

SMS Best Practice Submission

ANSP	NAV CANADA	Date of submission	July 2025
Contact Details	XXXXXXXXXX		
SoE Study Area	7.1 Fatigue Risk Management		
Best Practice Title	Fatigue Power BI App		
In use since	2019		
ANSPs using this practice			

Details:

There are many factors that cause or contribute to a person 'feeling fatigued'. In 2019 a Power BI report was developed to help us understand the Company's exposure to this risk from a shift schedule point of view, the Fatigue Risk Report.

The application extracts the schedule information from NAV CANADA's Employee Scheduling System (ESS) on a daily basis, running it against a set of fatigue science criteria and operational parameters, which represent proxies for actual sleep measures (the potential impact of the schedule in the quality and quantity of sleep opportunities).

It is important to highlight that there is never an inference to the level of 'tiredness' a particular individual, or of a group of people, may be experiencing; nor is the dashboard meant to be the sole source of data for evaluating exposure to fatigue. Rather, this tool allows us to monitor scheduling practices that could potentially lead an individual to experience fatigue, to identify facilities where a higher level of awareness is required, or to provide an impetus for further exploration regarding drivers of fatigue risk.

In 2022 NAV CANADA adjusted its operational shift limits to better align with fatigue mitigation principles. To further understand and monitor fatigue metrics, two additional Power BI reports were developed, using the same technical principles applied to the existing Power BI:

- Fatigue Limit Exceedance: runs the ESS data against the set of adjusted shift rules, monitoring for compliance.
- Fatigue Review: aggregated the scientific limits and shift non-compliance limits for use in support of Safety Investigations. Access to this report is only permitted to members of the Safety Investigation team. In it, users can select a specific time period relevant to an investigation and evaluate both ESS fatigue data sets as part of their investigation. This report identifies the individual for follow up if required, and only in support of the investigation. Privacy of the individual is maintained through the application of Just Culture principles, data governance, and system-level access restrictions.

These three reports are bundled into a Power BI App as a single point of contact with the data.

These reports went-live on September 1st, 2022 (fiscal 2023).

Power BI provides the opportunity for internal comparison of the 'in play' operational fatigue limits that were exceeded (which are functional limits that were possible to institute given staffing limitations) with the scientific principles-based database (that is more in alignment with ICAO guidance, fatigue science and industry best practice). It provides a tool to see how the organization is doing, which is essential if the FRMS is to evolve and improve.

The Power BI dashboard has eliminated the reliance on manual reports for fatigue duty limit exceedances (for all instances except for Time in Position). This has significantly decreased operational manager workload and, as the report is based on actual shifts worked, it has improved the accuracy of the reporting to 100%. Since its adoption, as it is an automated process, it has also eliminated non-adherence to reporting requirements.

Definition of metrics:

1. Fatigue Science

NAV CANADA uses four scientific factors to assess the risk of fatigue in schedules. These are:

- **Acute Sleep Disruption**
 - a. Rule 1: Rest is less than 12 hours
 - b. Rule 3: Night shifts, defined as a shift with any amount of time between 23:30 and 05:30
- **Chronic Sleep Disruption**
 - a. Rule 5: Time between non-consecutive shifts is less than 48 hours
 - b. Rule 6: More than 5 consecutive shifts worked and at least one night shift (see Rule 3)
 - c. Rule 7: Three or more consecutive night shifts
 - d. Rule 8: Two consecutive night shifts
- **Continuous Wakefulness**
 - a. Rule 2: Shift is longer than 12 hours
- **Circadian Rhythm Disruption**
 - a. Rule 4: Sum of hours of a shift and rest period is less than 21 hours
 - b. Rule 9: Backward shift rotation, defined as the latter shift starting three or more hours earlier than the start time of the previous shift
 - c. Rule 10: Duty-rest cycle exceeds 27 hours in block of consecutive shifts

2. Fatigue Limits

In July of 2024, the fatigue limits were adjusted in the spirit of the FRMS monitoring, feedback, data collection, analysis and response framework. During the initial months of post publication compliance to the limits, it was found that strict compliance did not guarantee effective fatigue management. In fact, in some cases, fatigue levels were increased due to unforeseen circumstances. Additionally, the reduction in schedule flexibility was causing issues within operations. To address this, NAV CANADA implemented the following updated limits for shift schedules:

- Limit 1 (Time between shifts): The minimum rest time between shifts is 10 hours – No change
- Limit 2 (Total hours of work – Full): The maximum consecutive calendar days of work is eight (8) days or maximum of seventy-two (72) hours of work in a defined work period, whichever occurs first. - No change to the limit but limit 2 data within the Power BI database has now been sub divided into 2a and 2b to gather data at a more granular level capturing both the 8 days and 72 hours conditions separately.
- Limit 3 (Recovery time – Full): The minimum non-duty time between work periods is one (1) calendar day off, provided the last shift worked ended before 22:30. In the event the last shift worked extends beyond 22:30, the first shift following the calendar day off must not start before 06:30. Limit is applied at schedule publication, with the following exception post publication: On a voluntary basis, employees can elect to reduce to 36 hours of rest time between shifts if the rest period for a calendar day off exceeds 36 hours.
- Limit 4 (Night duty shifts – Full): The maximum consecutive night duty shifts worked is three (3) shifts, unless the work period consists of a block of night duty shifts, which are limited to six (6) in a row. Limit is applied at schedule publication, with the following exception post publication: On a voluntary basis, consecutive nights can be extended provided the employee does not exceed eight (8) working calendar days. No set pattern required.
- Limit 5 (Night duty shift recovery – Full): The minimum non-duty time after three (3) consecutive night duty shifts is one (1) calendar day off and the first shift following the calendar day off must not start before 06:30. In the event the work period consisted of a block of night duty shifts, the minimum non-duty time between work periods is two (2) calendar days off. Limit is applied at schedule publication, with the following exception post publication: On a voluntary basis, employees can elect to reduce to 36 hours of rest time between shifts if the rest period for a calendar day off exceeds 36 hours.
- Limit 6 (Start and end times – Full): The minimum start time for a shift is 05:30. The maximum end time for a night duty shift is 08:30. - No change
- Limit 7 (Shift length): The maximum consecutive hours of work in a shift is twelve (12) hours, exclusive of handover duties. - No change

- Limit 8 (Time in Position): Time in position will be limited to four (4) hours before the provision of a meaningful break. **In locations where workload is continuous and cognitively intense, time in position is restricted to a maximum of two (2) hours.**

3. Operational Metrics

The following metrics are used to evaluate **operational scheduling patterns**:

- The number of consecutive shifts
- The shift duration
- The rest period duration between consecutive shifts
- The total hours worked within blocks of consecutive shifts
- The total days of rest between blocks of consecutive shifts

Power BI Report Principles

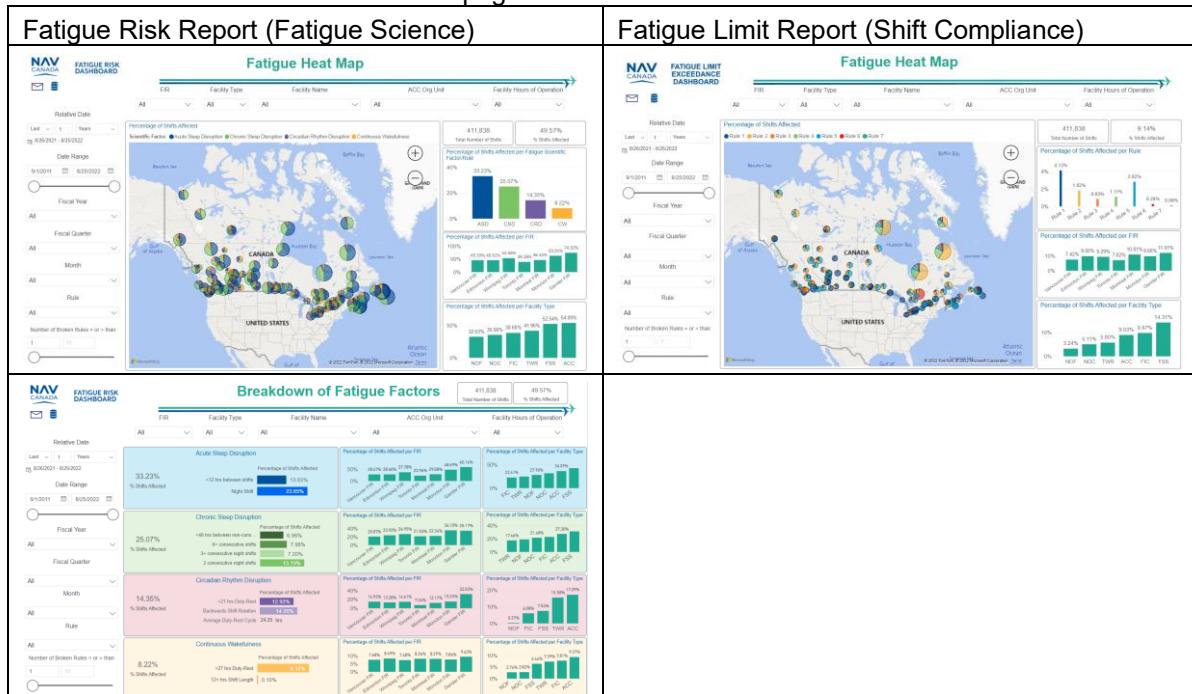
The reports were developed in Microsoft Power BI and is automatically refreshed daily.

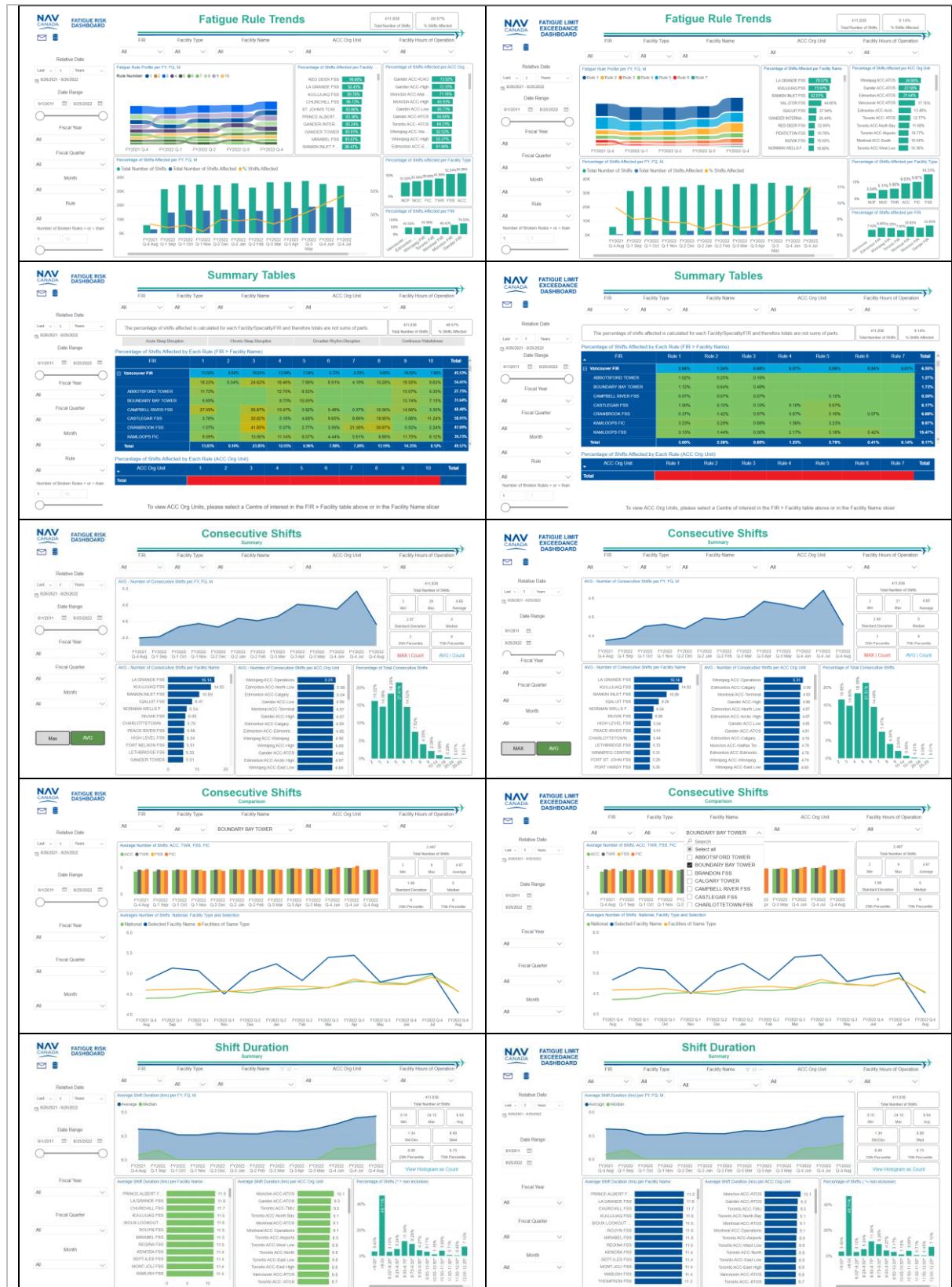
Filtering dimensions include:

- Date
- Flight Information Region
- Facility Type (example: Tower, ACC, FSS, etc.)
- Facility Name (example: Toronto Tower, Vancouver Tower, etc.)
- ACC Specialty (example: Gander Oceanic, Toronto Terminal, etc.)
- Facility Hours of Operation (24 or non-24 hours)
- Rule (Fatigue Science or Shift Compliance) criteria

The primary metric used to benchmark performance when considering the limits (either scientific or shift compliance) is the percentage of shifts that had at least one of the respective limits triggered ("Percentage of Shifts Affected"). The user can also select the minimum number of limits triggered per shift (e.g. only show the shifts that triggered at least 4 limits). Unit benchmarking is also possible, where a certain unit (Facility Name or ACC Specialty) can compare their metrics against the national average, as well as facilities of the same type (e.g., select a tower, the average from other towers is displayed). The operational metrics can be viewed as average, median, min, max, 25th and 75th percentile, standard deviation, as well as in histogram distributions.

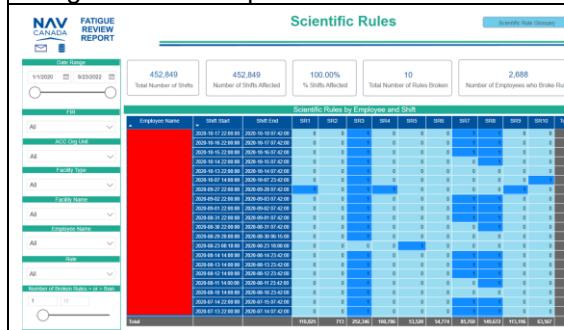
Below are screenshots of the different pages in the dashboard.







Fatigue Review Report



By submitting this document, your organisation is willing for the proposed Optimised or Good Practice to be shared with other ANSPs.

For Best Practices, this document should be sent together with the SoE in SMS questionnaire, to: soe_2025@eurocontrol.int

Submissions for consideration as Good Practices may be sent by the above date. They may also be identified during the survey interview sessions with the survey team, following which a Good Practice submission document will be requested.