have not therefore been repeated. The verification assessment would also also be the same as for Pu-239, with specific analysis techniques for U-233 being substituted in place of Pu-239.

5.3 Undeclared Facilities

5.3.1 U-235 Route

For the U-235 route, the importance of an undeclared facility or material acquisition route anomaly to the final acquisition of material is qualitatively assessed in the second row of analysis in Table 2.1. The important diversion paths are enrichment processes and acquisition from existing enriched uranium sources. The first row of the table assesses the likelihood of an anomaly according to each of the three defined state types. For four of the enrichment facilities, assessed with high importance, a detailed decision analysis was used to rank the three state types. Results are shown in Figures 1.2.1a, 1.2.1b, 1.2.1c and 1.2.1d, as described in Section 5.1.1. Intuitive rankings were used to rank the rest of the facilities by state type.

The bottom row of Table 2.1 shows the overall diversion-risk relative ranking as a function of state type. Of the enrichment facilities, for NWS and NNWSD, the ones judged with the most overall diversion-risk potential for undeclared facilities (Figures 2.2.1a and 2.2.1b), are in order of risk ranking the laser isotope method, [11] the aerodynamic (Helikon) method and the gas centrifuge. Diversion using very large scale undeclared facilities, such as gaseous diffusion, is very small, as shown. This assumes however that a verification regime is in place to detect undeclared facilities, as it should be noted that footnote [10] indicated that an Argentinian gaseous diffusion plant remained undeclared, and undetected, for 5 years.

Enrichment techniques at the R & D stage are also high on the diversion risk list for the two developed state types for similar reasons, as explained in Section 5.1.1. Acquisition of enriched uranium from undeclared existing stockpiles is identified as the highest risk for NWS, and is highest after R & D and laser isotope facilities for the NNWSD.

For the NNWSU (Figure 2.2.1c) which have quite different diversion risks than the developed states, the highest undeclared diversion risks are from clandestine (smuggled) acquisition, via theft or the offshore purchase of raw or refined enriched uranium. If adequate quantities were made available by this route the large technical complexities of enrichment facilities could be bypassed. This assessment is a result primarily of giving a high weighting for the current political and economic situation, and the large quantities of fissile material, in the former states of the USSR. Enriched uranium conversion facilities, the electromagnetic (calutron) enrichment method and the gas centrifuge enrichment method then follow in the relative risk rankings. As expected, NNWSU with intent are more likely to use demonstrated than advanced R & D enrichment methods for the undeclared enrichment facilities route. This technology was one of those chosen by Iraq, Section 5.1, in its pursuit of the U-235 route to weapon acquisition. The thermal diffusion enrichment method is also identified, but at a somewhat lower risk. The importance of this latter method, considered obselete by advanced states, is that it was the method used in the US to make HEU for the first nuclear weapon and it provided slightly enriched feed for final enrichment by calutrons [Fox, 1945]. The method has

[11] The tables do not distinguish between the molecular or the atomic vapour method. The molecular method is usually quoted as being simpler and more prone to diversion, and this method is therefore implied. The atomic vapour method is implicitly included with the methods under R & D enrichment techniques in Figure 2.2.1.a, b and c.