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A RULE-BASED METHODOLOGY FOR MONITORING AIRBORNE RADIOACTIVITY IN NUCLEAR POWER PLANTS

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ABSTRACT

A methodology is presented from the field of artificial intelligence that can be used in the monitoring of airborne radioactivity in commercial nuclear power plants. It involves the comparison of measured data from area radiation monitors against legislated or expected ranges. The structure of a rule is that of the information granule, i.e., a proposition of the form: X is G is λ . Where, X is a probability distribution reflecting the measured radiation reading, G is a membership function reflecting the legislated or expected range and λ is a membership function describing the uncertainty in the proposition " X is G ". In the knowledge base of an on-line expert system propositions such as "radiation_level_in_area_A is high is likely," represent the state of the plant from the radiological point of view at any given time. With each information granule a performance measure is associated. This provides an indexing scheme that allows a user to have intelligent (i.e., context-specific) access of on-line information about the radiological state of various areas and the plant as a whole. In addition to current information this

methodology allows for an intelligent database design. This means that the dynamic updating and cataloguing of radiological information tasks are carried out by the database itself.

The presented methodology couples random information pertaining to data from measurements with epistemic(non-measured, fuzzy) data. Its purpose is to provide an intelligent tool for monitoring, accessing and analyzing radiological information by a variety of users. It can be useful to health physics personnel that need reliable current as well as historical radiological information about the plant. In addition maintenance and operations people can benefit from an on-line expert system that monitors radiation levels in various plant areas. The presented methodology allows for an intelligent user-interface design that can accommodate the radiological information needs of different users in the plant environment. Its software implementation involves a rule-based expert system interfaced with an intelligent database.

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