A Monte Carlo unfolding method has been developed for neutron spectrometry with foil activation measurements. It is based on minimising least squares differences between measured and calculated activities under a Fisher regularisation constraint. The performance of the unfolding procedure is first illustrated by a set of 20 foil detectors to simulate reaction rates calculated for a typical neutron reactor energy spectrum. A demonstration of the method is next made using measured reaction rates of the Arkansas Nuclear One power plant benchmark spectrum of the Neutron Metrology File (NMF-90). Results of the method are compared with those obtained by the MAXimum Entropy Deconvolution (MAXED) code using the same input data and are found to be in good agreement with the measured activities. Our procedure has an advantage in unfolding the neutron energy distribution when an a priori solution for an underdetermined unfolding problem is lacking. This is illustrated by unfolding the fast neutron beam spectrum of the MedApp facility at the nuclear reactor FRM-II in the SAND-II expanded 640-energy group structure, using a set of 22 experimental activation rates without a guess solution