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System overview and design justifications for the United Kingdom's new neutron monitor, the NM-2023

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This presentation explores the system design justification for the United Kingdom's (UK) new ground-level neutron monitor, the NM-2023. Funded by UK Research & Innovation (UKRI), the project developed networkable instruments for ground-level neutron monitoring that are significantly cheaper, more compact, and capable of producing results comparable to existing neutron monitors. A core goal of the project was to provide the UK Met Office with operational instruments, the potential to increase monitoring worldwide and enhance existing global capabilities. Design decisions were influenced by this and the challenging application requirements of neutron monitoring. After evaluating boron-coated straw (BCS) neutron counters as an alternative to boron trifluoride (BF3) and helium-3 (He3) gas-filled counters, the choice settled on He3 proportional counters. While BCS counters avoid the toxicity of BF3 and the expense of He3, their counting efficiency—about one-third that of He3 at 4 atm for an equivalent size—proved insufficient for the application. The justification for the neutron counters used is complemented by an explanation of the data acquisition chain, leveraging the established nuclear safeguards supply chain and International Atomic Energy Agency (IAEA) approved-for-use technology. Key design aspects of the neutron monitor, including the support table, housing, uninterrupted power supply (UPS), heating, ventilation, air conditioning (HVAC), and data ingest, are also addressed.

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