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An approach to Safeguards By Design (SBD) for Fuel Cycle Facilities

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Implementation of safeguards in bulk handling facilities such as fuel fabrication facilities and reprocessing facilities are a challenging task. This is attributed to the nuclear material present in the facility in the form of powder, pellet, green pellet, solution and gaseous. Additionally material hold up, material unaccounted for (MUF) and the operations carried out round the clock add to the difficulties in implementing safeguards. In facilities already designed or commissioned or operational, implementation of safeguards measures are relatively difficult. The authors have studied a number of measures which can be adopted at the design stage itself. Safeguard By Design (SBD) measures can help in more effective implementation of safeguards, reduction of cost and reduction in radiological dose to the installation personnel. The SBD measures in the power reactors are comparatively easier to implement than in the fuel fabrication plants, since reactors are item counting facilities while the fuel fabrication plants are bulk handling type of facilities and involves much rigorous nuclear material accounting methodology. The safeguards measures include technical measures like dynamic nuclear material accounting, near real time monitoring, remote monitoring, use of automation, facility imagery, Radio Frequency Identification (RFID) tagging, reduction of MUF in bulk handling facilities etc. These measures have been studied in the context of bulk handling facilities and presented in this paper. Incorporation of these measures at the design stage (SBD) is expected to improve the efficiency of safeguardability in such bulk handling and item counting facilities and proliferation resistance of nuclear material handled in such facilities

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