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Towards Unattended Partial-Defect Verification of Irradiated Nuclear Fuel Assemblies Using the DCVD

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The Digital Cherenkov Viewing Device (DCVD) is a tool for verifying irradiated nuclear fuel assemblies in wet storage by means of measuring the Cherenkov light generated by the fuel. The DCVD is currently used in attended mode to verify the presence of irradiated fuel material, so-called gross defect verification, as well as to verify that part of the fuel material has not been diverted, so-called partial defect verification.
To further enhance the capabilities of the DCVD, image analysis techniques can be applied to the DCVD data to enhance image quality and to extract more information about the fuel. In this report, we both describe how general image analysis techniques can be applied, and we discuss specific methods applicable to DCVD data from PWR fuel assemblies. Based on our findings, we suggest some improvements to the current DCVD data acquisition procedures, and suggest methods for analysing DCVD data.
We also elaborate on how the methods presented may form a basis for unattended verification of irradiated fuel assemblies. Unattended verification is of interest when large quantities of irradiated fuel assemblies are to be verified at one specific measurement site during a long time period. This development of the DCVD capabilities are in line with the IAEA's Department of Safeguards Long-Term R&D Plan goal of developing "more sensitive and less intrusive alternatives to existing NDA instruments to perform partial defect test on spent fuel assembly prior to transfer to difficult to access storage".

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