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analysis of fission product ratios to determine the history of nuclear fuel

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Multivariate analyses of fission product activities have previously been successfully used to determine the history of spent nuclear fuel from gamma measurements. A high dimensional data-set is projected to a one- or two-dimensional space using e.g. Partial Least Squares (PLS) regression to the parameters of interest, such as reactor type, burnup, initial enrichment and cooling time. Previous work was focused on well controlled measurements of intact fuel assemblies where all non-volatile fission products could be compared together. This work extends the concept to measurements of dispersed traces in the atmosphere, where a direct comparison of activities from different elements is not possible. Instead, ratios of fission products from the same elements are used as input to the multivariate analysis. A feasibility study is presented, using synthetic data, where the sensitivity of the method is investigated together with a discussion of the way different isotopes contribute to the measurements.

Promotional text

A multivariate analysis of radio isotope measurements is used to project high-dimensional data sets to one or two dimensions. This substantially simplifies the regression to parameters of interest, such as reactor type, burnup, initial enrichment or cooling time.

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