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MEASUREMENT METHODOLOGY OF THE HEU TRANSPARENCY FISSILE MASS FLOW MONITOR (FMFM) IN NEUTRON ACTIVATED UF_6 GAS STREAMS

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The measurement methodology of ORNL FMFM, developed by the U.S. DOE for the HEU Transparency Implementation Program, relies on producing delayed gamma rays emitted from fission fragments carried by the UF_6 gas flow. To do this, ^{235}U fission is induced in the UF_6 gas by a thermalized and modulated ^{252}Cf-neutron source placed in an annular sleeve filled with moderator material that surrounds the stream pipe. In order for this technique to be effectively applicable the average range of fission fragments produced in the UF_6 must be smaller than the pipe diameter. The fission fragment range can be very large in low-density materials. Therefore, a methodology is developed to determine the fission fragment range and its distribution to assess the fraction of the fission fragments that will remain in the stream. The FMFM software has been developed to model these processes to interpret the measured delayed gamma ray signal obtained from detectors located downstream of ^{252}Cf source. The observed delay in the time correlated measurement between the source modulator and the detector signal provides the stream flow velocity and its amplitude is related to the ^{235}U concentration in UF_6. The detail operational characteristics of the FMFM and the measurement methodology are presented.

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