SUMMARY

There is much uncertainty associated with measured/estimated runway friction coefficients (FC) and aircraft braking coefficients (ABC). Hence landing distances or maximum landing weights calculated on the basis of measured/estimated friction coefficients are also uncertain. This has contributed to accidents and incidents where aircraft departed the runways because the surface was more slippery than expected. This theme investigation focuses on the general framework for winter operations and the factors related to meteorology, runway, regulations and operations that reduce the safety margins and increase the uncertainty on contaminated and slippery runways.

Over a 10-year period, the Accident Investigation Board Norway (AIBN) has received 30 reports of accidents and incidents related to operations on contaminated and slippery runways. In the same period AIBN has published 12 investigation reports and issued 36 safety recommendations.

This theme investigation focuses on the general framework for operations on contaminated and slippery runways and the potential for safety improvements in general. The AIBN has accumulated and analysed a large volume of documentation, reports, test and research data from various national and international sources in addition to consulting expertise in the field of micrometeorology.

In the 30 investigated occurrences, the AIBN found that the aircraft braking coefficient (ABC) was not in accordance with the measured/estimated runway friction coefficients (FC). The AIBN has identified numerous common factors that have reduced the safety margins and factors that explain the differences between ABC and FC. These factors are related to meteorological conditions and friction measurements uncertainty, runway treatment, operational aspects and regulatory conditions.

The AIBN believes that incidents relating to slippery runways occur because the involved parties do not realise that existing rules and regulations are based on a simplification of the actual physical conditions. The measured/estimated friction values are used as scientific truths and not compared to other meteorological conditions ("safety indicators"). The safety margins are reduced by operational procedures which to a limited degree take into account the uncertainties connected to input parameters used for landing distance calculations. The AIBN's findings are supported by research programmes and studies.

The AIBN findings show that the national regulations governing operations on contaminated and slippery runways are less strict than those that govern operations in summer conditions. This is in spite of the ICAO and EASA guidelines and regulations which prescribe that if winter operations are to be performed on a regular basis, the authorities require the operators to take special measures in order to attain an "*equivalent level of safety"* to summer conditions.

The many incidents and accidents relating to contaminated and slippery winter runways, reveal that an "equivalent level of safety" is not achieved in connection with Norwegian winter operations. The CAA Norway seems to lack an overall risk assessment quantifying the level of safety of winter operations as part of the State Safety Program (SSP) and establishment of an Acceptable Level of Safety (ALoS).

Based on the above, the AIBN issues seven (7) safety recommendations.