The diversion path listing is intended to be as complete and systematic as possible, so that a global perspective covering all potential fuel-cycle facilities and other material acquisition routes may be gained. The listing is also chosen to capture the different potential diversion likelihood, according to types of states. The state categorization types are defined in Section 4.3.1. The state grouping is based on potential intent and technical capability to violate a cut-off agreement, rather than based on the NPT status of a state. Most literature, until very recently, has concentrated almost exclusively on the US/USSR situation, and tended to consider only those diversion paths focusing on the most up-to-date and developing technologies, which only a large nuclear weapons state would likely pursue. In addition, undeveloped non-nuclear-weapon states are unlikely to be pursuing the sophisticated nuclear explosive designs of the developed states, and it should be recognized that fissile material specifications that developed states would likely use could be substantially simplified from those used by developed states if only a very crude fission weapon ($\approx$ 100 tons TNT) was the objective.

(d) A qualitative relative risk ranking for each diversion scenario as a function of state type. This is obtained by documenting and assessing the importance of specific characteristics of the variables that contribute to diversion risk. These variables are a combination of the likelihood of the diversion scenario and the importance of the diversion scenario to the final materials acquisition. Relative risk rankings of specific states are not provided, but the general framework used could be easily extended for this purpose.

The purpose of the threat risk assessment is to be able to identify and justify the dominant diversion risks and utilize this information in the formulation of a verification package for a cut-off agreement. While the diversion risk rankings are necessarily only qualitative and subject to uncertainty, the process of identifying the relevant variables and the subjective judgements used is visible and available for audit. Risk rankings on this subject are rarely discussed in the literature. As an example, a basic premise of Special Nuclear Materials safeguards to-date is that all nuclear materials, regardless of their importance in a potential weaponization process, are considered to require safeguards. The unclassified literature, prior to the Iraq example, for instance, also did not consider electromagnetic isotope enrichment as a credible diversion scenario. This report attempts to provide a systematic approach, identifying fissile material cut-off verification methods across a broad spectrum of potential diversion scenarios and relating them to a predicted scenario risk.

A simple example of proliferation relative risk rankings for specific U-235 enrichment facilities, based only on technical features of the processes, has previously been provided by Krass, [1983]. This current report expands upon this example considerably by showing how to include economic, political and social factors, in addition to technical factors, and by showing how a systematic decision analysis technique can be used to provide a single risk-ranking scale. The risk ranking of this report is also of much broader scope than that of Krass, [1983]; it covers all potential facilities (declared and undeclared) and material acquisition methods for all three isotopes relevant to the cut-off of fissile material.

3. Literature Search

A bibliography in Appendix A lists all recent and relevant review articles, provides an historical overview and provides detailed references on the various technical aspects of verification of fissile material cut-off. The list is provided in chronological order with the newest references first. The articles judged most relevant have vertical bar markers. A brief review summarizing the contents of some of the more relevant articles is provided in Appendix B. Some non-classified references providing specific technical information on nuclear weapons materials