long been discussed in the literature, [12] interestingly in a manner similar to calutron technology, as being obselete (for advanced states) but nevertheless as having some technical advantages, although only for small-scale enrichment programs. Advanced methods of enrichment were assessed as low risk from the NNWSU. As noted in Section 5, however, uranium enrichment is still a dynamic field. If the newer techniques that depend more upon the availability of chemicals and use well-established principles (e.g., chemical enrichment methods using solvent extraction or ion-exchange), as opposed to laser methods, are made available to undeveloped states, then the risk could change dramatically. As with the early dismissal by the developed nations of calutron technology, chemical enrichment methods were dismissed as being impractical for many years. However, the fact that developed states are taking many years to develop them, because in principle all enrichment methods are quite difficult, supports the current assessment of relatively low risk of newer techniques for the NNWSU. Denying access to existing technologies has nevertheless sometimes resulted in the successful development of indigenous technology, although undeveloped nations are only likely to acquire this technology, from sources in a developed state.

The only means of effectively verifying clandestinely obtained weapons-grade or enriched U-235 in some chemical form is by the use of intelligence information from various sources. Verification would be difficult because of the small quantity of material involved and because of the relative ease of handling the material, other than precautions to avoid criticality problems.

Verification of the existence of undeclared enriched uranium facilities is becoming more difficult, as facility sizes tend to decrease as equipment designs and efficiencies improve. Nevertheless, electromagnetic, gas centrifuge, aerodynamic and thermal diffusion facilities would still be fairly large and would have distinct signatures. It is expected that with current satellite and airborne monitoring techniques, and knowledge of the likely facility types, high confidence could be placed on identifying enrichment facility types of a known technology. Enrichment production capacities, however, would remain very uncertain, using surveillance technical means, unless alternative information, from routine, special inspections or other intelligence information, was available.

Verification methods to disclose undeclared uranium mining (including uranium mined from phosphate mines) and milling, or smuggled receipt of off-shore ore, would be expected to be conclusive. If access to the relatively small volumes needed of natural uranium concentrate were available, as a result of diversion from declared indigenous or undeclared offshore access, then technical means of verification of the uranium conversion process would be ineffective. Special inspections of natural and enriched uranium conversion facilities should be easily conclusive, provided the facilities could be correctly identified. Identification of a conversion facility would be very difficult, as the facility could be small and the nuclear emissions signatures would not be significant.

Diversion from undeclared research/test reactors is unlikely from any of the state types as the existence of these types of facilities is extremely easy to verify, although a facility located underground would be more difficult to identify.

While the diversion risk from mines and mills is low, because of the technically low importance to the final product, the use of potential verification techniques for undeclared

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[12] Benedict, M. and Pigford, T.R., Nuclear Chemical Engineering, McGraw Hill Book Company Inc, 1957 Edition, p. 516.