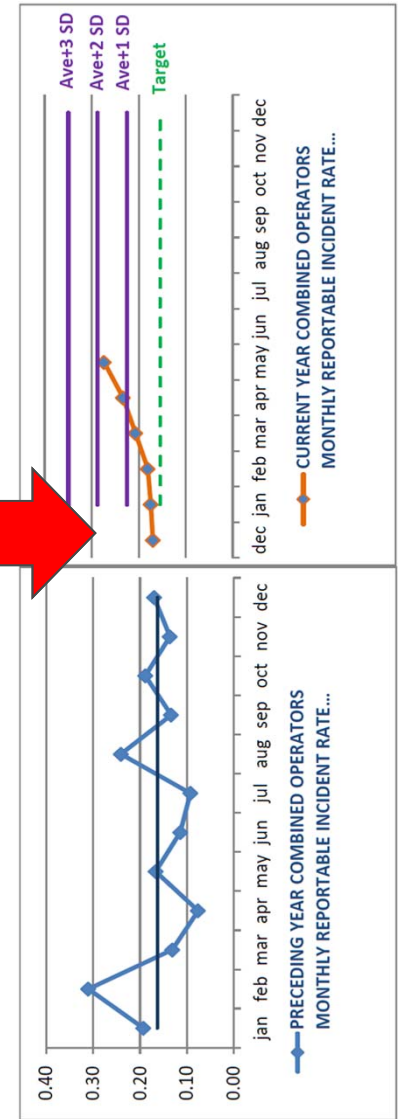
Current year					Alerting Criteria (line)			Current Year Target (line)
Mth	All Operators Total FH	All Operators Incidents	Incident Rate*	Ave	Ave+1SD	Ave+2SD	Ave+3SD	Current Year Target
dec	53006	9.00	0.17					
jan	51635	9.00	0.17	0.23	0.29	0.35	0.15	
feb	44295	8	0.18	0.23	0.29	0.35	0.15	
mar	48323	10	0.21	0.23	0.29	0.35	0.15	
apr	47176	11	0.23	0.23	0.29	0.35	0.15	
may	47469	13	0.27	0.23	0.29	0.35	0.15	
jun				0.23	0.29	0.35	0.15	
jul				0.23	0.29	0.35	0.15	
aug				0.23	0.29	0.35	0.15	
sep				0.23	0.29	0.35	0.15	
oct				0.23	0.29	0.35	0.15	
nov				0.23	0.29	0.35	0.15	
dec				0.23	0.29	0.35	0.15	

Number of occurrences and movements

* Rate Calculation: (per 1000 FH)

Target
0.15

Current Year Target is say 5% Ave rate improvement over the Ave rate for the preceding year, which is 0.15



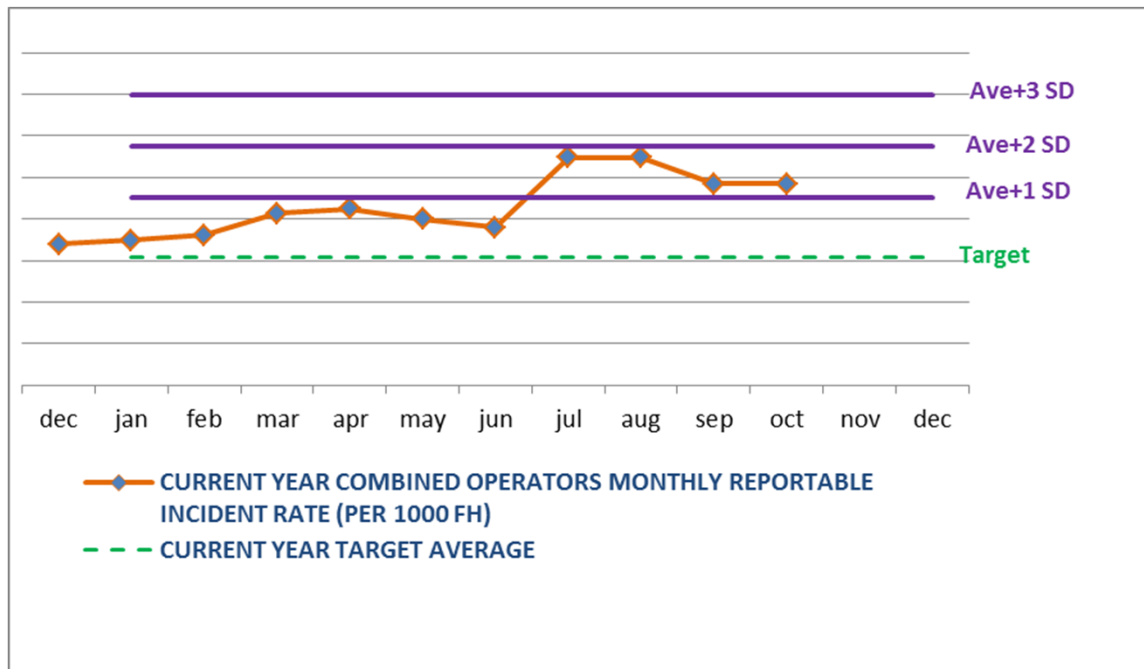


ACCEPTABLE LEVEL OF SAFETY PERFORMANCE

**Acceptable
level of safety
performance**

At the end of the monitoring period:

- ☑ Each SPI is checked against its own alert and target, the results of which will determine if :



- ☑ Alert level not breached – Yes / No
- ☑ Target achieved – Yes / No

Acceptable level of safety performance

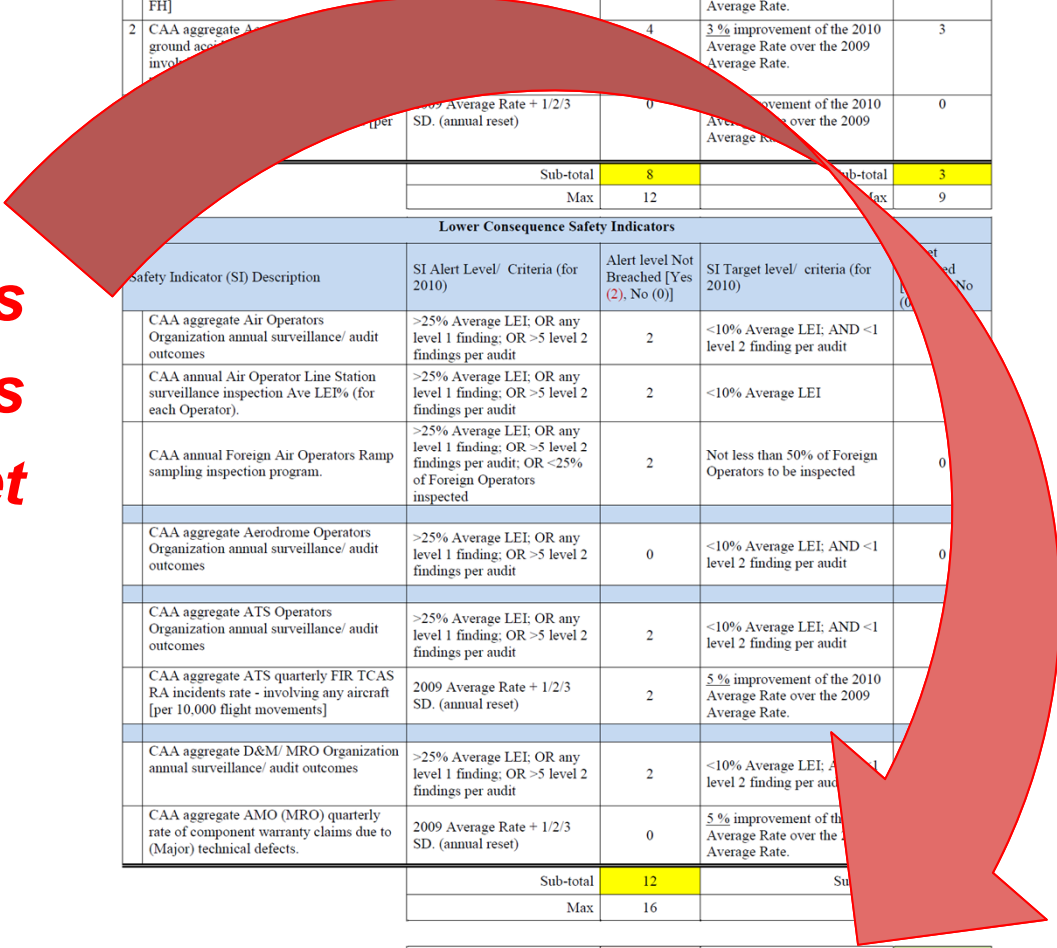
Therefore:

An SPI package is manifested in its aggregate alert/target performance

High Consequence Safety Indicators				
Safety Indicator (SI) Description	SI Alert Level/ Criteria (for 2010)	Alert level Not Breached [Yes (4), No (0)]	SI Target level/ criteria (for 2010)	Target Achieved [Yes (3), No (0)]
1 CAA aggregate Air Operators monthly accident/ serious incident rate [per 1000 FH]	2009 Average Rate + 1/2/3 SD. (annual reset)	4	5% improvement of the 2010 Average Rate over the 2009 Average Rate.	0
2 CAA aggregate Air Operators ground accident/ serious incident rate [per 1000 ground movements]	2009 Average Rate + 1/2/3 SD. (annual reset)	4	3% improvement of the 2010 Average Rate over the 2009 Average Rate.	3
3 CAA aggregate Air Operators Ramp sampling inspection program	2009 Average Rate + 1/2/3 SD. (annual reset)	0	5% improvement of the 2010 Average Rate over the 2009 Average Rate.	0
Sub-total		8	Sub-total 3	
Max		12	Max 9	

Lower Consequence Safety Indicators				
Safety Indicator (SI) Description	SI Alert Level/ Criteria (for 2010)	Alert level Not Breached [Yes (2), No (0)]	SI Target level/ criteria (for 2010)	Target Achieved [Yes (1), No (0)]
CAA aggregate Air Operators Organization annual surveillance/ audit outcomes	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	2	<10% Average LEI; AND <1 level 2 finding per audit	0
CAA annual Air Operator Line Station surveillance inspection Ave LEI ⁹ (for each Operator).	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	2	<10% Average LEI	0
CAA annual Foreign Air Operators Ramp sampling inspection program.	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit; OR <25% of Foreign Operators inspected	2	Not less than 50% of Foreign Operators to be inspected	0
CAA aggregate Aerodrome Operators Organization annual surveillance/ audit outcomes	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	0	<10% Average LEI; AND <1 level 2 finding per audit	0
CAA aggregate ATS Operators Organization annual surveillance/ audit outcomes	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	2	<10% Average LEI; AND <1 level 2 finding per audit	0
CAA aggregate ATS quarterly FIR TCAS RA incidents rate - involving any aircraft [per 10,000 flight movements]	2009 Average Rate + 1/2/3 SD. (annual reset)	2	5% improvement of the 2010 Average Rate over the 2009 Average Rate.	0
CAA aggregate D&M/ MRO Organization annual surveillance/ audit outcomes	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	2	<10% Average LEI; AND <1 level 2 finding per audit	0
CAA aggregate AMO (MRO) quarterly rate of component warranty claims due to (Major) technical defects.	2009 Average Rate + 1/2/3 SD. (annual reset)	0	5% improvement of the 2010 Average Rate over the 2009 Average Rate.	0
Sub-total		12	Sub-total 1	
Max		16	Max 16	

No Alert %	71.4%	Target Achieved %	35.3%
Overall ALoS Performance (for Year 2010)		57.8%	



Acceptable level of safety performance

At the beginning of a new monitoring period:

- ☑ The organisation establishes its minimum desired consolidated value, based on overall alert and target results (for example (ALoSP)), taking into account the preceding period's performance (**57.8%** shown in the figure)
- ☑ Could **60%** be a possible ALoSP to be established in the following monitoring period?

CAA aggregate D&M/ MRO Organization annual surveillance/ audit outcomes	>25% Average LEI; OR any level 1 finding; OR >5 level 2 findings per audit	2	<10% Average LEI; AND <1 level 2 finding per audit	1
CAA aggregate AMO (MRO) quarterly rate of component warranty claims due to (Major) technical defects.	2009 Average Rate + 1/2/3 SD. (annual reset)	0	5 % improvement of the 2010 Average Rate over the 2009 Average Rate.	0
	Sub-total	12	Sub-total	3
	Max	16	Max	8

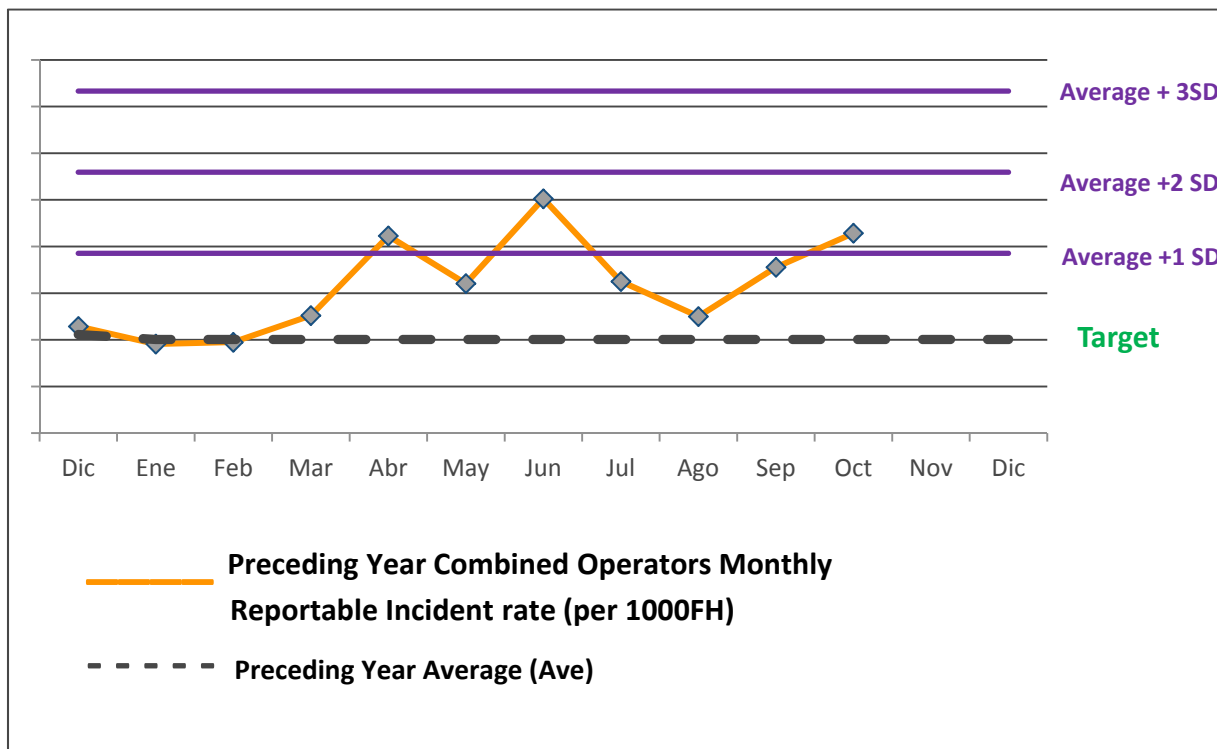
No Alert %	71.4%	Target Achieved %	35.3%
Overall ALoS Performance (for Year 2010)		57.8%	

A man in a dark suit and tie is shown from the chest up. He has his right hand on his forehead, looking slightly to the right with a thoughtful or stressed expression. The image is partially obscured by a large, semi-transparent blue rectangle with a fine grid pattern. The word "QUESTIONS" is written in white, bold, sans-serif capital letters across the center of this blue rectangle.

QUESTIONS

QUESTION

- ☑ At the end of a 12-month monitoring period, there were three data points (April, June and October) above the “Average + 1SD” alert line as shown below:



- ☑ Question: Has this alert graph breached any alert condition?
- ☑ Answer: **NO**, they are not **consecutive points**.

QUESTION

- Is a target setting the planned alert level to be achieved?

TRUE or FALSE?

- Answer: **FALSE**

- The **target** level means what is to be achieved.
- The **alert** level means what is not to be breached.

QUESTION

- Can an acceptable level of safety performance (ALOsP) be established and monitored for the achievement of alert and target results derived from the SPI package?

TRUE or FALSE?

- Answer: **TRUE**

SUMMARY

- ☑ Safety performance management is based on measurements.
- ☑ An SPI package is developed for measuring safety performance.
- ☑ Establish individual SPIs with **targets** and **alerts** based on safety metrics principles.
- ☑ Consolidate the **target** and **alert** results of SPI packages to show the overall performance of the safety system.
- ☐ Establish and obtain an acceptable level of safety performance for the organisation through the consolidated results of the SPI package.

