RAS 9459

NUCLEAR REGULATORY COMMISSION

Docket No. 50-413/414-OLA Official Exh. No. SEC-13
In the matter of Duke Cotawba
Staff ______ IDENTIFIED 1/13/05
Applicant ______ RECEIVED 1/13/05
Intervenor ✓ REJECTED ______
Cont'g Off'r ______
Contractor ______ DATE ______
Other ______ Witness ______
Reporter ______

Exhibit 8 SEC-13

IAEA SAFEGUARDS GLOSSARY

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INTERNATIONAL NUCLEAR VERIFICATION SERIES
No. 3

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common facility type (see No. 3.2), and may also be carried out for a specific facility. The purpose of a diversion path analysis is to determine whether a proposed set of safeguards measures (see No. 3.6) would provide sufficient detection capability with respect to a specific diversion path or diversion strategy.

3.12. Acquisition path analysis — the analysis of all plausible acquisition paths or acquisition strategies for a State (see No. 3.8) to acquire nuclear material usable for the manufacture of a nuclear explosive device. An acquisition path analysis may be part of the development of a State level safeguards approach (see No. 3.4). The purpose of an acquisition path analysis is to determine whether a proposed set of safeguards measures (see No. 3.6) would provide sufficient detection capability with respect to a specific acquisition path or acquisition strategy.

3.13. Conversion time — the time required to convert different forms of nuclear material to the metallic components of a nuclear explosive device. Conversion time does not include the time required to transport diverted material to the conversion facility or to assemble the device, or any subsequent period. The diversion activity is assumed to be part of a planned sequence of actions chosen to give a high probability of success in manufacturing one or more nuclear explosive devices with minimal risk of discovery until at least one such device is manufactured. The conversion time estimates applicable at present under these assumptions are provided in Table I.

TABLE I. ESTIMATED MATERIAL CONVERSION TIMES FOR FINISHED Pu OR U METAL COMPONENTS

Beginning material form	Conversion time
Pu, HEU or ^{233}U metal	Order of days (7–10)
PuO_2, $Pu(NO_3)_4$ or other pure Pu compounds; HEU or ^{233}U oxide or other pure U compounds; MOX or other non-irradiated pure mixtures containing Pu, U ($^{233}U + ^{235}U \geq 20\%$); Pu, HEU and/or ^{233}U in scrap or other miscellaneous impure compounds	Order of weeks (1–3)[a]
Pu, HEU or ^{233}U in irradiated fuel	Order of months (1–3)
U containing <20% ^{235}U and ^{233}U; Th	Order of months (3–12)

[a] This range is not determined by any single factor but the pure Pu and U compounds will tend to be at the lower end of the range and the mixtures and scrap at the higher end.

TABLE II. SIGNIFICANT QUANTITIES

Material	SQ
Direct use nuclear material	
Pu[a]	8 kg Pu
^{233}U	8 kg ^{233}U
HEU ($^{235}U \geq 20\%$)	25 kg ^{235}U
Indirect use nuclear material	
U ($^{235}U < 20\%$)[b]	75 kg ^{235}U (or 10 t natural U or 20 t depleted U)
Th	20 t Th

[a] For Pu containing less than 80% ^{238}Pu.
[b] Including low enriched, natural and depleted uranium.

3.14. Significant quantity (SQ) — the approximate amount of nuclear material for which the possibility of manufacturing a nuclear explosive device cannot be excluded. Significant quantities take into account unavoidable losses due to conversion and manufacturing processes and should not be confused with critical masses. Significant quantities are used in establishing the quantity component of the IAEA inspection goal (see No. 3.23). Significant quantity values currently in use are given in Table II.

3.15. Detection time — the maximum time that may elapse between diversion of a given amount of nuclear material and detection of that diversion by IAEA safeguards activities. Where there is no additional protocol in force or where the IAEA has not drawn a conclusion of the absence of undeclared nuclear material and activities in a State (see No. 12.25), it is assumed: (a) that all facilities needed to clandestinely convert the diverted material into components of a nuclear explosive device exist in a State; (b) that processes have been tested (e.g. by manufacturing dummy components using appropriate surrogate materials); and (c) that non-nuclear components of the device have been manufactured, assembled and tested. Under these circumstances, detection time should correspond approximately to estimated conversion times (see No. 3.13). Longer detection times may be acceptable in a State where the IAEA has drawn and maintained a conclusion of the absence of undeclared nuclear material and activities. Detection time is one factor used to establish the timeliness component of the IAEA inspection goal (see No. 3.24).

3.16. Detection probability — the probability, if diversion of a given amount of nuclear material has occurred, that IAEA safeguards activities will lead to detection. The detection probability is usually denoted as $1 - \beta$, with β being the non-detection probability (see No. 10.28). The detection probability for safeguards activities involving nuclear material accountancy can be quantified, and the accountancy detection probability $1 - \beta_a$ is preselected as an input parameter for establishing sampling plans. The values of $1 - \beta_a$ currently in use are 90% for 'high' and 20% for 'low' probability levels.

3.17. False alarm probability — the probability, α, that statistical analysis of accountancy verification data would indicate that an amount of nuclear material is missing when, in fact, no diversion has occurred (see No. 10.27). For nuclear material accountancy purposes, α (or the associated critical region (see No. 10.32)) is preselected as one of the input parameters for designing sampling plans and performing statistical tests. It is usually set at 0.05 or less, in order to minimize the number of discrepancies (see No. 3.25) or false anomalies (see No. 3.26) that must be investigated.

3.18. Inventory — the amount of nuclear material present at a facility or a location outside facilities (LOF). In the context of IAEA safeguards, the term 'inventory' is defined as the larger of: the maximum (running) inventory calculated from State reports (see Nos 12.5–12.8); or throughput, which is the estimated amount of material processed during the material balance period. This inventory is used for establishing the frequency and intensity of routine inspections for a facility or an LOF (see No. 11.16), as provided for in paras 79 and 80 of [153].

3.19. Annual throughput — "the amount of nuclear material transferred annually out of a facility working at nominal capacity" [153, para. 99]. Paragraph 84 of [66] defines throughput as "the rate at which nuclear material is introduced into a facility operating at full capacity".

3.20. IAEA timeliness detection goal — the target detection times applicable to specific nuclear material categories (see No. 4.24). These goals are used for establishing the frequency of inspections (see No. 11.16) and safeguards activities at a facility or a location outside facilities during a calendar year, in order to verify that no abrupt diversion (see No. 3.10) has occurred. Where there is no additional protocol in force or where the IAEA has not drawn and maintained a conclusion of the absence of undeclared nuclear material and activities in a State (see No. 12.25), the detection goals are as follows:

— One month for unirradiated direct use material,
— Three months for irradiated direct use material,
— One year for indirect use material.

Longer timeliness detection goals may be applied in a State where the IAEA has drawn and maintained a conclusion of the absence of undeclared nuclear material and activities in that State.

3.21. Safeguards Criteria — as currently defined, the set of nuclear material verification activities considered by the IAEA as necessary for fulfilling its responsibilities under safeguards agreements. The Criteria are established for each facility type and location outside facilities (LOF), and specify the scope, the normal frequency and the extent of the verification activities required to meet the quantity and the timeliness components of the inspection goal at facilities and LOFs (see Nos 3.23 and 3.24). In addition, the Criteria specify verification activities to be carried out in a co-ordinated manner across a State. The Criteria are used both for planning the implementation of verification activities and for evaluating the results therefrom (see Nos 12.20 and 12.23).

3.22. IAEA inspection goal — performance targets specified for IAEA verification activities at a given facility as required to implement the facility safeguards approach (see No. 3.3). The inspection goal for a facility consists of a quantity component (see No. 3.23) and a timeliness component (see No. 3.24). These components are regarded as fully attained if all the Safeguards Criteria (see No. 3.21) relevant to the material types (see No. 4.23) and material categories (see No. 4.24) present at the facility have been satisfied and all anomalies involving 1 SQ or more of nuclear material have been resolved in a timely manner (see No. 3.26). (See also Nos 12.23 and 12.25.)

3.23. Quantity component of the IAEA inspection goal — relates to the scope of the inspection activities at a facility that are necessary for the IAEA to be able to draw the conclusion that there has been no diversion of 1 SQ or more of nuclear material over a material balance period and that there has been no undeclared production or separation of direct use material at the facility over that period.

3.24. Timeliness component of the IAEA inspection goal — relates to the periodic activities that are necessary for the IAEA to be able to draw the conclusion that there has been no abrupt diversion (see No. 3.10) of 1 SQ or more at a facility during a calendar year.

3.25. **Discrepancy** — an inconsistency found in the facility operator's records, or between facility records and State reports (see No. 6.48), or between these records and inspector observations or indications resulting from containment and surveillance measures (see No. 8.6). Discrepancies that cannot be resolved (i.e. ascribed to innocent causes or otherwise satisfactorily explained) may lead to the determination that declared nuclear material is unaccountably missing. A discrepancy involving 1 SQ or more of nuclear material is classified as a possible anomaly (see No. 3.26).

3.26. **Anomaly** — an unusual observable condition which might result from diversion of nuclear material (see No. 2.3) or misuse of safeguarded items (see No. 2.4), or which frustrates or restricts the ability of the IAEA to draw the conclusion that diversion or misuse has not occurred (see No. 12.25). Examples of possible anomalies would be:

- Denial or restriction of IAEA inspector access for inspection (see No. 11.14);
- Unreported safeguards significant changes to facility design or operating conditions (see No. 3.28);
- A discrepancy involving 1 SQ or more of nuclear material (see No. 3.25);
- A significant departure from the agreed recording and reporting system (see No. 6.1);
- Failure of the facility operator to comply with agreed measurement standards or sampling methods (see No. 6.1);
- (For bulk handling facilities) a negative conclusion resulting from the evaluation of MUF (material unaccounted for), SRD (shipper/receiver difference) or other statistics (see No. 10.1);
- IAEA seals on equipment detached by non-IAEA staff, lost or showing signs of tampering (see Nos 8.5 and 8.12);
- Evidence of tampering with IAEA equipment (see No. 8.12).

3.27. **Facility practices** — a set of "prudent management practices required for the economic and safe performance of nuclear activities" [153, para. 4(c)] as applied by the facility operator. These practices include features which are relevant for the implementation of the facility safeguards approach (see No. 3.3), such as material identification and measurement procedures, record keeping, inventory taking frequencies and procedures, designation of measurement points and storage arrangements.

3.28. **Design information** — "information concerning nuclear material subject to safeguards under the agreement and the features of facilities relevant to safeguarding such material" [153, para. 8]; similarly in [66, para. 32]. Design information includes the facility description; the form, quantity, location and flow of nuclear material being used; facility layout and containment features; and procedures for nuclear material accountancy and control. This information is used by the IAEA, inter alia: to design the facility safeguards approach (see No. 3.3), to determine material balance areas (see No. 6.4) and select key measurement points and other strategic points (see No. 6.5), to develop the design information verification plan (see No. 3.31) and to establish the essential equipment list (see No. 3.32). Design information for existing facilities should be provided by the State during discussion of the Subsidiary Arrangements (see No. 1.26); in the case of new facilities, such information is to be provided by the State as early as possible before nuclear material is introduced into a new facility. Further, the State is to provide preliminary information on any new nuclear facility as soon as the decision is taken to construct, or to authorize the construction of, the facility, and to provide further information on the safeguards relevant features of facility design early in the stages of project definition, preliminary design, construction and commissioning. Facility design information is to be provided for any safeguards relevant changes in operating conditions throughout the facility life cycle (see No. 5.29). Under an INFCIRC/66-type safeguards agreement, the State is to provide design information on principal nuclear facilities to enable the IAEA to perform the design review at as early a stage as possible [66, para. 31]. Design information is submitted to the IAEA by the State using the IAEA design information questionnaire (DIQ).

3.29. **Design information examination (DIE)** — activities carried out by the IAEA to determine that the State has provided all relevant descriptive and technical information needed, inter alia, to design a safeguards approach for a specific facility (see No. 3.3).

3.30. **Design information verification (DIV)** — activities carried out by the IAEA at a facility to verify the correctness and completeness of the design information provided by the State (see No. 3.28). An initial DIV is performed on a newly built facility to confirm that the as-built facility is as declared. A DIV is performed periodically on existing facilities to confirm the continued validity of the design information and of the safeguards approach. The IAEA's authority for performing a DIV is a continuing right throughout all phases of a facility's life cycle until the facility has been decommissioned for safeguards purposes (see Nos 5.29 and 5.30).

3.31. **Design information verification plan (DIVP)** — a document prepared by the IAEA identifying the design information verification activities (see No. 3.30) required for each phase of a facility's life cycle (see No. 5.29).

3.32. **Essential equipment list (EEL)** — a list of equipment, systems and structures essential for the declared operation of a facility. The EEL is facility specific and is established during the design information examination (see No. 3.29); it identifies those items that may influence the facility's operational status, function, capabilities and inventory. The list is maintained and updated as part of the design information verification plan (DIVP) implementation (see No. 3.31).

3.33. State system of accounting for and control of nuclear material (SSAC) — organizational arrangements at the national level which may have both a national objective to account for and control nuclear material in the State and an international objective to provide the basis for the application of IAEA safeguards under an agreement between the State and the IAEA (see No. 6.1). Under a comprehensive safeguards agreement, the State is required to establish and maintain a system of accounting for and control of nuclear material subject to safeguards under the agreement. The system "shall be based on a structure of material balance areas, and shall make provision...for the establishment of such measures as:

(a) A measurement system for the determination of the quantities of nuclear material received, produced, shipped, lost or otherwise removed from inventory, and the quantities on inventory;
(b) The evaluation of precision and accuracy of measurements and the estimation of measurement uncertainty;
(c) Procedures for identifying, reviewing and evaluating differences in shipper/receiver measurements;
(d) Procedures for taking a physical inventory;
(e) Procedures for the evaluation of accumulations of unmeasured inventory and unmeasured losses;
(f) A system of records and reports showing, for each material balance area, the inventory of nuclear material and the changes in that inventory including receipts into and transfers out of the material balance area;
(g) Provisions to ensure that the accounting procedures and arrangements are being operated correctly; and
(h) Procedures for the provisions of reports to the Agency" [153, para. 32].

INFCIRC/66-type safeguards agreements do not explicitly call for States to establish and maintain a system of accounting for and control of nuclear material, but the fact that [66] calls for agreement between the IAEA and the State on a "system of records" and a "system of reports" implies the need for an appropriate organizational arrangement at the State level.

3.34. Regional system of accounting for and control of nuclear material (RSAC) — organizational arrangements that are made by a number of States in a region to institute a regional authority that fulfils for each of the States the functions that otherwise need to be performed by an SSAC for a single State (see No. 3.33).

3.35. New partnership approach (NPA) — an approach for implementing safeguards in the non-nuclear-weapon States members of Euratom, agreed between the IAEA and Euratom in 1992. The approach provides for common use of safeguards equipment, joint scheduling of inspections and special arrangements for inspection work and data sharing by the two organizations. The NPA enables the IAEA to economize on safeguards equipment and inspection efforts deployed in the relevant States while maintaining its ability to perform independent verification.

3.36. Safeguards quality assurance — in the context of IAEA safeguards, a management tool for ensuring a systematic approach to all of the activities affecting the quality of the safeguards implementation. To this end, the IAEA applies quality control techniques to, for example, the implementation of containment and surveillance measures, inspection documentation and safeguards information processing. In addition, quality audits are used to independently determine that each activity has been satisfactorily performed or that necessary corrective actions are being taken, and to identify opportunities for continuous improvement.

4. NUCLEAR AND NON-NUCLEAR MATERIAL

Nuclear material is necessary for the production of nuclear weapons or other nuclear explosive devices. Under comprehensive safeguards agreements, the IAEA verifies that all nuclear material subject to safeguards has been declared and placed under safeguards. Certain non-nuclear materials are essential for the use or production of nuclear material and may also be subject to IAEA safeguards under certain agreements.

4.1. Nuclear material — any source material (see No. 4.4) or special fissionable material (see No. 4.5) as defined in Article XX of [ST]. See also [153, para. 112], [66, para. 77] and [540, Article 18.h].

4.2. Nuclide — a species of atom characterized by the number of protons (atomic number) and the number of protons and neutrons together (mass number).

4.3. Isotope — one of two or more atoms of the same element that have the same number of protons in their nucleus but different numbers of neutrons. Isotopes have the same atomic number but different mass numbers. Isotopes of an element are denoted by indicating their mass numbers as superscripts to the element symbol, e.g. ^{233}U or ^{239}Pu, or as numbers following the name or symbol of the element, e.g. uranium-233 or Pu-239. Some isotopes are unstable to the extent that their decay needs to be considered for nuclear material accountancy purposes (e.g. ^{241}Pu has a half-life of 14.35 years).

4.4. Source material — "uranium containing the mixture of isotopes occurring in nature; uranium depleted in the isotope 235; thorium; any of the foregoing in the form of metal, alloy, chemical compound, or concentrate; any other material containing one or more of the foregoing in such concentration as the Board of Governors shall from time to time determine; and such other material as the Board of Governors shall from time to time determine" [ST, Article XX.3]. According to para. 112 of [153], "the term source material shall not be interpreted as applying to ore or ore residue. Any determination by the Board under Article XX of the Statute of the Agency after the entry into force of this Agreement which adds to the materials considered to be source material or special fissionable material shall have effect under this Agreement only upon acceptance by the State"; see also [540, Article 18.h]. However, ore concentrate is considered to be source material. (See also No. 2.11.)

4.5. Special fissionable material — "plutonium-239; uranium-233; uranium enriched in the isotopes 235 or 233; any material containing one or more of the foregoing; and such other fissionable material as the Board of Governors shall from time to time determine; but the term 'special fissionable material' does not include source material" [ST, Article XX.1]. See also [153, para. 112] and [540, Article 18.h]. (See also No. 4.4.)

4.6. **Fissionable material** — in general, an isotope or a mixture of isotopes capable of nuclear fission. Some fissionable materials are capable of fission only by sufficiently fast neutrons (e.g. neutrons of a kinetic energy above 1 MeV). Isotopes that undergo fission by neutrons of all energies, including slow (thermal) neutrons, are usually referred to as fissile materials or fissile isotopes. For example, isotopes ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu are referred to as both fissionable and fissile, while ^{238}U and ^{240}Pu are fissionable but not fissile.

4.7. **Fertile material** — a nuclear material which can be converted into a special fissionable material through capture of one neutron per nucleus. There are two naturally occurring fertile materials: ^{238}U and ^{232}Th. Through the capture of neutrons followed by two beta decays, these fertile materials are converted to fissionable ^{239}Pu and ^{233}U, respectively.

4.8. **Uranium** — a naturally occurring radioactive element with atomic number 92 and symbol U. Natural uranium contains isotopes 234, 235 and 238; uranium isotopes 232, 233 and 236 are produced by transmutation.

4.9. **Natural uranium** — uranium as it occurs in nature, having an atomic weight of approximately 238 and containing minute quantities of ^{234}U, about 0.7% ^{235}U and 99.3% ^{238}U. Natural uranium is usually supplied in raw form by uranium mines and concentration (ore processing) plants as uranium ore concentrate, most commonly the concentrated crude oxide U_3O_8, often called yellow cake (see No. 5.16).

4.10. **Depleted uranium** — uranium in which the abundance of the isotope ^{235}U is less than that occurring in natural uranium, e.g. uranium in spent fuel from natural uranium fuelled reactors and tails from uranium enrichment processes.

4.11. **Enriched uranium** — uranium having a higher abundance of fissile isotopes than natural uranium. Enriched uranium is considered a special fissionable material (see No. 4.5).

4.12. **Low enriched uranium (LEU)** — enriched uranium containing less than 20% of the isotope ^{235}U. LEU is considered a special fissionable material (see No. 4.5) and an indirect use material (see No. 4.26).

4.13. High enriched uranium (HEU) — uranium containing 20% or more of the isotope ^{235}U. HEU is considered a special fissionable material (see No. 4.5) and a direct use material (see No. 4.25).

4.14. Uranium-233 — an isotope of uranium which is produced by transmutation of ^{232}Th through irradiating thorium fuel in a reactor. Uranium-233 is considered a special fissionable material (see No. 4.5) and a direct use material (see No. 4.25).

4.15. Plutonium — a radioactive element which occurs only in trace amounts in nature, with atomic number 94 and symbol Pu. As produced by irradiating uranium fuels, plutonium contains varying percentages of the isotopes 238, 239, 240, 241 and 242. Plutonium containing any ^{239}Pu is considered a special fissionable material (see No. 4.5) and, except for plutonium containing 80% or more of ^{238}Pu, a direct use material (see No. 4.25).

4.16. Mixed oxide (MOX) — a mixture of the oxides of uranium and plutonium used as reactor fuel for the recycling of plutonium in thermal nuclear reactors ('thermal recycling') and for fast reactors. MOX is considered a special fissionable material (see No. 4.5) and a direct use material (see No. 4.25).

4.17. Thorium — a radioactive element with atomic number 90 and symbol Th. Naturally occurring thorium consists only of the fertile isotope ^{232}Th, which through transmutation becomes the fissionable ^{233}U.

4.18. Americium — a radioactive element with atomic number 95 and symbol Am. Isotopes of americium, which are formed by neutron capture or by the decay of ^{241}Pu, are fissionable and may have the potential to be used in a nuclear explosive device. While not defined under the IAEA Statute [ST] as source material or special fissionable material (see Nos 4.4 and 4.5), information on separated americium is collected by the IAEA under voluntary arrangements with relevant States. Americium has sometimes been referred to as an 'alternative nuclear material.'

4.19. Neptunium — a radioactive element with atomic number 93 and symbol Np. The isotope ^{237}Np is both fissionable and fissile; it is formed during the irradiation of fuel in reactors and may be separated from high level waste and reprocessing streams. While not defined under the IAEA Statute [ST] as source material or special fissionable material (see Nos 4.4 and 4.5), separated neptunium is monitored by the IAEA under voluntary arrangements with relevant States. Neptunium has sometimes been referred to as an 'alternative nuclear material.'

4.20. Enrichment — "the ratio of the combined weight of the isotopes uranium-233 and uranium-235 to that of the total uranium in question" [153, para. 105], [66, para. 73], usually stated as a percentage. Although this definition deals with the combined weight of the two fissile uranium isotopes, in practice they are rarely mixed and are normally accounted for separately. The term 'enrichment' is also used in relation to an isotope separation process by which the abundance of a specified isotope in an element is increased, such as the production of enriched uranium or heavy water, or of plutonium with an increase in the fissile isotope.

4.21. Depletion — any process by which the abundance of a specified isotope (e.g. a fissile isotope) in an element is reduced, such as the stripping process in an enrichment plant, the burnup of nuclear fuel in a reactor or radioactive decay (e.g. the decay of ^{241}Pu contained in spent fuel).

4.22. Transmutation — the conversion of one nuclide into another through one or more nuclear reactions, and more specifically, the conversion of an isotope of one element into an isotope of another element through one or more nuclear reactions. For example, ^{238}U is converted into ^{239}Pu by neutron capture followed by the emission of two beta particles.

4.23. Material type — classification of nuclear material according to the element contained and, for uranium, the degree of enrichment. The types are: plutonium; high enriched uranium; ^{233}U; depleted, natural and low enriched uranium; and thorium.

4.24. Material category — categorization of nuclear material according to its irradiation status and suitability for conversion into components of nuclear explosive devices. The categories are: unirradiated direct use material, irradiated direct use material and indirect use material.

4.25. Direct use material — nuclear material that can be used for the manufacture of nuclear explosive devices without transmutation or further enrichment. It includes plutonium containing less than 80% ^{238}Pu, high enriched uranium and ^{233}U. Chemical compounds, mixtures of direct use materials (e.g. mixed oxide (MOX)), and plutonium in spent reactor fuel fall into this category. Unirradiated direct use material is direct use material which does not contain substantial amounts of fission products; it would require less time and effort to be converted to components of nuclear explosive devices than irradiated direct use material (e.g. plutonium in spent reactor fuel) that contains substantial amounts of fission products.

4.26. **Indirect use material** — all nuclear material except direct use material. It includes: depleted, natural and low enriched uranium, and thorium, all of which must be further processed in order to produce direct use material.

4.27. **Material form** — classification of nuclear material according to its physical form; material can be either in item form or in bulk form. Material is in item form as long as it consists of individually identifiable units (e.g. fuel assembly, bundle, pin, plate or coupon) that are kept intact during their stay in a material balance area. Bulk material is material in loose form, such as liquid, gas or powder, or in a large number of small units (e.g. pellets or pebbles) that are not each individually identified for nuclear material accountancy purposes.

4.28. **Improved nuclear material** — as defined in para. 74 of [66], nuclear material that has been altered in such a way that "either:

(a) The concentration of fissionable isotopes in it has been increased; or
(b) The amount of chemically separable fissionable isotopes in it has been increased; or
(c) Its chemical or physical form has been changed so as to facilitate further use or processing".

4.29. **Strategic value** — a relative measure of the suitability of a nuclear material for conversion into components of nuclear explosive devices. (See also Nos 4.25 and 4.26.)

4.30. **Effective kilogram (ekg)** — a special unit used in the safeguarding of nuclear material. As defined in para. 104 of [153] and para. 72 of [66], the quantity of nuclear material in effective kilograms is obtained by taking:

(a) For plutonium, its weight in kilograms;
(b) For uranium with an enrichment of 0.01 (1%) and above, its weight in kilograms multiplied by the square of its enrichment;
(c) For uranium with an enrichment below 0.01 (1%) and above 0.005 (0.5%), its weight in kilograms multiplied by 0.0001;
(d) For depleted uranium with an enrichment of 0.005 (0.5%) or below, and for thorium, its weight in kilograms multiplied by 0.00005.

4.31. **Feed material** — nuclear material introduced at the start of a process operation, e.g. UF_6 as the feed to an enrichment process or to a UO_2 conversion process, or UO_2 as the feed to a fuel fabrication operation.