RULEMAKING ISSUE

(Notation Vote)

August 9, 1990 SECY-90-277

For: The Commissioners

From: James M. Taylor, Executive Director for Operations

Subject: PROPOSED RULEMAKING FOR 10 CFR PART 74 TO REQUIRE MATERIAL CONTROL AND ACCOUNTING AT URANIUM ENRICHMENT FACILITIES

Purpose: To obtain Commission approval of the proposed amendments.

Background: From 1975 to 1984, NRC's material control and accounting (MC&A) requirements for all major fuel cycle facilities were contained primarily in 10 CFR 70.51, 70.57, and 70.58. For the most part, those requirements did not vary with respect to the type of facility or with respect to the special nuclear material (SNM) category (e.g., low enriched uranium, high enriched uranium, or plutonium). In 1985, a new Part 74 was created that amended the Part 70 MC&A requirements to recognize the different categories of SNM and to convert MC&A requirements from a prescriptive format to a performance-based format, in accordance with Commission policy.

The existing Part 74 rule, specifically 10 CFR 74.31, pertains to licensees and applicants authorized to possess and use large quantities of low enriched uranium. Enrichment facilities were specifically exempted from coverage by 10 CFR 74.31 because (1) NRC had not received an application for a uranium enrichment facility, and at that time, saw no prospects for receiving such an application, and (2) it was felt that the safeguards issues pertaining to enrichment facilities were somewhat different and more complex than for other low enriched uranium facilities.

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NOTE: TO BE MADE PUBLICLY AVAILABLE WHEN THE FINAL SRM IS MADE AVAILABLE.

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There now exists a near-term potential for applications for new enrichment facilities. There is also a possibility, over a longer term, that legislation will be enacted that would put all or part of the Department of Energy's enrichment facilities under the jurisdiction of NRC regulations. It would thus be appropriate for the NRC to clarify and formalize its regulatory position with respect to MC&A requirements applicable to enrichment facilities producing low enriched uranium.

Discussion: This paper proposes amendments to Part 74 to require licensees who build or operate enrichment facilities producing low enriched uranium to establish a written performance-based MC&A program. The MC&A program would include measures to maintain knowledge of source material (SM) and SNM and would impose additional requirements to protect against and detect specific unauthorized activities.

Two alternatives to rulemaking were considered: (1) regulation by license conditions and (2) regulation by the existing general MC&A requirements in Part 70. Although conceptually straightforward, the first alternative does not have the rigorous NRC internal review process or the benefit of public comment. The second alternative requires the least amount of work but is unacceptable because the requirements of Part 70 were not intended and are not appropriate to address potential clandestine unauthorized enrichment of uranium. A more detailed program is needed to provide MC&A requirements consistent with the potential danger to the common defense and security posed by operating such facilities.

The proposed rule is based on existing MC&A regulations in 10 CFR 74.31 that apply to light-water reactor uranium fuel fabrication facilities. These requirements provide adequate protection for low enriched uranium at existing licensed facilities, and for the most part are applicable to enrichment facilities as well. They have been retained in the proposed rule. However, an enrichment facility can be used clandestinely for production of high enriched uranium or unauthorized production of low enriched uranium. Additional safeguards are needed to protect against such unauthorized activities. These include frequent inventories of SM and SNM in process, the same control of SM as SNM, and other requirements specifically directed at protecting against and detecting unauthorized enrichment activities. The proposed 10 CFR 74.33 does not depend on 10 CFR 74.31 but is intended to be a stand-alone provision.

Coordination: The Offices of Administration, Enforcement, and Nuclear Material Safety and Safeguards concur in this proposed rulemaking. The Office of General Counsel has reviewed this proposed rulemaking and has no legal objections.

Recommendation: That the Commission:

1. Approve for publication the Notice of Proposed Rulemaking (Enclosure 1) for a 75-day public comment period.

2. Note that:

   a. A draft regulatory guide (Enclosure 2) will be published for concurrent public comment.
   b. A draft regulatory analysis (Enclosure 3) will be available in the Public Document Room.
   c. A draft environmental assessment (Enclosure 4) will be available in the Public Document Room.
   d. A public announcement (Enclosure 5) will be issued.
   e. Congressional committees will be informed of this proposed rulemaking (Enclosure 6).
   f. The staff will forward the proposed rulemaking, upon Commission approval, to OMB for approval of the information collection requirements.

James M. Taylor
Executive Director
for Operations

Enclosures:
1. Federal Register Notice of Proposed Rulemaking
2. Draft Regulatory Guide
3. Draft Regulatory Analysis
4. Draft Environmental Assessment
5. Draft Public Announcement
6. Congressional letters

Commissioners' comments or consent should be provided directly to SECY by c.o.b. Thursday, August 23, 1990.

Commission staff office comments, if any, should be submitted to the Commissioners NLT August 16, 1990, with an information copy to the Office of the Secretary. If the paper is of such a nature that it requires additional review and comment, the Commissioners and the Secretariat should be apprised of when comments may be expected.

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Enclosure 1

Federal Register Notice

[7590-01]

NUCLEAR REGULATORY COMMISSION

10 CFR Parts 2, 40, 50, 70, and 74

RIN 3150 - AD56

Material Control and Accounting Requirements for Uranium Enrichment Facilities Producing Special Nuclear Material of Low Strategic Significance

AGENCY: Nuclear Regulatory Commission.

ACTION: Proposed rule.

SUMMARY: The Nuclear Regulatory Commission (NRC) is proposing new performance-based material control and accounting requirements that would be applicable to uranium enrichment facility licensees who produce significant quantities of special nuclear material (SNM) of low strategic significance. The proposed requirements are similar to existing requirements which apply to licensees authorized to possess and use more than one effective kilogram of SNM of low strategic significance. The proposed rule would impose additional requirements to ensure that enrichment facilities would produce only enriched uranium of low strategic significance as authorized. The proposed requirements would also apply to all applicants who build or operate enrichment facilities.

DATE: Comment period expires (75 days from the date of publication in the Federal Register). Comments received after this date will be considered if it is practical to do so, but the NRC is able to assure consideration only for comments received on or before this date.

ADDRESSES: Mail written comments to the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Docketing and Service Branch. Deliver comments to One White Flint North, 11555 Rockville Pike, Rockville, MD, between 7:45 a.m. and 4:15 p.m. Federal workdays.

Copies of the draft regulatory analysis, the environmental assessment and finding of no significant impact, the paperwork statement submitted to OMB, the draft regulatory guide, and comments received may be examined at the NRC Public Document Room, 2120 L Street NW. (Lower Level), Washington, DC.

FOR FURTHER INFORMATION CONTACT: Mr. Gordon E. Gundersen, Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 492-3803 or Mr. Donald R. Joy, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 492-0352.

SUPPLEMENTARY INFORMATION:

Background

From 1975 to 1984, NRC's material control and accounting (MC&A) requirements for all major fuel cycle facilities (including any potential private enrichment facilities and reprocessing plants) were contained in 10 CFR Part 70 (primarily §§ 70.51, 70.57 and 70.58). Those requirements, for the most part, did not vary with respect to the type of facility or with respect to the special nuclear material (SNM) category (i.e., low enriched uranium, high enriched uranium, or plutonium). In 1985, a new 10 CFR Part 74 was created to amend the 10 CFR Part 70 MC&A

requirements that (1) recognized the different levels of safeguards significance among the different types of SNM, and (2) converted MC&A requirements from a prescriptive-based to a performance-based format (in accordance with NRC policy).

The existing provisions of Part 74, specifically 10 CFR 74.31, pertained to licensees (and applicants) authorized to possess and use more than one effective kilogram of SNM of low strategic significance as defined in 10 CFR 74.4. Enrichment facilities were specifically exempted from coverage by 10 CFR 74.31 because (1) NRC had not received an application for a uranium enrichment facility, and at that time, saw no prospects for receiving such an application, and (2) the NRC believed that the safeguards issues pertaining to enrichment facilities producing SNM of low strategic significance (i.e., enriched uranium with a U^{-235} concentration below 10 percent) were somewhat different and more complex than for other 10 CFR 74.31 type facilities.

There is a possibility that applications for a license for the construction and operation of new enrichment facilities may be submitted to the NRC in the near future. There is also a possibility, over a longer term, that legislation will be enacted that would put all or part of the Department of Energy's (DOE) enrichment facilities under the jurisdiction of NRC regulations. It would thus be appropriate for the NRC to clarify and formalize its regulatory position with respect to MC&A requirements applicable to enrichment facilities producing low enriched uranium.

Section 74.31 is a set of MC&A objectives and capabilities required of licensees to assure the NRC and the general public that proper stewardship of SNM is maintained. These requirements provide adequate

protection for SNM of low strategic significance at existing licensed facilities. However, an enrichment facility can be used clandestinely for production of high enriched uranium or unauthorized production of uranium of authorized enrichment using source material that was not entered into the accounting system. Thus, additional safeguards are needed for enrichment facilities to protect against such unauthorized activities. For centrifuge enrichment facilities it is expected that during startup of each cascade the enrichment level in the cascade may temporarily exceed the regulatory limit. This is considered to be part of the startup process and not an unauthorized activity. Since the proposed 10 CFR 74.33 was developed by starting with the existing 10 CFR 74.31 requirements, most of the general performance objectives of 10 CFR 74.31 were incorporated. Notably, 10 CFR 74.31(a)(3), "Aid in the investigation and recovery of missing material," was not retained. Although this objective might be helpful following an actual theft of SNM, it is not logically part of an MC&A system. The proposed 10 CFR 74.33 sets forth requirements for traditional MC&A measures and additional measures to protect against unauthorized activities at facilities producing SNM of low strategic significance. The proposed 10 CFR 74.33 does not depend on 10 CFR 74.31 but is intended to be a stand-alone provision.

Draft Regulatory Guide

The proposed rule is written in general, performance-based language to give the applicant flexibility in designing a cost-effective system to make best use of site-specific features. The purpose of the draft regulatory

guide is to provide an acceptable method of meeting the required performance-based system capabilities in 10 CFR 74.33. It should be noted that the applicant is free to use any method that complies with the requirements of 10 CFR 74.33.

The Commission also requests public comment on the draft regulatory guide. Comments on the draft guide may be submitted to the NRC as indicated under the ADDRESSES heading.

Finding of No Significant Environmental Impact: Availability

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that these amendments are not a major Federal action significantly affecting the quality of the human environment, and therefore an environmental impact statement is not required. The rule is mainly administrative in nature and would not change any requirements that could have significant environmental impact. The proposed rule would provide assurance that only enriched uranium of low strategic significance as authorized by the license is produced at a licensed enrichment facility through material control and accounting measures and other appropriate requirements. There may be some increase in occupational exposure stemming from safeguards-related activities such as data recording, inspecting, or sample taking, but likely not enough to be measurable or identifiable.

Paperwork Reduction Act Statement

This proposed rule amends information collection requirements that are subject to the Paperwork Reduction Act (44 U.S.C. 3501 et seq.). The recordkeeping and reporting requirements in this rulemaking have been submitted to the Office of Management and Budget for review and approval of the paperwork requirements.

Public reporting burden for this collection of information is estimated to average ___ hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Information and Records Management Branch MNBB-7714, U.S. Nuclear Regulatory Commission, Washington, DC 20555; and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-3019, (3150-0123), Office of Management and Budget, Washington, DC 20503.

Draft Regulatory Analysis

The NRC has prepared a draft regulatory analysis on this proposed regulation. The analysis examines the costs and benefits of the alternatives considered by the NRC.

The Commission requests public comments on the draft regulatory analysis. Comments on the draft analysis may be submitted to the NRC as indicated under the ADDRESSES heading.

Regulatory Flexibility Certification

In accordance with the Regulatory Flexibility Act, 5 U.S.C. 605(b), the Commission certifies that, if promulgated, this rulemaking will not have a significant economic impact on a substantial number of small entities. The proposed rule, when promulgated, would affect only persons who build or operate enrichment facilities producing enriched uranium of low strategic significance. The owners of enrichment facilities do not fall within the scope of the definition of "small entities" set forth in Section 601(3) of the Regulatory Flexibility Act, 15 U.S.C. 632, or the Small Business Size Standards set out in regulations issued by the Small Business Administration at 13 CFR Part 121.

Backfit Analysis

The NRC has determined that the backfit rule, 10 CFR 50.109, does not apply to this proposed rule and, thus, a backfit analysis is not required for these amendments because it does not involve any provisions that would impose backfits as defined in 10 CFR 50.109(a)(1).

List of Subjects

Part 2: Administrative practice and procedures, Antitrust, Byproduct material, Classified information, Environmental protection,

Nuclear materials, Nuclear power plants and reactors, Penalty, Sex discrimination, Source material, Special nuclear material, Waste treatment and disposal.

Part 40: Government contracts, Hazardous materials--transportation, Nuclear materials, Criminal penalties, Reporting and recordkeeping requirements, Source material, Uranium.

Part 50: Antitrust, Classified information, Fire protection, Incorporation by reference, Intergovernmental relations, Nuclear power plants and reactors, Criminal penalties, Radiation protection, Reactor siting criteria, Reporting and recordkeeping requirements.

Part 70: Hazardous materials--transportation, Material control and accounting, Nuclear materials, Packaging and containers, Criminal penalties, Radiation protection, Reporting and recordkeeping requirements, Scientific equipment, Security measures, Special nuclear material.

Part 74: Accounting, Hazardous materials--transportation, Material control and accounting, Nuclear materials, Packaging and containers, Criminal penalties, Radiation protection, Reporting and recordkeeping requirements, Scientific equipment, Special nuclear material.

For the reasons set forth in the preamble and under the authority of the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and 5 U.S.C. 553, the NRC is proposing to adopt the following amendments to 10 CFR Part 74, and conforming amendments to 10 CFR Parts 2, 40, 50, and 70.

PART 2 - RULES OF PRACTICE FOR DOMESTIC LICENSING PROCEEDINGS

1. The authority citation for Part 2 continues to read as follows:

AUTHORITY: Secs. 161, 181, 68 Stat. 948, 953, as amended (42 U.S.C. 2201, 2231); sec. 191, as amended, Pub. L. 87-615, 76 Stat. 409 (42 U.S.C. 2241); sec. 201, 88 Stat. 1242, as amended (42 U.S.C. 5841); 5 U.S.C. 552.

Section 2.101 also issued under secs. 53, 62, 63, 81, 103, 104, 105, 68 Stat. 930, 932, 933, 935, 936, 937, 938, as amended (42 U.S.C. 2073, 2092, 2093, 2111, 2133, 2134, 2135); Sec. 114(f), Pub. L. 97-425, 96 Stat. 2213, as amended (42 U.S.C. 10134(f)); sec. 102, Pub. L. 91-190, 83 Stat. 853, as amended (42 U.S.C. 4332); sec. 301, 88 Stat. 1248 (42 U.S.C. 5871). Sections 2.102, 2.103, 2.104, 2.105, 2.721 also issued under secs. 102, 103, 104, 105, 183, 189, 68 Stat. 936, 937, 938, 954, 955, as amended (42 U.S.C. 2132, 2133, 2134, 2135, 2233, 2239). Section 2.105 also issued under Pub. L. 97-415, 96 Stat. 2073 (42 U.S.C. 2239). Sections 2.200-2.206 also issued under secs. 186, 234, 68 Stat. 955, 83 Stat. 444, as amended (42 U.S.C. 2236, 2282); sec. 206, 88 Stat. 1246 (42 U.S.C. 5846). Sections 2.600-2.606 also issued under sec. 102, Pub. L. 91-190, 83 Stat. 853 as amended (42 U.S.C. 4332). Sections 2.700a, 2.719 also issued under 5 U.S.C. 554. Sections 2.754, 2.760, 2.770, 2.780 also issued under 5 U.S.C. 557. Section 2.764 and Table 1A of Appendix C also issued under secs. 135, 141, Pub. L. 97-425, 96 Stat. 2232, 2241 (42 U.S.C. 10155, 10161). Section 2.790 also issued under sec. 103, 68 Stat. 936, as amended (42 U.S.C. 2133) and 5 U.S.C. 552. Sections 2.800 and 2.808 also issued under 5 U.S.C. 553. Section 2.809 also issued under 5

U.S.C. 553 and sec. 29, Pub. L. 85-256, 71 Stat. 579, as amended (42 U.S.C. 2039). Subpart K also issued under sec. 189, 68 Stat. 955 (42 U.S.C. 2239); sec. 134, Pub. L. 97-425, 96 Stat. 2230 (42 U.S.C. 10154). Subpart L also issued under sec. 189, 68 Stat. 955 (42 U.S.C. 2239). Appendix A also issued under sec. 6, Pub. L. 91-560, 84 Stat. 1473 (42 U.S.C. 2135). Appendix B also issued under sec. 10, Pub. L. 99-240, 99 Stat. 1842 (42 U.S.C. 2021b et seq.).

2. In Appendix C, Supplement III is amended by adding new paragraphs A.3 and B.4 to read as follows:

Supplement III - Severity Categories

Safeguards

A. * * *

3. Actual unauthorized production of a formula quantity of special nuclear material.

B. * * *

4. Actual unauthorized production of special nuclear material.

* * * * *

PART 40 - DOMESTIC LICENSING OF SOURCE MATERIAL

3. The authority citation for Part 40 continues to read as follows:

AUTHORITY: Secs. 62, 63, 64, 65, 81, 161, 182, 183, 186, 68 Stat. 932, 933, 935, 948, 953, 954, 955, as amended, secs. 11e(2), 83, 84, Pub. L. 95-604, 92 Stat. 3033, as amended, 3039, sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2014(e)(2), 2092, 2093, 2094, 2095, 2111, 2113, 2114, 2201, 2232, 2233, 2236, 2282); sec. 274, Pub. L. 86-373, 73 Stat. 688 (42 U.S.C. 2021); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846); sec. 275, 92 Stat. 3021, as amended by Pub. L. 97-415, 96 Stat. 2067 (42 U.S.C. 2022).

Section 40.7 also issued under Pub. L. 95-601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Section 40.31 (g) also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Section 40.46 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Section 40.71 also issued under sec. 187, 68 Stat. 955 (42 U.S.C. 2237).

For the purposes of sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273); §§ 40.3, 40.25(d)(1)-(3), 40.35(a)-(d) and (f), 40.41(b) and (c), 40.46, 40.51(a) and (c), and 40.63 are issued under sec. 161b, 161i, and 161o, 68 Stat. 948, 949, and 950, as amended, (42 U.S.C. 2201(b), 2201(i), and 2201(o)), and §§ 40.5, 40.9, 40.24(c), (d)(3), and (4), 40.26(c)(2), 40.35(e), 40.42, 40.61, 40.62, 40.64, and 40.65 are issued under sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

4. In § 40.1, paragraph (a) is revised to read as follows:

§ 40.1 Purpose.

(a) The regulations in this part establish procedures and criteria for the issuance of licenses to receive title to, receive, possess, use,

transfer, or deliver source and byproduct materials, as defined in this part, and establish and provide for the terms and conditions upon which the Commission will issue such licenses. (Additional requirements applicable to natural and depleted uranium at enrichment facilities are set forth in Part 74 of this Chapter.) The regulations in this part also establish certain requirements for the physical protection of import, export, and transient shipments of natural uranium. (Additional requirements applicable to the import and export of natural uranium are set forth in Part 110 of this Chapter.) The regulations in this part do not establish procedures and criteria for the issuance of licenses for materials covered under Title I of the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat. 3021).

* * * * *

PART 50 - DOMESTIC LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

5. The authority citation for Part 50 continues to read as follows:

AUTHORITY: Secs. 102, 103, 104, 105, 161, 182, 183, 186, 189, 68 Stat. 936, 937, 938, 948, 953, 954, 955, 956, as amended, sec. 234, 83 Stat. 1244, as amended (42 U.S.C. 2132, 2133, 2134, 2135, 2201, 2232, 2233, 2236, 2239, 2282); secs. 201 as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246 (42 U.S.C. 5841, 5842, 5846).

Section 50.7 also issued under Pub. L. 95-601, sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Section 50.10 also issued under secs. 101, 185,

68 Stat. 936, 955, as amended (42 U.S.C. 2131, 2235); sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332). Sections 50.13, 50.54(dd), and 50.103 also issued under sec. 108, 68 Stat. 939, as amended (42 U.S.C. 2138). Sections 50.23, 50.35, 50.55 and 50.56 also issued under sec. 185, 68 Stat. 955 (42 U.S.C. 2235). Sections 50.33a, 50.55a and Appendix Q also issued under sec. 102, Pub. L. 91-190, 83 Stat. 853 (42 U.S.C. 4332). Sections 50.34 and 50.54 also issued under sec. 204, 88 Stat. 1245 (42 U.S.C. 5844). Sections 50.58, 50.91, and 50.92 also issued under Pub. L. 97-415, 96 Stat. 2073 (42 U.S.C. 2239). Section 50.78 also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Sections 50.80 through 50.81 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234). Appendix F also issued under sec. 187, 68 Stat. 955 (42 U.S.C. 2237).

For the purposes of sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273); §§ 50.7(f), 50.46(a) and (b), and 50.54(c) are issued under sec. 161b, 161i and 161o. 68 Stat. 948, 949, and 950 as amended (42 U.S.C. 2201(b), 2201(i), and 2201(o)); §§ 50.7(a), 50.10(a)-(c), 50.34(a) and (e), 50.44(a)-(c), 50.46(a) and (b), 50.47(b), 50.48(a), (c), (d), and (e), 50.49(a), 50.54(a), (i), (i)(1), (1)-(n), (p), (q), (t), (v), and (y), 50.55(f), 50.55a(a), (c)-(e), (g), and (h), 50.59(c), 50.60(a), 50.62(c), 50.64(b), and 50.80(a) and (b) (b) are issued under sec. 161i, 68 Stat. 949, as amended (42 U.S.C. 2201(i)); and §§ 50.49(d), (h), and (j), 50.54(w), (z), (bb), (cc), and (dd), 50.55(e), 50.59(b), 50.61(b), 50.62(b), 50.70(a), 50.71(a)-(c) and (e), 50.72(a), 50.73(a) and (b), 50.74, 50.78, and 50.90 are issued under sec. 161o, 68 Stat 950, as amended (42 U.S.C. 2201(o)).

6. In § 50.34, a new paragraph (h) is added to read as follows:

§ 50.34 Contents of applications; technical information.

* * * * *

(h) Fundamental nuclear material control plan. Each applicant for a license to operate a production facility that would be subject to § 74.33(a) shall submit a fundamental nuclear material control plan pursuant to § 74.33(b) as applicable.

PART 70 - DOMESTIC LICENSING OF SPECIAL NUCLEAR MATERIAL

7. The authority citation for Part 70 continues to read as follows:

AUTHORITY: Secs. 51, 53, 161, 182, 183, 68 Stat. 929, 930, 948, 953, 954, as amended, Sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2071, 2073, 2201, 2232, 2233, 2282); Secs. 201, as amended, 202, 204, 206, 88 Stat. 1242, as amended, 1244, 1245, 1246 (42 U.S.C. 5841, 5842, 5845, 5846).

Sections 70.1(c) and 70.20a(b) also issued under Secs. 135, 141, Pub. L. 97-425, 96 Stat. 2232, 2241 (42 U.S.C. 10155, 10161). Section 70.7 also issued under Pub. L. 95-601, Sec. 10, 92 Stat. 2951 (42 U.S.C. 5851). Section 70.21(g) also issued under sec. 122, 68 Stat. 939 (42 U.S.C. 2152). Section 70.31 also issued under Sec. 57d, Pub. L. 93-377, 88 Stat. 475 (42 U.S.C. 2077). Sections 70.36 and 70.44 also issued under sec. 184, 68 Stat. 954, as amended (42 U.S.C. 2234).

Section 70.61 also issued under secs. 186, 187, 68 Stat. 955 (42 U.S.C. 2236, 2237). Section 70.62 also issued under sec. 108, 68 Stat. 939, as amended (42 U.S.C. 2138).

For the purposes of sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273); §§ 70.3, 70.7(g) 70.19(c), 70.21(c), 70.22 (a), (b) (d)-(k), 70.24 (a), and (b), 70.32(a)(3), (5) and (6), (d) and (i), 70.36, 70.39(b) and (c), 70.41(a), 70.42(a) and (c), 70.56, 70.57 (b), (c), and (d), 70.58 (a)-(g)(3), and (h)-(j) are issued under sec. 161b, 161i, and 161o, 68 Stat. 948, and 950, as amended (42 U.S.C. 2201 (b), 2201(i), and 2201(o)); §§ 70.7, 70.20a (a) and (d), 70.20b (c) and (e), 70.21(c), 70.24(b), 70.32(a)(6), (c), (d), (e), and (g), 70.36, 70.51(c)-(g), 70.56, 70.57 (b) and (d), 70.58 (a)-(g)(3) and (h)-(j) are issued under sec. 161i, 68 Stat. 949, as amended (42 U.S.C. 2201(i)); and §§ 70.5, 70.9, 70.20b (d) and (e), 70.38, 70.51 (b) and (i), 70.52, 70.53, 70.54, 70.55, 70.58 (g)(4), (k) and (l), 70.59, and 70.60 (b) and (c) are issued under sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o));

8. In § 70.22, paragraph (b) is revised to read as follows:

§ 70.22 Contents of applications.

* * * * *

(b) Each application for a license to possess special nuclear material and equipment capable of enriching uranium, or to possess and use at any one time and location special nuclear material in a quantity exceeding one effective kilogram except for applications for use as sealed sources and for those uses involved in the operation of a nuclear reactor licensed pursuant to Part 50 of this chapter and those involved

in a waste disposal operation, must contain a full description of the applicant's program for control and accounting for such special nuclear material or enrichment equipment that will be in the applicant's possession under license to show how compliance with the requirements of §§ 70.58, 74.31, 74.33, or 74.51 of this chapter, as applicable, will be accomplished.

* * * * *

9. In § 70.32, paragraph (c)(1) is revised to read as follows:

§ 70.32 Conditions of license.

* * * * *

(c)(1) Each license authorizing the possession and use at any one time and location of uranium source material or special nuclear material in a quantity exceeding one effective kilogram, except for use as sealed sources and those uses involved in the operation of a nuclear reactor licensed pursuant to Part 50 of this chapter and those involved in a waste disposal operation, shall contain and be subject to a condition requiring the licensee to maintain and follow:

(i) The program for control and accounting for uranium source material or special nuclear material and fundamental nuclear material controls implemented pursuant to §§ 70.22(b), 70.58(1), 74.31(b), 74.33(b), or 74.51(c)(1) of this chapter, as appropriate;

(ii) The measurement control program for uranium source material or special nuclear material control and accounting implemented pursuant to §§ 70.57(c), 74.31(b), 74.33(b), or 74.59(e) of this chapter, as appropriate; and

(iii) Such other material control procedures as the Commission determines to be essential for the safeguarding of uranium source material or of special nuclear material and providing that the licensee shall make no change that would decrease the effectiveness to the material control and accounting program implemented pursuant to §§ 70.22(b), 70.58(1), 70.51(g), 74.31(b), 74.33(b), or 74.51(c)(1) of this chapter and the measurement control program implemented pursuant to §§ 70.57(c), 74.31(b), 74.33(b), or 74.59(e) of this chapter without the prior approval of the Commission. A licensee desiring to make such changes shall submit an application for amendment to its license pursuant to § 70.34.

* * * * *

10. In § 70.51, paragraph (b) is revised to read as follows:

§ 70.51 Material balance, inventory, and records requirements.

* * * * *

(b) Licensees subject to the recordkeeping requirements of §§ 74.31, 74.33 and 74.59 of this chapter are exempt from the requirements of § 70.51(b)(1) through (5).

PART 74: MATERIAL CONTROL AND ACCOUNTING OF SPECIAL NUCLEAR MATERIAL

11. The authority citation for Part 74 is revised to read as follows:

AUTHORITY: Secs. 53, 57, 161, 182, 183, 68, Stat. 930, 932, 948, 953, 954, as amended, Sec. 234, 83 Stat. 444, as amended (42 U.S.C. 2073,

2077, 2201, 2232, 2233, 2282); secs. 201, as amended, 202, 206, 88 Stat. 1242, as amended, 1244, 1246, (42 U.S.C. 5841, 5842, 5846).

For the purposes of sec. 223, 68 Stat. 958, as amended (42 U.S.C. 2273); §§ 74.17, 74.31, 74.51, 74.53, 74.55, 74.57, 74.59, 74.81, and 74.82 are issued under secs. 161b and 161i, 68 Stat. 948, 949, as amended (42 U.S.C. 2201(b); and 2201(i)); and §§ 74.11, 74.13, 74.15, and 74.17, are issued under Sec. 161o, 68 Stat. 950, as amended (42 U.S.C. 2201(o)).

12. § 74.1 is revised to read as follows:

§ 74.1 Purpose.

(a) This part has been established to contain the requirements for the control and accounting of special nuclear material at fixed sites and for documenting the transfer of special nuclear materials. General reporting requirements as well as specific requirements for certain licensees possessing special nuclear material of low strategic significance and formula quantities of strategic special nuclear material are included. Requirements for the control and accounting of source material at enrichment facilities are also included. The specific control and accounting requirements for other licensees are contained in §§ 70.51, 70.57, and 70.58 of this chapter.

(b) The general conditions and procedures for the submittal of a license application for the activities covered in this part are detailed in § 50.34 or § 70.22 of this chapter.

* * * * *

13. In § 74.2, paragraphs (b) and (c) are revised to read as follows:

§ 74.2 Scope.

* * * * *

(b) In addition, specific control and accounting requirements are included for certain licensees who:

(1) possess and use formula quantities of strategic special nuclear material,

(2) possess and use special nuclear material of low strategic significance, or

(3) possess uranium source material and equipment capable of producing enriched uranium.

(c) Specific control and accounting requirements for special nuclear material of moderate strategic significance and for miscellaneous categories of licensees who possess special nuclear material are contained in §§ 70.51, 70.57, and 70.58 of this chapter.

* * * * *

14. In § 74.4, the term "batch" is added to read as follows:

§ 74.4 Definitions.

* * * * *

Batch means a portion of source material or special nuclear material handled as a unit for accounting purposes at a key measurement point and for which the composition and quantity are defined by a single set of

measurements. The source material or special nuclear material may be in bulk form or contained in a number of separate items.

* * * * *

15. In § 74.8, paragraph (b) is revised to read as follows:

§ 74.8 Information collection requirements; OMB approval.

* * * * *

(b) The approved information collection requirements contained in this part appear in §§ 74.11, 74.13, 74.31, 74.33, and 74.51.

* * * * *

16. Section 74.11, paragraph (a) is revised to read as follows:

§ 74.11 Reports of loss or theft or attempted theft or unauthorized production of special nuclear material.

(a) Each licensee who possesses one gram or more of contained uranium-235, uranium-233, or plutonium shall notify the NRC Operations Center within 1 hour of discovery of any loss or theft or other unlawful diversion of special nuclear material which the licensee is licensed to possess, or any incident in which an attempt has been made to commit a theft or unlawful diversion of special nuclear material. Each licensee who operates a uranium enrichment facility shall notify the NRC Operations Center within 1 hour of discovery of any production of uranium enriched to 10 percent or more in the isotope U-235 or any unauthorized

production of uranium of low strategic significance. For centrifuge enrichment facilities the requirement to report enrichment levels greater than that authorized by license within 1 hour does not apply to each cascade during its startup process, not to exceed the first 24 hours. The requirement does not pertain to measured discards or inventory difference quantities.

* * * * *

17. Section 74.17, is revised to read as follows:

§ 74.17 Special nuclear material physical inventory summary report.

(a) Each licensee subject to the requirements of § 74.31 or § 74.33 shall submit a completed Special Nuclear Material Physical Inventory Summary Report on NRC Form 327 not later than 60 calendar days from the start of the physical inventory required by § 74.31(c)(5) or § 74.33(c)(4) of this chapter. The licensee shall report the inventory results by plant and total facility to the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

(b) Each licensee subject to the requirements of § 70.51(e) of this chapter shall submit a completed Special Nuclear Material Physical Inventory Summary Report on NRC Form 327 not later than 30 calendar days from the start of the physical inventory required by § 70.51(e)(3) of this chapter. The licensee shall report the inventory results by plant and total facility to the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

(c) Each licensee subject to the requirements of § 74.51 shall submit a completed Special Nuclear Material Physical Inventory Summary Report on NRC Form 327 not later than 45 calendar days from the start of the physical inventory required by § 74.59(f). The licensee shall report the inventory results by plant and total facility to the Director, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

18. A new § 74.33 is added to read as follows:

§ 74.33 Nuclear material control and accounting for uranium enrichment facilities authorized to produce special nuclear material of low strategic significance.

(a) General performance objectives. Each licensee who is authorized by this chapter to possess equipment capable of enriching uranium or operate an enrichment facility, and produce, possess, or use more than one effective kilogram of special nuclear material of low strategic significance at any site or contiguous sites, subject to control by the licensee, shall establish, implement, and maintain a Commission-approved material control and accounting system that will achieve the following objectives:

(1) Maintain accurate, current, and reliable knowledge of source material and special nuclear material;

(2) Protect against and detect any production of uranium enriched to 10 percent or more in the isotope U-235;

(3) Protect against and detect unauthorized production of uranium of low strategic significance;

(4) Resolve indications of missing uranium;

(5) Resolve indications of any production of uranium enriched to 10 percent or more in the isotope U-235; and

(6) Resolve indications of unauthorized production of uranium of low strategic significance.

(b) Implementation dates. Each applicant for a license who would, upon issuance of a license pursuant to any part of this chapter, be subject to the requirements of paragraph (a) of this section shall:

(1) No later than 2 years prior to facility start up, submit a fundamental nuclear material control plan describing how the performance objectives and the system features and capabilities of § 74.33(c) will be met; and

(2) Implement the approved plan submitted pursuant to paragraph (b)(1) of this section prior to (a) receipt of more than 5,000 grams of U-235 or (b) the NRC's issuance of a license.

(c) System features and capabilities. To meet the general performance objectives of paragraph (a) of this section, the material control and accounting (MC&A) system must include the features and capabilities described in paragraphs (c)(1) through (8) of this section. The licensee shall establish, document, and maintain:

(1) A management structure that assures:

(i) clear overall responsibility for MC&A functions;

(ii) independence of MC&A management from production responsibilities;

(iii) separation of key MC&A responsibilities from each other; and

(iv) use of approved written MC&A procedures and periodic review of those procedures;

(2) A measurement program that assures that all quantities of source material and special nuclear material in the accounting records are based on accurately measured values;

(3) A measurement control program that assures that:

(i) measurement bias is estimated, minimized through the measurement control program, and any significant biases are eliminated from inventory difference values of record;

(ii) all MC&A measurement systems are controlled so that twice the standard error of the inventory difference is less than the greater of 5,000 grams of U-235 or 0.25 percent of the active inventory for each total plant material balance; and

(iii) any measurements performed under contract are controlled so that the licensee can satisfy this requirement;

(4) An inventory program that assures that accurate, current, and reliable knowledge of SM and SNM is maintained, and that includes:

(i) performing, unless otherwise required to satisfy Part 75 of this chapter, a dynamic (nonshutdown) physical inventory of in-process uranium and U-235 at least every 65 days, and performing a static physical inventory of all other uranium and U-235 located outside of the enrichment processing equipment at least every 370 calendar days, with static physical inventories being conducted in conjunction with a dynamic physical inventory of in-process uranium and U-235 so as to provide a total plant material balance at least every 370 calendar days; and

(ii) reconciling and adjusting the book inventory to the results of the static physical inventory and resolving, or reporting an inability to

resolve, any inventory difference that is rejected by a statistical test which has a 90 percent power of detecting a discrepancy of a quantity of U-235 established by NRC on a site-specific basis within 60 days after the start of each static physical inventory;

(5) A detection program, independent of production, that provides high assurance of detection of any;

(i) production of uranium enriched to 10 percent or more in the U-235 isotope in any product stream, and

(ii) unauthorized production of uranium of low strategic significance;

(6) An item control program that ensures that;

(i) current knowledge is maintained of items that exist for 14 or more calendar days with respect to identity, uranium and U-235 content, and stored location, and

(ii) items are stored and handled, or subsequently measured, in a manner so that the amount of U-235 involved in any unauthorized removal of items or uranium from items greater than 500 grams will be detected. Exempted are licensee-identified items each containing less than 500 grams U-235 up to a cumulative total of 50 kilograms of U-235;

(7) A resolution program that ensures that any shipper-receiver differences are resolved that are statistically significant and exceed 500 grams U-235 on;

(i) an individual batch basis; and

(ii) a total shipment basis for all source material and special nuclear material; and

(8) An assessment program that;

(i) independently assesses the effectiveness of the MC&A system at least every 24 months,

(ii) documents the results of the above assessment,

(iii) documents management's findings on whether the MC&A system is currently effective, and

(iv) documents any actions taken on recommendations from prior assessments.

(d) Recordkeeping.

(1) Each licensee shall establish records that will demonstrate that the performance objectives of paragraph (a) and the system features and capabilities of paragraph (c) of this section have been met and maintain these records in an auditable form, available for inspection, for at least 3 years, unless a longer retention time is required by Part 75 of this chapter.

(2) Records that must be maintained pursuant to this part may be the original or a reproduced copy or a microform if such reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations. The record may also be stored in electronic media with the capability for producing, on demand, legible, accurate, and complete records during the required retention period. Records such as letters, drawings, and specifications must include all pertinent information such as stamps, initials, and signatures.

(3) The licensee shall maintain adequate safeguards against tampering with and loss of records.

* * * * *

Dated at Rockville, Maryland, this _____ day of _____, 1990.

For the Nuclear Regulatory Commission.

_____

Samuel J. Chilk,

Secretary of the Commission.

Enclosure 2

Draft Regulatory Guide

REGULATORY GUIDE

MATERIAL CONTROL AND ACCOUNTING REQUIREMENTS FOR URANIUM ENRICHMENT FACILITIES AUTHORIZED TO PRODUCE SPECIAL NUCLEAR MATERIAL OF LOW STRATEGIC SIGNIFICANCE

TABLE OF CONTENTS

A. INTRODUCTION

The Nuclear Regulatory Commission has proposed material control and accounting (MC&A) requirements for uranium enrichment facilities in Section 74.33, "Material Control and Accounting for uranium enrichment facilities authorized to produce special nuclear material of low strategic significance" of 10 CFR 74 "Material Control and Accounting for Special Nuclear Material." This section provides the regulatory basis for licensing the material control and accounting activities at enrichment facilities that are authorized to produce and possess more than one effective kilogram of special nuclear material (SNM) of low strategic significance.

Uranium enrichment facilities, because of the nature of the operations and the types of materials which will be onsite, pose two special problems which must be addressed in the NRC's regulations. Since the equipment used to enrich uranium to authorized levels can also be used to produce moderate and high enriched uranium, the NRC can not rule out the possibility that this may be done through deliberate misuse of the equipment. In addition, there is the possibility that undeclared source material (SM) could be introduced into the process equipment and that unauthorized production of uranium of low strategic significance could occur. Section 74.33 establishes material control and accounting (MC&A) performance objectives which to protect against, detect, and respond to such occurrences. This is consistent with MC&A requirements for other NRC licensed facilities which are authorized to possess and use more than one effective kilogram of special nuclear material of low strategic significance.

Section 74.33 sets forth the general performance objectives which should be addressed by the Fundamental Nuclear Material Control (FNMC) Plan. They are as follows:

(1) Maintain accurate, current, and reliable knowledge of the source material and special nuclear material;

(2) Protect against and detect any production of uranium enriched to 10 percent or more in the isotope U^{235};

(3) Protect against and detect any unauthorized production of uranium of low strategic significance;

(4) Resolve indications of missing uranium;

(5) Resolve indications of any production of uranium enriched to 10 percent or more in the isotope U^{235}; and

(6) Resolve indications of unauthorized production of uranium of low strategic significance.

This regulatory guide describes methods which the NRC considers acceptable for compliance with the general performance objectives. Alternative methods will also be considered provided that the licensee or applicant demonstrates that all the objectives have been met. In addition, this guide describes the detailed information that the licensee or applicant should provide in the FNMC Plan.

B. DISCUSSION

The proposed 10 CFR 74.33 material control and accounting (MC&A) regulation, for uranium enrichment facilities authorized to produce and possess uranium of low strategic significance (up to a maximum U^{235} enrichment of 9.99 percent), necessitates the development of objectives, criteria, and guidance to be used during the development of FNMC Plans that applicants will be required to submit. An applicant's FNMC Plan should demonstrate how the system features and capabilities specified in § 74.33(c) will be achieved and maintained, and how they will be utilized to achieve the performance objectives of § 74.33(a).

Because this rule is a performance based regulation, it is the objectives, rather than the means for achieving them, that are defined in § 74.33. Thus, applicants or licensees are free to decide how to design, manage, and operate their MC&A system. Hence, this regulatory guide is not intended to be an exhaustive description of all possible methodologies that a licensee might use to achieve the desired objectives. Instead, this regulatory guide provides at least one alternative acceptable to the NRC for meeting the rule. Other alternatives are acceptable provided that they meet the rule.

In the final analysis, the NRC must make a judgement as to whether the applicant or licensee can, without going beyond its FNMC Plan, achieve with high probability the objectives stated in § 74.33(a) and using the system features and capabilities stated in § 74.33(c). The guidance provided in this regulatory guide pertains to both applicant submitted FNMC Plans and, in the future, any revisions made to existing plans. It is very important that explanations and discussions appearing in the Fundamental Nuclear Material Control (FNMC) Plan be as detailed and precise as possible so that any potential ambiguity is minimized.

The annex of the FNMC Plan should provide supplementary and general information about the facility and the MC&A system (e.g., copies of blank record forms, a site map, process diagrams, an example of the standard error of inventory difference (SEID) calculation). The description of all MC&A system components and actions to be taken should be presented in the body of the plan and should not be dependent upon supplementary information in the annex for proper understanding.

C. REGULATORY POSITION

1.0 PERFORMANCE OBJECTIVES

Each licensee subject to 10 CFR 74.33 should implement and maintain an MC&A system that is capable of achieving the six performance objectives of § 74.33(a).

1.1 Maintain accurate, current, and reliable knowledge of source material and special nuclear material

In order to maintain current knowledge of the source material (SM) and special nuclear material (SNM) in their possession, licensees should have in place a program which provides information about how much material is in their possession and where that material resides. Accurate knowledge means that the amounts and locations of the material in question are based on measurements. Current knowledge means that the amounts and locations of all items and material classes are known. Reliable knowledge means that the quantities and locations of all classes of material and items listed in the accounting records are in fact correct and verifiable.

1.1.1 Shipments and Receipts

The licensee or applicant should accurately account for all SNM and SM which is received or shipped. This should be accomplished by maintaining reliable records that are based on accurate measurements. Detailed guidance on shipper-receiver procedures and the treatment of shipper-receiver data is provided in Section 9 of this regulatory guide.

1.1.2 Monitoring Material Movements

Whenever the licensee receives a shipment, it should monitor its movement and location within the facility. This should involve use of item control procedures to monitor the location and integrity of items until they are introduced to the process, measurement of the material when it is introduced into the process or removed from the process, process monitoring procedures to track the material's location within the enrichment process, and item control procedures to monitor the quantity, location, and integrity of items to be shipped or discarded. Guidance on the item control program is provided in Section 8 of this regulatory guide while guidance on measurements and measurement control programs are in Section 4 and 5, respectively. Monitoring the location of the material in process involves the use of production data to keep track of its quantity and location within the enrichment process. This should be accomplished by maintaining a detailed and accurate recordkeeping system for production data that provides knowledge of the material's location on a timely basis.

1.1.3 Dynamic Physical Inventories

In order to verify that the controls described in Sections 1.1.1 and 1.1.2 have been effective, the licensee should perform a dynamic physical inventory at intervals not to exceed 65 days. This inventory provides a snapshot of the amount and location of material in process at a given time. The licensee would be expected to strike a material balance around its processing equipment, any active UF_6 feed cylinders, and active UF_6 product cylinders as well as the tails process stream. This material balance would rely on indirect measurements and production parameters to estimate the material in the enrichment process, the rate at which feed is being introduced to the process, the rate at which product is being removed from process, and the amount of material residing inside process equipment. The amount

of material estimated to be inside the process equipment should be compared to the MC&A records to provide an indication as to whether or not a theft has occurred. Since the yearly physical inventory should be sensitive enough to detect the loss of a detection quantity (DQ), the bimonthly dynamic physical inventories should be sensitive enough to detect a loss of a quantity of at least DQ/6. A DQ is a site specific licensee calculated quantity of U^{235}, the limits of which are discussed in Section 6 of this regulatory guide. Section 6 also provides guidance on the conduct of dynamic physical inventories.

1.1.4 Yearly Plant Physical Inventory

Once a year, at intervals not to exceed 370 days, the licensee should conduct a total plant inventory and must be able to detect, with at least a 90 percent power of detection, an actual loss or theft of DQ that may have occurred since the last yearly inventory. The licensee should verify the presence of all SNM and SM currently possessed by the enrichment facility, as stated in its accounting records. This verification should be accomplished by a dynamic (non-shutdown) physical inventory of the uranium and U^{235} contained within the enrichment processing equipment and a static physical inventory of all other uranium material that is not within the processing equipment. Criteria pertaining to physical inventories are discussed in Section 7 of this regulatory guide. For the purpose of this Section, however, it should be noted that a total plant inventory involves:

(a) measuring (or, when direct measurement is not feasible, using indirect measurements) all bulk SNM and SM quantities on hand (i.e., all SNM and SM not in item form),

(b) verifying the presence, on a 100 percent basis, of all uniquely identified SNM and SM items that the accounting records indicate should be on hand,

(c) measuring a sample of randomly selected unencapsulated and unsealed items, based on a statistical sampling plan, to verify the total SNM and SM contained in those items, and

(d) verifying the integrity of all encapsulated items and items affixed with tamper indicating devices.

1.2 Protect against and detect any production of uranium enriched 10 percent or more in the isotope U^{235}

The licensee should have a program for monitoring the isotopic composition of product streams, independent of operations, which provides high assurance of timely detection of any production of uranium enriched to 10 percent or more in the isotope U^{235}. The enrichment technology used may determine the extent of the program. For example; gaseous diffusion technology requires a limited program because of the difficulty in reconfiguring the equipment to produce higher enrichments in a short time by a few people while centrifuge technology will require a more extensive program because of the ease in reconfiguring the machines to produce higher enrichments in a short period of time. The program can use nondestructive assay with fixed detectors or portable detectors or UF_6 samples can be taken and analyzed for U^{235} concentration.

The program should be managed and maintained independent of the operations (production) unit organization. The NRC Operations Center should be notified within one hour of discovery of any production of uranium enriched to 10 percent or more in the isotope U^{235} isotope pursuant to § 74.11. Detailed guidance for this program is provided in Section 12 of this regulatory guide.

1.3 Protect against and detect unauthorized production of uranium of low strategic significance

A program should be implemented which will, with high assurance, protect against and detect the unauthorized production of any uranium of low strategic significance that is not part of the facility's official planned production. The program should be capable of detecting the introduction of any feed material not declared or entered into the facility MC&A system. Another example of unauthorized production is the removing of small amounts of authorized production in side streams or freezing out SNM in the production equipment and later recovering the material for illegitimate use. The program should be managed and maintained independently of the production or operations organization unit. Pursuant to § 74.11, discovery of unauthorized production of uranium of low strategic significance should be reported to the NRC Operations Center within one hour. Detailed guidance for this program is provided in Section 12 of this regulatory guide.

1.4 Resolve indications of missing uranium

The licensee or applicant should have a formalized program to resolve any indication that SM or SNM is missing. Resolution of such indicators means that the licensee has made a positive determination that a theft or loss of SNM or SM has not occurred. As stated in 10 CFR 74.33(c)(5), only indications that suggest a possible loss of 500 grams or more of U^{235} need to be investigated.

The resolution process would ordinarily begin with a thorough review of the MC&A records to locate blatant errors. These might include omissions of entire items, errors in inputing values into computer programs or on records, incorrect entries, transcription errors, errors in estimating the amount of holdup in equipment, or calculational errors. A detailed examination of the MC&A records for each material type should identify gross errors. The next stage in the resolution process would be to

attempt to isolate the storage area or process stream that appears to be causing the anomaly. Once this is accomplished, all of the information which contributed to the SM and SNM quantities for that storage location or process stream should be verified. If resolution still is not accomplished, the licensee should remeasure and sample material in the storage area or process stream to verify the quantities. Failure to resolve the indication is reportable under § 74.11. Detailed guidance on resolution of indicators of missing uranium is presented in Section 11 of this regulatory guide.

1.5 Resolve indications of production of uranium enriched to 10 percent or more in the isotope U^{235}

Licensees or applicants are responsible for developing and following a formalized program designed to resolve indications of the production of uranium enriched to 10 percent or more in the isotope U^{235}. Resolution of such indicators means that the licensee has made a positive determination that an enrichment of uranium to 10 percent or more in the isotope U^{235} has not occurred. Since unauthorized enrichment would not normally be detected through the conduct of physical inventories or periodic dynamic inventories, the resolution process should include the investigation of all the information which contributed to the indication of unauthorized enrichment. Upon receipt of an indication that uranium enriched to 10 percent or more has been discovered, the licensee should immediately isolate the process area or storage area from which the indication came in order to verify the indication. The instruments and measurement systems used for monitoring should be examined to determine whether they are functioning properly. A thorough examination of the processing equipment should be performed to ensure that unauthorized modifications have not been made. The presence of uranium enriched to 10 percent or more should be verified through remeasuring the material in question whether in item form or in

process equipment. If this investigation fails to contradict the original indication of unauthorized enrichment to 10 percent or more, this condition is reportable under § 74.11.

If the investigation conducted to resolve the indication does not verify the unauthorized enrichment of 10 percent or more, further measures are needed before the licensee may conclude that the indicator is resolved. To protect against the relocation and concealment of the enriched uranium, a thorough investigation of the entire facility should be performed by individuals independent of the processing organization. Detailed guidance on resolution of indicators of uranium enriched to 10 percent or more is presented in Section 11 of this regulatory guide.

1.6 Resolve indications of unauthorized production of uranium of low strategic significance

Licensees and applicants are also responsible for developing and following a formalized program designed to resolve indications of the production of unauthorized uranium enriched to less than 10 percent in the isotope U^{235}. Resolution means that the licensee has made a positive determination that such unauthorized production has not occurred.

Since there are a number of different activities which the licensee will need to employ to protect against and detect unauthorized production of uranium enriched to less than 10 percent in the isotope U^{235}, the resolution process will be dictated by the type of indicator which occurs. For example, if an employee reports that there appears to be excess UF_6 feed cylinders in a storage area, the resolution process would include verifying the report and a detailed analysis of shipping and receiving records as well as production records. On the other hand, if it is discovered that enriched uranium production is

ahead of scheduled, it may be appropriate to sample product streams that withdraw UF_6 tails as well as the activities above. Some examples of indicators of unauthorized production of uranium of low strategic significance are:

(a) portable feed or withdrawal equipment in the processing area,
(b) extra UF_6 cylinders in the processing area or in storage areas,
(c) out of specification enrichment levels for UF_6 tails,
(d) excessively high production rates in product streams,
(e) production goals being achieved ahead of schedule,
(f) unauthorized reconfiguration of enrichment equipment, and
(g) the violation of the integrity of tamper indicating devices on valves, sample ports, or cylinders of product, feed, or tails.

In the event of any of these or other indicators of unauthorized production of uranium enriched to less than 10 percent in the isotope U^{235}, the licensee should verify that the indicator is true, determine its cause, and come to a conclusion whether or not unauthorized production has occurred or is underway. If an indication of unauthorized production can not be shown to be false, this is sufficient to conclude that the event has taken place and is reportable under § 74.11. Detailed guidance on resolution of indications of unauthorized production of uranium of low strategic significance are included in Section 11.

2.0 ORGANIZATION

2.1 Corporate Organization

The corporate structure should be described in detail, and all corporate organization positions that have responsibilities related to nuclear material control and accounting at the licensee's site should be identified. At least one corporate official should have responsibilities pertaining to the control and accounting of all SM and SNM possessed by the licensee.

2.1.1 Responsibilities and Authority

A description of the corporate level functions, responsibilities, and authorities for MC&A program oversight and assessments should be provided.

2.2 Facility Organization (Non-MC&A)

A description should be provided of the management structure for the facility. The description should address all positions which interface with the nuclear material control and accounting program. The facility management structure should be shown by means of comprehensive organization charts. As a minimum, the charts should indicate where the responsibility lies for the: (a) overall MC&A program, (b) SM and SNM custodianship, (c) receiving and shipping of SM and SNM, (d) analytical laboratories, (e) physical inventories, (f) monitoring programs to protect against and detect unauthorized enrichment activities, and (g) on-site nuclear material handling operations

2.2.1 Responsibilities and Authority

A position description should be provided for each facility level position, outside of the MC&A organization, that has responsibilities relating to MC&A activities (such as sampling, mass measurements, analytical measurements, etc.). For each such position, the functions, responsibilities, and authorities should be clearly described.

2.3 MC&A Organization

A position-by-position description and an organizational chart of the entire MC&A organization should be provided. A single individual should be designated as the overall manager of the MC&A program. In order to ensure independence of action and objectivity of decisionmaking, the MC&A manager should either (a) report directly to the facility manager, or (b) report to an individual who reports directly to the facility manager, and who has no production responsibilities.

2.3.1 Responsibilities and Authority

A description which clearly indicates the responsibility and authority of each supervisor and manager should be provided for the various functions within the MC&A organization. The discussion should describe how the activities of one functional unit or individual serve as a control over or checks the activities of other units or individuals. The FNMC Plan should explain how coordination is achieved and maintained between the MC&A organization and other plant organizational groups that perform MC&A related activities. There should be a clear definitive statement that the MC&A manager will review and approve all written MC&A procedures, and any future revisions, both within and outside his organization pertaining to MC&A related activities. In addition to the MC&A manager function, the functions to be addressed should include, as a minimum, the: (a)

nuclear material accounting, (b) measurement control program, (c) item control program, (d) monitoring programs, and (e) statistics.

The discussion pertaining to statistics should identify those individuals responsible for such activities as calculation of the standard error of the inventory difference (SEID), determination of active inventory, evaluation of shipper-receiver differences, and determining control limits.

Whenever more than one key MC&A function is assigned to the same person, the FNMC Plan should clearly describe the checks and balances which preclude such things as: (a) performance of accounting or record control functions by individuals who also generate source data; and (b) any individual having sole authority to overcheck, evaluate, or audit information for which he or she is responsible.

2.4 Training and Qualification Requirements

This section of the FNMC Plan should describe the training programs to be established and maintained to provide qualified personnel and to provide for the continuing level of qualification with respect to personnel assigned to SM and SNM control and accounting responsibilities. Training procedures and qualification criteria should be discussed in clear definitive statements. Minimum qualification requirements should be stated for each key MC&A position.

2.5 MC&A System Description

The length of this section and its level of detail will be somewhat dependent upon the information provided in the previous sections of this chapter. The overall MC&A organization should

be described in a manner that explains how the six general performance objectives of § 74.33(a) and the features and capabilities of § 74.33(c) will be effectively achieved.

The individual who has responsibility for the following MC&A related functions should be specified by title:

(a) overall MC&A program management [Note: This individual should not have any major non-MC&A related responsibilities.]
(b) measurements [Note: Responsibility may be divided on the basis of type of measurements --- such as, analytical laboratory measurements, NDA measurements, bulk measurements, and sampling.]
(c) accountability records,
(d) measurement control and statistics,
(e) item control,
(f) physical inventories,
(g) custodial responsibilities (SM and SNM storage and movement controls),
(h) monitoring program for detecting unauthorized enrichment activities,
(i) investigation and resolution of indicators (suggesting possible loss or possible unauthorized enrichment activities),
(j) receiving and shipping of SM and SNM,
(k) analytical laboratories, and
(l) MC&A recordkeeping system and controls.

The information in this chapter should also include a description of the policies, instructions, procedures, duties, responsibilities, and delegation of authority in sufficient detail to demonstrate the separation and overchecks built into the MC&A system.

3.0 MC&A PROCEDURES

MC&A procedures to be described are those written procedures which, if not performed correctly, could result in a failure to achieve one or more of the performance objectives of 10 CFR 74.33(a) and the features and capabilities of § 74.33(c). All MC&A procedures should be identified in the body of the FNMC Plan. The FNMC Plan should also contain a clear definitive statement that the procedures will be followed. This set of MC&A procedures should, as a minimum, adequately address the following topics regardless of which facility organizational group is responsible for the particular topic:

(a) accountability record system,
(b) sampling and measurements,
(c) measurement control program,
(d) item control program,
(e) both static and physical inventories,
(f) investigation and resolution of loss indicators,
(g) investigation and resolution of unauthorized enrichment indicators of uranium enriched to greater than 10 percent in the isotope U^{235},
(h) monitoring program to detect unauthorized production of uranium to enrichments of less than 10 percent in the isotope U^{235},
(i) determination of SEID, active inventory, and inventory difference,
(j) MC&A recordkeeping system, and
(k) independent assessment of the effectiveness of the MC&A program.

4.0 MEASUREMENTS

4.1 Measurement Points

The FNMC Plan should identify and describe each and every measurement point in the material flow path in terms of (a) location, (b) material type (e.g., UF_6 source, product, and tails material, and scrap) being measured, and (c) characteristic being measured (e.g., gross weight, % U, U^{235} concentration). Each measurement that is utilized either for accounting purposes or for a monitoring program to detect an unauthorized activity should be identified.

4.2 Measurement Systems

The FNMC Plan should describe in detail each measurement system utilized for nuclear material accounting purposes. A measurement system can be defined as any instrument or device, or combination of devices, used to derive a (a) mass, (b) volume, (c) uranium element concentration, or (d) U^{235} concentration. Each measurement system should also be defined or identified by the following parameters: (a) measurement device or equipment utilized, (b) standards used for calibration, (c) standards used for control, (d) sampling technique and equipment utilized, (e) sample aliquoting technique, and (f) sample pre-treatment methodology.

The FNMC Plan should provide descriptions for each measurement system associated with bulk, analytical, and NDA measurements.

4.2.1 Bulk Measurement Systems

For each mass (weight) system, the applicant or licensee should specify the weighing device, the type of container(s) weighed, material within the containers being weighed, capacity of weighing device, range to be utilized, and sensitivity of device. The description should include the capacity and the sensitivity of the scale (e.g., capacity not to exceed x kilograms, and sensitivity to be at least as good as y grams).

For each volume measurement system, the FNMC Plan should identify the vessel (tank, column, etc.) to which the measurement applies, the material being measured, the volume measuring device, and the sensitivity of the device.

4.2.2 Analytical Measurement Systems

For each analytical (laboratory) measurement system, the FNMC Plan should specify the following:

(a) type of material or chemical compound (e.g., UF_6, uranium alloy, U_3O_8, uranyl nitrate solution),
(b) characteristics measured (e.g., grams U per gram sample, U^{235} concentration),
(c) analytical method used,
(d) sampling technique,
(e) sample handling (i.e., pre-analysis sample storage and treatment), and

(f) means of calibration

4.2.3 NDA Measurement Systems

For each non-destructive assay (NDA) measurement system, the FNMC Plan should identify the following:

(a) the NDA equipment package (detector and electronics),
(b) the type of container measured,
(c) SM or SNM material type,

(d) geometry (including source to detector distance), and
(e) the means of calibration and for determining attenuation.

4.2.4 Other Measurement Systems

If applicable, the FNMC Plan should also identify any other measurement systems used for MC&A which do not fall within the three categories covered by subsections 4.2.1, 4.2.2, and 4.2.3.

4.3 Measurement Uncertainties

The expected measurement uncertainties of the described measurement systems should be provided. The variance due to calibration, variance due to sampling, and random error variance components for each measurement system should be stated. The units in which the errors are expressed should be clearly identified.

4.4 Measurement Procedures

The licensee or applicant should make a clear definitive statement that an approved measurement procedures (methods) manual, or a set of approved manuals will be established and maintained. The organizational units that are responsible for the preparation, revision, and approval of measurement procedures should be stated. There should also be a clear definitive statement that a periodic review of the procedures will be conducted.

There should be a clear statement that any given measurement procedure can not be used without documented approval. As a minimum, each procedure should be approved by the overall MC&A manager and by the manager of the organizational unit responsible for performing the measurement. Measurement procedures should also be approved by the measurement control program manager.

The FNMC Plan should provide a clear definitive statement that the set of described measurement systems will be maintained for the measurement of all SM and SNM in the facility.

5.0 MEASUREMENT CONTROL PROGRAM

5.1 Organization and Management

The organization and management of the measurement control program should be described in sufficient detail to show how the measurement quality assurance function is assigned, and how independence from the analytical laboratory, and other units performing either sample taking or measurements, is maintained. The measurement control program manager should be at a management level that is sufficient to ensure objectivity and independence of action. Thus, the measurement control program manager should either report directly to the overall MC&A manager, or if in a different organizational unit, be on the same level as the MC&A manager.

The licensee's measurement control program should be properly managed so as to have adequate calibration frequencies, sufficient control of biases, and sufficient measurement accuracy to achieve the objectives and capabilities required by § 74.33.

5.1.1 Functional Relationship

The relationship and coordination between the measurement control program manager and the analytical laboratory, and other measurement performing groups, should be clearly defined. There should be adequate assurance that the measurement control program manager has the authority to enforce all applicable measurement control requirements.

5.1.2 Procedures

The measurement control program procedures should be maintained in a manual which should be established, maintained and readily available. This manual should contain all the currently applicable written procedures pertaining to measurement

control and measurement quality assurance. These procedures should be subject to an annual review. Responsibility for preparation, revision, and approval of manual procedures should be specified. Individual measurement control program procedures should have documented approval by the measurement control manager. The procedures should address the following:

(a) calibration frequencies and methods,
(b) standards used for calibration (specifications and storage controls)
(c) standards used for control (obtaining or preparation of, and traceability of),
(d) control standard measurements,
(e) replicate sampling and replicate measurements,
(f) control limits and control responses,
(g) generation and collection of control data, and
(h) recordkeeping controls and requirements.

5.1.3 Contractor Program Audits

If measurement services are provided by an outside contractor or company off-site laboratory, the audit program used to monitor the off-site measurements should be described. The purpose of such audits is to ensure that the contractor or off-site laboratory has an acceptable measurement control program to the extent that use of the contractor's measurements should not compromise the licensee's ability to meet any measurement or measurement control requirement contained in either § 74.33(c) or in its FNMC plan. An initial audit of the contractor's measurement control program should be conducted prior to licensee use of measurements performed by the contractor or off-site laboratory.

All contractor or off-site laboratory audit findings and recommendations should be documented and submitted to both the measurement control program manager and the overall MC&A manager

within 30 days after completion of the audit. The two managers should arrive at an agreement as to what corrective actions need to be taken based on their evaluation of the report and transmit these findings to the contractor or off-site laboratory in writing. The licensee should not use measurements performed by such contractors or off-site laboratories until they have verified that the corrective actions have been instituted.

The individual(s) who conduct a contractor audit need not be employed by the licensee, but they should not be employed by, or be in any way associated with, the contractor or off-site laboratory; so that the independence of the conclusions may be maintained.

5.2 Calibrations

The FNMC Plan should describe the licensee's calibration program in terms of:

(a) calibration frequency for each measurement device or system,
(b) identification of the reference standards used for calibration of each measurement device or system,
(c) protection and control of calibration standards to maintain the validity of their certified values, and
(d) the range of calibration for each measurement device or system, and the minimum number of calibration runs (observations) needed to establish a calibration.

Unlike control standards, calibration standards need not be representative of the process material or items to be measured by the calibrated device or system. If practical, the calibration standard should be subjected to all the steps involved in the measurement process that the process unknowns are subjected to (such as sample pre-treatment). It is the primary measurement device, not necessarily the entire measurement system, that needs

to be calibrated. This is particularly true when the primary measurement device is common to two or more measurement systems. For example, the Davis & Gray titration method is often used to analyze samples of both uranium hexafluoride and uranyl nitrate to determine uranium concentration. In this case, two measurement systems involving different sampling methods, different sample pre-treatment methods, and different control standards are being utilized. The potassium dichromate titrant is, however, common to both systems, and it is the titrant that is calibrated (or standardized) with a reference standard such as certified U_3O_8 or certified uranium metal.

In the case of non-consumable calibration standards such as weight standards, the frequency of re-certification of assigned values should be specified. The re-certification frequency should be dependent upon how often the standards are handled, the standards' stability, and the adequacy of the controls used to maintain the integrity of the standards. Biannual re-certifications of such standards is usually acceptable.

The FNMC Plan should contain a clear definitive statement that no SM or SNM accountability value will be based on a measurement that fell outside the range of calibration. The FNMC Plan should also identify those measurement systems that are point-calibrated. A point-calibrated measurement system, is one in which:

(a) the entire measurement system is be calibrated with a standard or set of standards that are representative of the process unknowns that are measured by the system. That is, the representative calibration standard(s) undergoes all the measurement steps, and in the same manner, that the unknowns do, and

(b) one or more calibration standards are processed (measured) along with each unknown or set of unknowns measured. That is, both the standard(s) and unknown(s)

are measured at the same time with the same individual measuring both the standard(s) and unknown(s),

(c) the measurement values assigned to the process unknowns are derived from the measurement response observed for the standard(s) that was measured along with the unknowns, and

(d) the measurement response for each unknown should fall within a range that is within plus or minus 10 percent of the response for a standard measured at the same time as the unknown.

5.3 Control Standard Program

For those measurement systems that are not point-calibrated, a defined program for the periodic measurement of control standards should be established and followed. Control standard measurements serve the dual purpose of (a) monitoring the stability of a previously established calibration factor, and (b) estimating the system bias over the calibration period. The minimum total number of control standard measurements during the calibration period as well as the typical frequency needs to be specified for each measurement system.

Control standards should be representative of the process material or items being measured. To be "representative", the standards need not always be identical to the process unknowns, but any constituent of the process material, or any factor associated with a process item, that potentially could produce a bias effect on the measurement should be present to the same degree in the control standards. For scales used to weigh very large items, such as UF_6 cylinders, the control standard weights should be artifact cylinders (both empty and full) of certified mass, so as to avoid a bias effect caused by buoyancy or point loading.

For each measurement system that is not point-calibrated, the control standards to be used for control standards

measurements should be identified and described. In addition to material composition and matrix factors, biases can also be induced by changes in temperature, humidity, line voltage, and background radiation. Biases can also be operator induced. Therefore, the scheduling of control standard measurements should be based on the following considerations:

(a) does the variation between operators need to be considered and hence monitored?
(b) can environmental variables contribute to measurement bias?
(c) is bias likely to vary with respect to the time of day?
(d) is a particular bias likely to be long term, short term, or cyclic in nature?
(e) is bias a function of the process measurement values over the range of calibration? That is, is the relative percent bias non-uniform over the range of calibration?
(f) what controls or procedures are needed to ensure that sampling or aliquoting of the control standard is representative of the sampling or aliquoting of the process material?
(g) to eliminate bias in each measurement system, how much like, in terms of chemical composition, uranium concentration, density, homogeneity, and impurity content, should the control standards be relative to the process unknowns?

5.4 Replicate Program

Duplicate measurements performed on single samples (or single items) and measurement of replicate samples are necessary in order to estimate the analytical and sampling variance components. For non-sampling measurement systems such as NDA and

weight measurement systems, the analytical variance component can be derived either from:

(a) replicate measurements performed on the process items, or
(b) the replicate data generated from the measurement of control standards.

For each measurement system involving sampling and analysis, the FNMC Plan should indicate (a) how many samples are to be taken and measured for each accountability batch measurement, and (b) how many analyses are to be performed on each accountability sample. If two or more samples are used and two analyses per sample are performed for each accountability batch measurement, replicate requirements are automatically met. If, however, one sample per batch is normally used for accountability purposes, the replicate program should include a periodic taking of a second (replicate) sample. Sampling error should be estimated by taking replicate samples and assuring that those replicates are independent of one another (e.g., by remixing). The number of replicate samples measured for each analytical measurement system during an inventory period should equal at least one of the following:

(a) 100 percent of the accountability batches sampled,
(b) the greater of (i) 15 or (ii) 15 percent of the accountability batches sampled, or
(c) 50

5.5 Control Limits

Both warning and out-of-control limits should be established and utilized for both control standard and replicate sample measurements for those measurement systems used for nuclear material accountability. For point-calibrated systems, assigned

value of the standard(s) measured along with the unknown(s) is assumed to be valid. If there is a possibility of a change in the standard's true value due to factors such as evaporation, moisture pickup, or oxidation, then the value of the standard should be checked periodically. Therefore, control limits for the verification measurements associated with such standards should be established. This is especially true for those point-calibrated systems that utilize a single standard, or aliquots from a single standard, over any extended period of time.

The warning and out-of-control limits are normally set by the licensee based on a tradeoff between the cost of investigating and resolving incidents where limits are exceeded and the cost of accepting measurements of poor quality. Warning limits set at the 0.05 level of significance, and out-of-control limits set at the 0.001 level of significance are usually sufficient. When a system generates a control measurement that falls beyond an out-of-control limit, the system should not be used for accounting purposes until it has been brought back into control.

Control limits should be recalculated at a predetermined frequency, and modified if required. The FNMC Plan should clearly explain how control limits are established and the frequency for redetermining them.

5.5.1 Control Charts

Measurement control data such as control standard measurement results and the differences between measurement values of replicate pairs should be plotted on graphs. All control charts should be reviewed at least once every two weeks unless a measurement system was not utilized during that period. The review should address the frequency of control data exceeding either the warning or the out-of-control limits, and also evaluate for any significant trends.

5.5.2 Response Actions

Either the analyst or operator performing a control measurement or the supervisor should have the responsibility for promptly reporting any control measurement that exceeds an out-of-control limit. Such reporting should be made to the measurement control program manager, who should have the responsibility and authority to carry out the necessary response and corrective action.

Minimum response and minimum corrective action requirements should be clearly defined. In addition, the measurement control program manager should be responsible for, and have the authority for, determining and executing additional response and corrective actions, as deemed appropriate.

The minimum response to a reported incident of a control measurement exceeding an out-of-control limit should consist of:

(a) verifying that the measurement system in question has been taken out of service with respect to accountability measurements,
(b) documenting the occurrence of the event,
(c) performing at least two additional control measurements, and
(d) if results of (c), above, do not show the system to be back in-control, performing additional control measurements using a different control standard or different replicate sample (as appropriate) or recalibrate the measurement system.

For those measurement systems that make a significant contribution to the magnitude of the SEID, the response to an out-of-control condition should also include the remeasurement of any samples (items) that were measured prior to out-of-control condition, but after the last within control measurement. The validity of the prior measurements can be established without a

complete remeasurement of all the samples (items) involved if remeasurement on a "last in, first out" basis is used. That is, the last sample (item) measured prior to the out-of-control measurement, should be the first to be remeasured, and continuing in reverse order until two consecutive remeasurements are found to be not statistically different from their initial measurement.

6.0 STATISTICS

In order to achieve the objectives and capabilities of § 74.33, each licensee or applicant should institute a statistical program which evaluates the MC&A data to ensure that accurate and precise measurements are made, that the measurement data is analyzed in a rigorous manner, and that hypotheses concerning the status of the nuclear material possessed are appropriately tested. The NRC has sponsored the development of a comprehensive reference which specifically addresses the statistical treatment of accounting data. The statistical methods described in this text, entitled "Statistical Methods for Nuclear Material Management," NUREG/CR-4604, are recommended by the NRC for satisfying the requirements of § 74.33.

The FNMC Plan should:

(a) contain a detailed discussion of the procedures and methodologies for estimating measurement variance components,

(b) discuss how biases are determined and how bias corrections are applied, including:
   (1) how often biases are estimated,
   (2) how the effect of the bias on the measured quantity of material in the item is determined,
   (3) when and how bias corrections to items are made,
   (4) how their effect on inventory difference is determined, and
   (5) when and how bias corrections are applied to the inventory difference,

(c) describe the procedure and means for determining active inventory,

(d) provide all relevant information regarding the determination of SEID,

(e) specify the detection quantity (DQ), which should not exceed the greater of 25 kg U^{235} or 1.3 percent of the U^{235} introduced into the enrichment process during the interval since the last total plant inventory, and

(f) specify inventory difference threshold values to be used and how they were arrived at.

There should be a clear definitive statement that at least two individuals independently verify the correctness of the SEID calculation for each total plant material balance. If the SEID value is calculated using a computer, the verification by two or more persons involves checking for correctness of the input data used by the computer to calculate SEID and the correctness of a sample calculation used to verify the computer program.

7.0 PHYSICAL INVENTORIES

7.1 General Description

The applicant or licensee should provide a general description of how both dynamic (non-shutdown) inventories of the enrichment processing equipment, and static inventories of the balance of the plant will be planned and conducted. For enrichment facilities utilizing laser isotopic separation technology, a total plant shutdown inventory may be required.

The FNMC Plan should contain a clear definitive statement that physical inventory functions and responsibilities will be comprehensively reviewed with all involved individuals before the start of each dynamic and static inventory.

For static inventories, a book inventory listing, derived from the MC&A record system, should be generated just prior to the actual start of the inventory, and such a listing should include all SM and SNM that the records indicate should be possessed by the licensee at the inventory cut off time, except for material to be covered by the dynamic inventory that is to be conducted in conjunction with the static inventory.

For dynamic inventories, a book inventory quantity, to which the results of the dynamic physical inventory will be compared, is needed. One approach to estimating the in-process inventory is to use a "running book in-process inventory" (RBIPI) technique. The RBIPI is the quantity of uranium and U^{235} calculated as follows:

$$RBIPI = BI + CI - CO$$

Where: BI = Beginning in-process inventory (at the start of the current inventory period) as determined from the previous dynamic inventory.

CI = Cumulative measured input to the enrichment process for the current dynamic inventory period.

CO = Cumulative measured output from the enrichment process for the current dynamic inventory period.

7.2 Organization, Procedures, and Schedules

The FNMC Plan should explain the makeup and duties of the typical physical inventory organization, for both dynamic and static inventories. The individual having responsibility for the coordination of the physical inventory effort should be identified by position title. The FNMC Plan should also indicate how the preparation and modification of inventory procedures are to be controlled.

The FNMC Plan should contain a clear definitive statement that specific inventory instructions will be prepared and issued for each dynamic and static inventory.

7.3 Typical Inventory Composition

The typical expected in-process inventory of material within the enrichment equipment for both uranium and U^{235} at the time of dynamic physical inventory should be specified. For gas centrifuge and gaseous diffusion plants, the in-process inventory should be specified by accounting for UF_6 gas, solid UF_6 to be drawn off, and residual holdup solids deposited within the equipment.

A typical composition, by material types, of a static physical inventory should also be presented. UF_6 cylinders on inventory should be accounted for by material type (i.e., tails, feed, and product). If different size cylinders are used within

one of the three UF_6 categories, they should be treated as different material types.

7.4 Conducting Dynamic Physical Inventories

A description of the dynamic inventory methodology, including cutoff and inventory minimization procedures, should be presented, with all measurements (including sampling) being identified. The FNMC Plan should contain sufficient information to show how the total in-process inventory for both uranium and U^{235} is obtained. The means for measuring or estimating residual, deposited holdup should be addressed in detail. The change or variation in such deposited holdup from one dynamic inventory to the next should also be discussed.

7.5 Conducting Static Physical Inventories

A description of the procedures and methodologies associated with performing static physical inventories should be provided in sufficient detail to demonstrate that valid inventories will be conducted. Such description should include a general outline of how:

(a) inventory functions are organized and how the functions are separated,
(b) inventory teams are assigned and instructed on the use of uniform practices,
(c) source data is obtained, verified, and recorded,
(d) inventory forms are controlled,
(e) item counts verify the presence of each item while preventing any item from being counted more than once, and
(f) cut off and material handling procedures for non-enrichment processes such as scrap recovery.

Special item storage and handling or tamper-indicating methods, which are used to ensure that the recorded SM or SNM content can be used for inventory purposes without remeasurements, should be described.

The FNMC Plan should also provide a description of how item identities are verified and how tampering with the contents of items will be detected or prevented.

For items that are not encapsulated, affixed with tamper indicating devices, or otherwise protected so as to ensure the validity of prior measurements, the basis for determining which items are to be measured at physical inventory time and justification of any proposed alternatives to measurement of any SM and SNM included in the inventory should be presented. If a statistical sampling is proposed as an alternative method to 100 percent verification, the FNMC Plan should describe the sampling plan. Such a description should include:

(a) the method of classifying (stratifying) the types of items to be sampled (i.e., selected for remeasurement);
(b) how the sample size (i.e., the number of items) will be calculated for each stratum;
(c) the quality of the measurement methods used to verify original measurement values;
(d) the procedure for reconciling discrepancies between original and remeasured values, and when additional tests and remeasurements would be performed; and
(e) the basis for discarding an original SM or SNM value and replacing it with a remeasured value.

One acceptable means for establishing the number of items, to be randomly selected for remeasurement, from a given stratum is given by the following equation:

$$n = N\,[1 - (0.10)^{x/9}]$$

Where: n = number of items to be remeasured
N = total number of items in stratum
x = maximum U^{235} content per item (kilograms)
g = DQ = detection quantity (kilograms U^{235})

The FNMC Plan should contain a clear definitive statement that any items on ending inventory that have not been previously measured, will be measured for inventory purposes.

The decision rationale for determining when the element and isotope factors for items, objects, or containers will be measured directly for inventory and when they may be based on other measurements should be presented in the FNMC Plan. For example, if the U^{235} contained in liquid waste batches is derived by applying an average enrichment factor to the measured uranium element content, the rationale for such a practice, as opposed to measuring each batch for both uranium and U^{235} content, should be discussed, and the method for establishing the average enrichment factor should be described.

If the content of items is established through measurements and those items are tamper-safed or access to them is controlled, the SM or SNM quantity in those items may be based on those measured values. Otherwise, verification of SM or SNM content can be achieved by reweighing either (a) all the items within a given stratum, or (b) randomly selected items from the stratum based on a statistical sampling plan. A statistical sampling plan will not be acceptable if there is any likelihood of any significant change in the uranium concentration (or weight fraction) or in the uranium isotopic distribution due to such factors as oxidation, change in moisture content, commingling with materials of different enrichments, or different compositions.

7.6 Inventory Difference Limits and Response Actions

Each licensee should have a well defined system for evaluating total plant IDs and taking action when IDs exceed certain predetermined thresholds. As a minimum, there should be three response levels for excessive IDs. The following would be one acceptable approach for three increasing levels of response actions:

Warning Level: U^{235} ID $\geq$ 1.7 (SEID) + 500 grams
Significant ID Problem: Either U or U^{235} ID $\geq$ 3(SEID)
Major ID Problem: U^{235} ID $\geq$ DQ - 1.3(SEID)

All of the above limits are expressed in terms of absolute values of ID (i.e., no regard for algebraic sign). The minimum response for a warning level ID should be a documented licensee investigation, conducted by the MC&A organization. Such an investigation should provide a conclusion for the probable cause of the excessive ID, and give recommendations for avoiding recurrence. When a warning level ID is positive, it should be regarded as being equivalent to an indicator of a possible loss that requires investigation and resolution (see section 11.1).

For a significant ID problem, an extensive investigation by the licensee should be conducted. If a significant ID problem can not be satisfactorily explained, a static or dynamic reinventory may be needed.

For any unresolved ID determination that remains a major ID problem (even if the ID is negative), the licensee may need to take steps for scheduling a plant wide reinventory and investigation. The NRC considers a positive ID large enough to be a major ID problem as a very serious condition.

The FNMC Plan should fully describe in clear definitive statements the minimum response actions for each ID action level.

8.0 ITEM CONTROL

8.1 Organization

The FNMC Plan should identify the individual responsible for overseeing the item control program by position. The positions of those individuals who have significant item control program responsibilities should also be identified.

8.2 General Description

The applicant or licensee should state that the MC&A system will maintain a record of all SM and SNM items. The MC&A system should provide current knowledge of the location, identity, and quantity of all SNM and SM contained in all non-exempt items. Items that can be exempt from item control program coverage are:

(a) items having an existence time of less than 14 calendar days; and
(b) any licensee identified items listed by material type containing less than 500 grams U^{235} each but not to exceed a plant total of 50 kilograms U^{235}.

Each item should have a unique identity. The following are acceptable means for providing a unique identity:

(a) a unique alpha-numeric identification on a tamper-safe seal that has been applied to a container of SM or SNM,
(b) a unique alpha-numeric identification permanently inscribed, embossed, or stamped on the container or item itself, or
(c) a uniquely pre-numbered (or bar coded) label (applied to each item having adhesive qualities such that its removal from an item would preclude its reuse.

Location designations shown by the MC&A records need not be unique, but location designations should be specific enough so that any item may be located within one hour. The MC&A record system should be tamper-proof and controlled in such a manner that the record of an item's existence cannot be destroyed or falsified without a high probability of detection.

Each non-exempt item should be stored and handled in a manner that enables detection of, and provides protection against, unauthorized or unrecorded removals of SM and SNM.

8.3 Item Identity Controls

Example descriptions should be provided of the item records showing how items are identified for each material type and each type of container.

If the unique number on a tamper-safe seal is the basis for providing unique item identity, the FNMC Plan should:

(a) describe the type of seals utilized,
(b) describe how the seals are obtained and what measures are implemented to ensure that duplicate (counterfeit) seals are not manufactured,
(c) describe how the seals are stored, controlled, issued, destroyed, and accounted for, and
(d) describe how seal usage and disposal records are maintained and controlled.

Similar information should be provided for other methods of unique item identity (e.g., labels).

8.4 Storage Controls

Item storage areas and controls should be fully described in the FNMC. In particular, controls that are used as the basis for

accepting the values of prior measurements, as opposed to remeasuring the item at inventory time should be discussed in detail and the rationale for accepting prior measurements explained. Any controls used to ensure the validity of prior measurements should be equivalent to the protection provided by tamper-safing seals.

Both administrative controls (such as custodian assignments and limiting authorized access to storage areas) and physical controls (e.g., locked and alarmed doors) should be identified.

8.5 Item Monitoring Methodology and Procedures

As part of the item control program, a licensee should maintain a system of item monitoring that:

(a) verifies that items shown in the MC&A records are actually stored and identified in the manner indicated in the records,
(b) verifies that generated items and changes in item locations are properly recorded in the MC&A record system in a timely manner, and
(c) can detect, with high probability, any real loss of items or uranium from items amounting to 500 grams or more of U^{235}.

The item monitoring system should conduct the following activities at least on a monthly basis:

(a) check the actual storage status of a sufficient sample of randomly selected items from each stratum,
(b) check the accuracy of the MC&A records for a sufficient sample of randomly selected items from each storage area, and

(c) check the accuracy of a sufficient sample of randomly selected production records of created and consumed items.

The actual frequency of the above activities, and the size of the random sample, both should be a function of the expected discrepancy rate. In addition, the FNMC Plan should contain clear definitive procedures for identifying and resolving item discrepancies.

8.6 Description of Typical Item Strata

The FNMC Plan should describe the expected item population in terms of the following:

(a) type of item (i.e., stratum),
(b) expected number of items within each stratum,
(c) the average uranium and U^{235} content of the items within each stratum, and
(d) the expected rate of item generation and consumption for each stratum.

8.7 Investigation and Resolution of Item Discrepancies

The applicant or licensee should discuss in clear definitive statements the procedures and controls that will ensure that all incidents involving missing or compromised items or falsified item records will be investigated. A compromised item is one for which there is evidence of tampering or which is found somewhere other than in its assigned location.

If any item (whether encapsulated or not) is located after it has been determined that it is missing or if an item is found to be compromised, the contents should be verified by measurement. Guidance on resolution of indicators, which is in

Section 11 of this regulatory guide, should be utilized to resolve item discrepancies.

9.0 SHIPPER-RECEIVER COMPARISONS

9.1 Receiving Procedures

The first action to be taken upon receipt should be the verification of the correct number of items, the correct item identities, and the integrity of the tamper-indicating seals. The applicant or licensee should specify what other checks and measurements are conducted upon receipt. The FNMC Plan should state, for each material type, the maximum elapsed time for determining whether or not a significant shipper-receiver difference (SRD) exists.

9.2 Determination of Receiver's Values

For natural UF_6, the licensee should establish the receiver's values by performing a measurement of U^{235} concentration, weighing each cylinder, and using a nominal percent uranium factor.

All SNM receipts, and any SM receipts not in the form of UF_6 should be measured for uranium and U^{235} concentration.

The FNMC Plan should specify whether the receiver's or shipper's measurements for each material type will be entered into the MC&A records.

9.3 Evaluation of SRDs

Shipper-receiver differences, which are greater than 500 grams of U^{235}, are evaluated by testing the hypothesis that the SRD equals zero. The NUREG/CR-4604 "Statistical Methods for Nuclear Material Management," in its chapter on hypothesis testing, provides methods that are acceptable to the NRC. In selecting the statistical level of significance, consider that the actual statistical test should have at least a 90 percent power of detection for a facility-specific quantity of U or U^{235}

because of the consequence of not rejecting the null hypothesis when the true SRD is not zero.

9.4 Resolution of Significant SRDs

The FNMC Plan should describe the procedures to be followed in the investigation of a significant SRD, and discuss how such difference will be resolved. The criteria for determining that a significant SRD is resolved should also be presented. Resolution of a significant SRD usually involves a referee measurement of retainer samples.

10.0 ASSESSMENT OF THE MC&A PROGRAM

10.1 General Description

The capabilities, performance, and overall effectiveness of the licensee's MC&A program should be independently reviewed and assessed at least every 24 months. The FNMC Plan should describe the assessment program in terms of:

(a) maximum interval between assessments,
(b) selection procedures for assessment team,
(c) number of team members to be selected,
(d) qualification and expertise of team members,
(e) independence of individual team members from their MC&A responsibilities and the activities which they review and assess, and
(e) maximum elapsed time and minimum actual effort to be utilized for completion of the assessment and issuance of a final team report.

It is preferable that the entire MC&A program be reviewed and evaluated during each assessment. When this is the situation, intervals between assessments can be as much as 24 calendar months. If individual assessments cover part of the MC&A system, the intervals should be no greater than 12 calendar months. Thus, the type of assessment (partial or total) and the maximum interval between assessments should be specified. "Interval" means the elapsed time between the either the start of or termination of successive assessments.

The responsibility and authority for the assessment program should lie at least one level higher in the licensee's organizational structure, than that of the MC&A manager. Such responsibility should include the selection of the assessment team leader and the initiation of corrective actions. Team members may be selected from the facility staff or from outside, but

an individual member should not participate in the assessment of the parts of the MC&A system for which that person has direct responsibility. Hence, the MC&A manager may not be a team member. Also, team members should not reciprocate assessments. The leader of the assessment team should have no responsibilities for managing any of the MC&A elements being assessed.

The minimum number of individuals on any given assessment should be dependent on the knowledge and expertise of the team relative to MC&A activities, and their experience in conducting reviews.

Personnel assigned to the assessment team should have a good understanding of the objectives and the requirements of the MC&A program and should have sufficient knowledge and experience to be able to judge the adequacy of the parts of the system they review. The team should have authority to investigate all aspects of the MC&A system and should be given access to all necessary information.

In order to provide a meaningful and timely assessment, the review and evaluation process should not be protracted. The actual review and investigation activities should be completed in 30 days, with an additional 15 days allowed for completing and issuing a final team report.

10.2 Report of Findings and Recommendations

The areas to be reviewed should encompass the entire MC&A system, and the level of detail of the reviews should be sufficient to ensure that the assessment team has adequate information to make reasoned judgments of its effectiveness. The report should provide findings pertaining to:

(a) organizational effectiveness to manage and execute MC&A activities,

(b) management responsiveness to indications of losses of uranium and possible unauthorized enrichment activities,

(c) staff training and competency to carry out MC&A functions;

(d) reliability and accuracy of accountability measurements made on SM and SNM,

(e) effectiveness of the measurement control program in monitoring measurement systems and its sufficiency to meet the requirements for controlling bias and the standard error of inventory difference,

(f) soundness of the material accounting records,

(g) effectiveness of the item control program to track and provide current knowledge of items,

(h) capability to promptly locate items and effectiveness in doing so,

(i) timeliness and effectiveness of shipper-receiver difference evaluations and resolution of excessive SRDs,

(j) soundness and effectiveness of the inventory taking procedures,

(k) capability to verify the presence of SM and SNM,

(l) capability to detect and resolve indications of unauthorized enrichment activities and the effectiveness of doing so, and

(m) capability to detect and resolve indications of missing uranium and the effectiveness of doing so.

Upon completion of each assessment, the findings and recommendations for corrective action, if any, should be documented. The written report should be distributed to the plant manager, the MC&A manager, and other managers affected by the assessment.

10.3 Management Review and Response to Report Findings and Recommendations

Management should review the assessment report and take the necessary actions to correct any MC&A system deficiencies. The management review should be documented within 30 days following the submittal of the assessment team's report and it should include a schedule for the correction of deficiencies. Corrective actions, if any, that pertain to daily or weekly activities should be initiated promptly after the submittal of the final assessment report.

The FNMC Plan should address resolution and follow-up actions associated with concerns identified in the assessment report. The individuals responsible for resolving identified concerns, and the timeliness of such resolution should be specified.

11.0 RESOLVING INDICATIONS OF UNAUTHORIZED PRODUCTION OF ENRICHED URANIUM AND OF MISSING URANIUM

The FNMC Plan should discuss the means by which the licensee will resolve indicators of either missing uranium involving 500 or more grams U^{235} or of indicators of unauthorized enrichment. The three generic types of indications are as follows:

(a) indications that enriched uranium that the licensee is authorized to produce is missing,
(b) indications that the enrichment equipment has been or is being used to produce unauthorized uranium enriched in the isotope U^{235} to less than 10 percent, and
(c) indications that the enrichment equipment has been or is being used to produce uranium enriched in the isotope U^{235} to 10 percent or more.

The applicant or licensee's resolution program should address the possible indicators of missing uranium. The FNMC Plan should enumerate all the potential indicators that can be postulated for (a) through (c) above and develop resolution procedures for each.

11.1 Indicators of Missing Uranium

Possible indicators of missing uranium could include the following:

(a) lack of agreement of dynamic or static inventories with the MC&A records,
(b) determination through the item control program that a specific item is not in its authorized location,
(c) discovery of tampering with the MC&A records,
(d) discovery that an item's integrity or its tamper indicating seal have been compromised,

(e) discovery of unauthorized feed or withdrawal equipment in the processing area,
(f) discovery that a measurement system is not functioning properly or has been compromised, and
(g) an allegation of a theft.

Resolution of an indication means that the licensee has made a positive determination that a theft of more than 500 grams of U^{235} has not occurred. For each type of loss indicator, the licensee should develop detailed resolution procedures and should document them in the FNMC.

The resolution process should include (a) a thorough check of the accountability records and source information, (b) locating the source of the problem, (c) isolating the exact reason for the problem within the area or processing unit, (d) determining the amounts of SNM or SM involved, and (e) making a determination that the indication is or is not resolved. The resolution procedures should be prepared in such a manner that no individual that could be responsible for the loss could also be responsible for resolution.

11.2 Indications of Unauthorized Production of Uranium Enriched to Less Than 10 Percent in the Isotope U^{235}

Possible indicators of unauthorized production of uranium enriched to less than 10 percent in the isotope U^{235} include the following:

(a) presence of unauthorized product, feed, or tails cylinders in the processing area,
(b) presence of natural UF_6 cylinders which have not been entered into the MC&A record system,
(c) production goals achieved ahead of schedule,
(d) UF_6 tails that are lower in enrichment assay than specifications or there is an excess mass of UF_6 tails,

(e) incorrectly identified product cylinders, such as UF_6 tails or SM identified as enriched product material,

(f) discovery of tampering with the MC&A records,

(g) discovery that an item's integrity or its tamper-indicating seal have been compromised,

(h) discovery of unauthorized feed or withdrawal equipment in the processing area,

(i) discovery that a measurement system is not functioning properly or has been compromised, and

(j) an allegation that unauthorized enrichment of uranium to 10 percent or less in the isotope U^{235} is or has been occurring.

Resolution of an indication means that the licensee has made a positive determination that unauthorized production of uranium enriched to less than 10 percent in the isotope U^{235} has not and is not occurring. For each type of indicator, the licensee should develop detailed resolution procedures and should document them in the FNMC Plan.

In the event of any of these or other indicators of unauthorized production of uranium enriched to less than 10 percent in the isotope U^{235}, the licensee should verify that the indicator is true, determine its cause, and come to a conclusion whether or not unauthorized production of has occurred or is being produced. If an indication of unauthorized production can not be shown to be false, this is sufficient to conclude that the event has taken place and is reportable under § 74.11.

11.3 Indications of Unauthorized Production of Uranium Enriched to 10 Percent or More in the Isotope U^{235}

Possible indicators of unauthorized production of uranium enriched to 10 percent or greater in the isotope U^{235} include:

(a) any measurement from a product stream monitoring program which indicates out-of-specification enrichment concentrations for any product or tail stream,
(b) unauthorized feed or withdrawal equipment in the enrichment processing area,
(c) unauthorized reconfiguration of enrichment equipment,
(d) equipment utilized for monitoring enrichment levels in product streams not functioning properly or compromised, and
(e) an allegation that unauthorized production of uranium enriched to greater that 10 percent in the isotope U^{235} has occurred or is underway.

Resolution of an indication means that the licensee has made a positive determination that unauthorized production of uranium enriched to 10 percent or greater in the isotope U^{235} has not and is not occurring. For each type of indicator, the licensee should develop detailed resolution procedures and should document them in the FNMC Plan.

Since unauthorized enrichment would not normally be detected through the conduct of physical inventories or periodic dynamic inventories, the resolution process should include the investigation of all the information which contributed to the indication of unauthorized enrichment. Upon receipt of an indication that uranium enriched to 10 percent or more has been discovered, the licensee should immediately isolate the process area or storage area from which the indication came in order to verify the indication. The instruments and measurement systems used for monitoring should be examined to determine whether they are functioning properly. A thorough examination of the processing equipment should be performed to ensure that unauthorized modifications have not been made. The presence of uranium enriched to 10 percent or more should be verified through remeasuring the material in question whether in item form or in process equipment. If this investigation fails to contradict the

original indication of unauthorized enrichment to 10 percent or more, this condition is reportable under § 74.11.

If the investigation conducted to resolve the indication does not verify the unauthorized enrichment of 10 percent or more, further measures are needed before the licensee may conclude that the indicator is resolved. To protect against the relocation and concealment of the enriched uranium a thorough investigation of the entire facility should be performed by individuals independent of the processing organization.

12.0 PROGRAM FOR PRECLUDING OR DETECTING UNAUTHORIZED PRODUCTION OF ENRICHED URANIUM

There are several alternative approaches available to protect against and detect unauthorized production of enriched uranium. The licensee may perform an analysis to identify and evaluate all scenarios through which clandestine enrichment could occur and provide a monitoring program to protect against and detect each scenario. Alternatively, a program could be instituted to monitor the enrichment level of the uranium in all process streams and possible withdrawal paths in a timely fashion so that any amount of uranium enriched to 10% or more in the isotope U^{235} would be detected.

12.1 Organization

The individual position responsible for executing the program for detecting unauthorized production of enriched uranium should be identified. This individual need not be part of the MC&A organization, but should be independent of the production organization. Personnel who are assigned program responsibilities should also be independent of production supervision. This program should be well coordinated with both MC&A and production management.

The overall organization, including the minimum staffing requirements and functions, should be in the FNMC Plan. There should also be a clear definitive statement that the program director will have the necessary authority to carry out all aspects of the program.

12.2 Monitoring Program for Clandestine Enrichment Scenarios

12.2.1 General Description of Program

The overall design of this program for this alternative should include the analysis of clandestine enrichment path surveys. That is, for each conceivable scenario for clandestine enrichment, there should be a monitoring system for the timely detection of that scenario. The analysis should be extensive and conducted by individuals having a thorough knowledge of the processing equipment and enrichment technology. All conceptual scenarios for unauthorized production of uranium enriched to 10 percent or more in the isotope U^{235} employed enrichment technology should be identified. These scenarios should include process system adjustments, batch recycle processing, cascade interconnections, cascade isolation, and cascade reconfiguration to increase the number of stages.

The extensiveness and complexity of the portion of the program, aimed at protecting against and detecting enrichment of uranium to 10 percent or more, should be dependent on the minimum time it would conceivably take to produce a quantity of high enriched uranium.

When the unauthorized production of uranium enriched to 10 percent or more in the isotope U^{235} is the primary concern the following types of measures should be considered:

(a) process design features that preclude unauthorized enrichment to be conducted simultaneously with normal (authorized) production,

(b) personnel access controls that limit the number of individuals who could gain access to the enrichment processing equipment or its control mechanisms,

(c) physical security controls such as locked and alarmed doors, TV monitors, etc. that would detect unauthorized access to processing equipment or product material, and

(e) process control systems that could detect unauthorized use of production equipment.

In describing the portion of program aimed at protecting against and detecting production of uranium enriched to greater that 10 percent in the isotope U^{235}, the FNMC Plan should address the following:

(a) sampling ports, and frequency of sampling, to be utilized for monitoring product streams,
(b) the means for verifying the validity of process control measurements and laboratory enrichment measurements (i.e., how would falsification of process measurements be detected?), and
(c) the type of equipment or instrumentation, that is in addition to and independent from that used and controlled by production personnel, to be utilized for monitoring purposes.

The FNMC Plan should address the following aspects of the program to protect against and detect unauthorized production of uranium of low strategic significance:

(a) the type of surveillance, and its frequency, to be applied to the processing areas,
(b) the type of surveillance, and it frequency, to be applied to the process control room and other areas where operation of processing equipment can be controlled or modified,
(c) the type of surveillance, and its frequency, to be applied to product withdrawal areas and feed introduction areas,
(d) process monitoring activities, other than process sampling, that could contribute to the detection of unauthorized production,
(e) use of tamper-indicating seals on process valves and flanges, and

(f) production control activities that could contribute to the detection of unauthorized production.

12.2.2 Data, Information, and Activities to Be Monitored

The specific data, information, and activities to be monitored should be identified. The frequency of each specified monitoring activity and frequency of data evaluation should be addressed.

The means for independently verifying the authorized process enrichment parameters needs to be shown. In order to accomplish this, the program should address the following:

(a) independent weighing, sampling, and isotopic assay of material introduced at the feed addition station(s),
(b) independent weighing, sampling, and isotopic assay of material withdrawn at the product and tails loadout stations,
(c) independent sampling and isotopic assay of in-process material at randomly selected points, and
(d) verifying that the quantity of U^{235} independently determined to be in the product and tails is consistent with the independently determined feed input.

For gaseous diffusion and gas centrifuge facilities, the licensee or applicant should consider the monitoring of such process parameters as UF_6 gas pressures, flow rates, enrichments, valve positions, operating parameters, cascade configuration and connections, and tracking all potential UF_6 containers in the process area. The purpose is to ensure that the amount of low enriched uranium being produced does not exceeded the amount planned.

12.3 Program for Monitoring of Output Streams

The overall design of the program should include analysis on all processing and product streams to determine where uranium isotopic measurements should be made and at what frequency to preclude clandestine enrichment activities. That is, for each conceivable scenario for clandestine enrichment, there should be a monitoring system for the timely detection of any implementation of that scenario. Since the activity of most interest is whether unauthorized high enriched uranium is being produced, NDA measurement techniques for enrichment may be useful. Either manual measurements using portable NDA instruments can be utilized or the instruments can be permanently affixed to the process equipment. In the former case, administrative controls should be utilized to prevent collusion of the measurement personnel with a potential clandestine perpetrator. In the later case, frequent inspection and testing of the instruments should be performed to prevent tampering or disabling of the NDA measurement system.

The scenario analysis performed should address each product stream regardless of material type or composition and be conducted by individuals having a thorough knowledge of the processing equipment and enrichment technology. All conceptual means for production of uranium of enrichment levels equal to or greater than 10 percent in the isotope U^{235} should be identified. These approaches should include process system adjustments, batch recycle processing, cascade interconnections, and cascade reconfiguration (e.g., to increase the number of stages).

The extensiveness and complexity of the monitoring program should be dependent on such factors as:

(a) the minimum time it would conceivably take to produce a facility specific quantity of high enriched uranium,

(b) process design features that would preclude clandestine enrichment production to be conducted simultaneously with normal (authorized) enrichment,

(c) personnel access controls that limit the number of individuals who could gain access to the enrichment processing equipment or its control mechanisms,
(d) physical security controls such as locked and alarmed doors, TV monitors, etc. that would detect unauthorized access to enrichment equipment, feed or product material, or the enrichment production area, and
(e) process control systems that would detect unauthorized use of enrichment equipment.

The FNMC Plan should address such aspects as:

(a) type and frequency of uranium isotopic measurements,
(b) type and frequency of monitoring NDA measurements,
(c) required accuracy of the isotopic measurements, and
(d) administrative controls to be applied to all monitoring measurements.

12.3.1 Data, Information, and Activities to Be Monitored

The specific data, which will be collected and analyzed, should be identified. The frequency of the measurements and of data evaluations should be stated.

The means for independently verifying the authorized process enrichment parameters, listed in Section 12.2.2, should be shown.

12.4 Documentation Requirements

The applicant or licensee should make a clear definitive statement that a MC&A procedure that defines the basis for (a) declaring that unauthorized enrichment has taken place, and (b) declaring that unauthorized production of uranium of low strategic significance has taken place.

Whenever it is determined that unauthorized enrichment is possibly occurring, that determination becomes an "indicator"

that should be subject to the investigation and resolution requirements of § 74.33(c)(5), which are discussed in Section 11.0 of this regulatory guide. If actual unauthorized production of enriched uranium is discovered, that discovery should be reported to the NRC within one hour as required in § 74.11.

13.0 RECORDKEEPING

13.1 Description of Records

The FNMC plan should identify all records, forms, reports, and standard operating procedures that should be retained pursuant to § 74.33(d). Such records should include, but are not limited to the following:

(a) documents that define changes in the MC&A management structure or changes in responsibilities relating to MC&A positions,

(b) procedures pertaining to any accountability or § 74.33(c)(5) related measurement or sampling operation,

(c) forms used to record or report measurement data and measurement results, including source data,

(d) forms (notebooks, etc.) used to record calibration data associated with any accountability measurement system,

(e) forms (notebooks, etc.) used to record quantities, volumes, and other data associated with the preparation of standards (both calibration and control) used in connection with accountability measurement systems,

(f) forms (and official memos) used to record or report measurement control program data, control limit calculations, out-of-control investigations, etc,

(g) forms (listings, instructions, etc.) associated with a physical inventory (both dynamic and static),

(h) forms (formal worksheets, etc.) used in the calculation of SEID, ID, and active inventory values,

(i) ledgers (journals, computer printout sheets, etc.) associated with the accountability system,

(j) ledgers (journals, computer printout sheets, etc.) associated with the item control program, including seal usage and "attesting to" records,

(k) completed DOE/NRC-742 Forms, and incoming and outgoing DOE/NRC-741 Forms,

(l) forms (memos, reports, etc.) associated with identification of, investigation of, and resolution of significant shipper-receiver differences,

(m) loss indication and alleged theft investigation reports,

(n) investigation reports pertaining to indication of unauthorized enrichment activities,

(o) investigation reports pertaining to excessive inventory differences,

(p) official reports containing the findings and recommendations of MC&A system assessments as well as any letters or memos pertaining to response actions to assessment team recommendations,

(q) forms used for recording data associated with the monitoring program,

(r) monitoring program status or summary reports, and

(s) training, qualification, and re-qualification reports or records.

Examples of the more important MC&A forms should be provided in the FNMC Plan annex.

The retained records and reports should contain sufficient detail to enable NRC inspectors to determine that the licensee has attained the system features and capabilities of § 74.33(c) and has met the general performance objectives of § 74.33(a).

13.2 Program for Assuring an Accurate and Reliable Record System

The FNMC Plan should describe the controls that are utilized to ensure that records are highly accurate and reliable. The

record system should also provide a capability for easy traceability of all SM and SNM transactions from source data to final accounting records.

The following topics should be addressed:

(a) the auditing system or program to verify the correctness and completeness of records,

(b) the overchecks for preventing or detecting missing or falsified data and records,

(c) the plan for reconstructing lost or destroyed SM or SNM records,

(d) access controls used to ensure that only authorized persons can update and correct records, and

(e) the protection and redundancy of the record system so that any act of record alteration or destruction will not eliminate the ability to provide complete MC&A information.

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants regarding the NRC staff's plans for using this regulatory guide.

This proposed revision has been released to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method to be described in the active guide reflecting public comments will be used in the evaluation of Fundamental Nuclear Material Control Plans submitted by applicants or licensees pursuant to 10 CFR 74.33.

Enclosure 3

Draft Regulatory Analysis

Draft
Regulatory Analysis
for
Material Control and Accounting for
Uranium Enrichment Facilities
Authorized To Produce
Special Nuclear Material of Low Strategic Significance

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards

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1 STATEMENT OF THE PROBLEM

This regulatory analysis addresses the costs and benefits of a rule that would govern the control and accounting of uranium at plants licensed to produce enriched uranium from natural uranium. The enriched uranium would be used to fuel commercial light water power reactors.

The rulemaking would apply to only one class of facilities: plants licensed to enrich uranium. The operative provisions of the rule would be set forth in Title 10 of the Code of Federal Regulations, Part 74 (10 CFR Part 74).

In the United States, current uranium enrichment operations are carried out exclusively by the Department of Energy (DOE). The operations have been and continue to be exempt by law from regulation by the NRC. Although licensed commercial enrichment plants are permitted by law, the staff has viewed past commercial interest in enrichment as insufficient to justify a definitive regulatory response such as a material control and accounting (MC&A) rulemaking. Inasmuch as there has been no need, the NRC currently has no regulations explicitly designed to regulate MC&A at licensed enrichment plants.

The need for a material control and accountability rule is now emerging. One commercial entity has informed the NRC of its intention to seek a license to construct and operate an enrichment plant using gas centrifuge technology. In a separate action, DOE is proposing the construction and operation of an enrichment plant utilizing the atomic vapor laser separation (AVLIS) process. Congress may require such a facility to be licensed by the NRC, although no requirements for NRC licensing exist at present. Both plants would be designed to produce low enriched uranium from natural uranium, where the term "natural uranium" refers to uranium that has not been artificially enriched.

At the present time the NRC cannot rule out the possibility that enrichment equipment could be deliberately misused to produce unauthorized enriched uranium. The unauthorized enriched uranium could be either an undeclared excess of enriched uranium at the licensed enrichment level or uranium enriched to a level higher than that authorized. Production of unauthorized enriched uranium would be inimical to the common defense and security of the United States and is prohibited by the Atomic Energy Act of 1954 as amended. The NRC concludes that the enrichment of uranium at licensed plants should be carefully regulated and that the issue of material control and accounting at licensed enrichment plants should be addressed.

One means of dealing with the foregoing situation is through a rulemaking process in which the public is formally involved. An NRC rulemaking action, including a public comment period, typically takes about two years. According to the schedules of the prospective applicants, applications may be submitted to the NRC as early as March 1991. Any rulemaking should be well advanced at that time if it is to be of maximum value in the licensing of the prospective facilities. It follows that NRC consideration of its options must begin now if the rulemaking option is to remain viable.

Enrichment can be carried out by diffusion or by laser separation as well as by a centrifuge process. The general performance criteria contained in the proposed rule would apply to all three technologies. Centrifuge enrichment was selected as a basis for MC&A cost estimates in this analysis because that technology is expected to be proposed by the first of the prospective license applications.

2 OBJECTIVES

The objective of this analysis is to establish a basis for a material control and accounting rule to apply to licensed enrichment facilities and to present estimates of the cost of implementing the rule. The rule requires the licensees to meet the following MC&A objectives:

(1) Maintain accurate, current, and reliable knowledge of source material and special nuclear material.

(2) Protect against and detect any production of uranium enriched to 10 percent or more in the isotope U-235.

(3) Protect against and detect unauthorized production of uranium of low strategic significance.

(4) Resolve indications of missing uranium.

(5) Resolve indications of any production of uranium enriched to 10 percent or more in the isotope U-235.

(6) Resolve indications of unauthorized production of uranium of low strategic significance.

3 ALTERNATIVES

The staff considered the following alternatives for material control and accounting at enrichment plants:

1. Regulate through rulemaking.
2. Regulate through license conditions.

A "do nothing" alternative was considered but was quickly rejected. It can be stated as: Create no new regulatory structure but carry out the necessary licensing actions using current regulatory rules and practices. General requirements for material control and accounting are set forth in 10 CFR Part 70, most particularly in §70.51(b). These requirements, however, were not designed with enrichment plants in mind and hence do not address the important topics of source (feed) material control and accounting or detection of unauthorized enrichment. Thus, before they could be applied at enrichment plants, the requirements would have to be supplemented with license conditions. For the purposes of this analysis, the alternative substantially reduces to the license condition alternative and does not constitute a separate, viable alternative.

4 CONSEQUENCES OF THE ALTERNATIVES

The viable alternatives are:

- Regulate through rulemaking.
- Regulate through license conditions.

This section examines the costs and benefits of these alternatives.

Regulation through rulemaking involves a formal process. It typically takes about two years, but in this case would be shortened to about 15 months. It consists of proposed rule development, proposed rule publication in the Federal Register, public comment period, evaluation of public comments received, development of a final rule taking into account the comments received, and publication of the final rule in the Federal Register. Regulation through license conditions is simpler. The NRC would develop safeguards requirements to apply specifically to an applicant's facility. The requirements would be incorporated as conditions of each license.

4.1 Common Features of the Alternatives

The alternatives have some important features in common. First, the construction and operating requirements to be imposed upon a licensee would be essentially independent of whether regulation through rulemaking or regulation through license conditions is selected. Virtually identical sets of requirements would be imposed. Second, because the requirements would be essentially identical, the cost to licensees to carry out the requirements is independent of the alternative selected. Finally, the cost to the NRC (and ultimately to the licensee) for safeguards inspections at the facility would be independent of the alternative selected.

The objectives of the material control and accounting requirements are restated here for convenience:

1. Maintain accurate, current, and reliable knowledge of source material and special nuclear material.

2. Protect against and detect any production of uranium enriched to 10 percent or more in the isotope U-235.

3. Protect against and detect unauthorized production of uranium of low strategic significance.

4. Resolve indications of missing uranium.

5. Resolve indications of any production of uranium enriched to 10 percent or more in the isotope U-235.

6. Resolve indications of unauthorized production of uranium of low strategic significance.

The cost of satisfying the objectives will be dominated by the cost of satisfying Objectives 1, 2 and 3. These would dominate the day-to-day cost of MC&A program.

From time to time the MC&A program may produce information indicating the possibility of unauthorized enrichment or missing uranium. A licensee must have at hand the capability (through skills, procedures, and equipment) to resolve these indications as valid or not. However, this capability is expected to be needed infrequently, with the result that the cost of satisfying Objectives 4, 5, and 6 will be small relative to the day-to-day cost of the program. For these reasons, the cost of satisfying Objectives 4, 5, and 6 is not considered further in this analysis.

The requirements proposed to satisfy Objective 1 are similar to those now set forth in 10 CFR 74.31 - Nuclear material control and accounting for special nuclear material of low strategic significance. The benefits of adopting similar requirements for this action are:

- They are fairly recent (1985).
- They are a product of the formal rulemaking, including the public comment process.
- They have been tested by application at six low enrichment fuel fabrication facilities for a period of several years. No marked defects justifying a need for change have been uncovered.
- Adoption will assure consistency; material accounting for low enriched uranium at enrichment plants will be similar to that for low enriched uranium at other plants.
- Simple additions (e.g. expansion to make source material as well as low enriched uranium subject to accounting) are likely all that are needed to make the requirements suitable for enrichment plants.

The annual labor cost to a licensee to carry out the requirements was developed in the following way. The key parameters and material flows in a fictitious 1.5×10^6 separative-work-unit (SWU) centrifuge plant were estimated. Next, a series of tasks needed to carry out the requirements were identified. Each task was analyzed and the labor needed to carry out the several tasks was calculated. Supporting details are set forth in the appendix. A summary of the annual labor needs follows:

Task	Staff Hours
- Weigh 1366 gas cylinders	1366
- Draw 1366 samples	684
- Assay U and U235, 2732 aliquots	2732
- Inventory 228 cylinders	32
- Evaluate measured inventory difference (ID)	80
- Estimate measurement uncertainty of ID	160
- Evaluate overall MC&A program	160
- Evaluate in-process inventory	80
- Provide accountability representative	1040
- Provide MC&A oversight	1040

Task	Staff Hours
- Sample and assay solid, liquid, and gas waste	319
- Support NRC inspection activities	72
- Total	7765

The individual responsible for material control and accounting oversight is the principal onsite technical expert on material control and accounting. This individual would be responsible for coordinating the accountability and measurement control programs and thus be responsible for inventory and measurement uncertainty estimates.

The individual acting as accounting representative would report to the "oversight" position and would be responsible for keeping the accounting records and for oversight of receipts, shipments, and warehousing of source and special nuclear material.

An average labor rate for persons engaged in the MC&A program is estimated to be $40 per hour. The cost of labor to satisfy Objective 1 is calculated to be $310,600 annually. The present value of $310,600 annually over the estimated 40-year life of the plant is calculated to be $5.32 million at a 5 percent interest rate and $3.04 million at a 10 percent interest rate.

The capital cost to satisfy Objective 1 is estimated to be in the range of 0.1 percent to 1 percent of the overall plant cost. For a $750 million plant, the corresponding bounds are $750 thousand to $7.5 million. The principal assets required would be cylinder transport equipment, precision scales, sampling ports, assay laboratory with the capability of both U and U-235 measurement, office space, and computer and supporting software (to provide for data storage, physical inventory listing, material balance reporting with computation of the inventory difference, determination of statistical measurement uncertainty, generation of nuclear transfer documentation, storage of training records, and control of tamper-indicating seals).

These assets contribute both to MC&A requirements and to production. They might be budgeted to either account or be proportioned. The high estimate might apply if the MC&A program is deemed to be the major user of the assets, the low estimate if production is deemed to be the major user. Annual maintenance costs are estimated at 10 percent of capital costs.

The second and third objectives of the MC&A program call for protection against and detection of any unauthorized production of enriched uranium. One issue related to these objectives is whether additional explicit, dedicated measures are needed to satisfy them. The following arguments suggest that detection of (or protection against) unauthorized enrichment would be achieved automatically as a consequence of other factors that are necessarily present and that no additional measures are needed:

- There is no specifically identified threat (e.g., adversary groups) waiting for or pursuing opportunities to carry out unauthorized enrichment. In 1979 the NRC conducted a study to develop information about possible adversary groups that might pose a threat to nuclear activities. Actual adversary actions directed against domestic activities were found to be limited to inconsequential actions or harrassments such as hoax bomb threats, vandalism, radiopharmaceutical thefts,

and firearms discharges. No action has been carried out at a level of sophistication comparable to that required to support an unauthorized enrichment scenario. Since 1979 the staff has consulted continuingly with law enforcement agencies and intelligence gathering agencies to obtain their views concerning the possible existence of groups interested in acquisition of unauthorized nuclear material. None of the information that the staff has collected confirms the presence of an identifiable threat.

- The presence of classified material at an enrichment plant, both documents and hardware, necessitates a personnel clearance program. In general, personnel who have access to the interior parts of enrichment machines must hold a "Q" clearance issued by the NRC or the equivalent clearance issued by another agency. To qualify for such a clearance, the individual is subjected to a background check for trustworthiness, which includes a field investigation of the individual's personal history. This practice assures the continuing presence of a number of technically competent, trustworthy personnel at enrichment plants. Unauthorized enrichment must be concealed from these individuals if it is to remain undetected.

- Uranium in the U.S. is rigorously controlled. Enrichment licensees must report all transfers and receipts so that all usable uranium is accounted for at all times. Annual inventories are taken, and the results are reported to the NRC. For unauthorized uranium to be sent to an enrichment plant and remain undetected, the U.S. material accountability system would have to break down at multiple places simultaneously. A similar argument holds for movements of uranium within an enrichment plant.

- Apart from any material control and accounting considerations, an enrichment plant operator must assay feed, product, and tails to assure the economics of the operation, to guarantee the quality of the product, and to prevent criticality. These assays provide a significant measure of protection against undetected, unauthorized enrichment.

Several counterarguments can be cited in support of the proposition that additional measures are needed to protect against and detect unauthorized enrichment:

- Licensees will have protracted control over equipment capable of enriching uranium. Issuance of a 40-year license is expected. During that period undeclared uranium may be sought by groups or nations. The NRC cannot reliably rule out that workers at licensee plants (as well as NRC inspectors) might be subject to pressures, enticements, and threats as groups or nations pursue their respective interests.

- Much suitable feed material in the world is not under U.S. control. Smuggling of the material cannot be ruled out.

- There is no way to guarantee over a period of decades that the personnel clearance system will protect against infiltration of adversaries into sensitive positions among the licensee staff.

- The NRC has considered a range of illicit enrichment scenarios. Absent appropriate countermeasures, one or a small number of conspirators could carry out certain of the scenarious.

- Given scenarios favorable to conspirators, enrichment machines have the capability to produce unacceptable quantities of high enriched uranium in a short time.

The NRC believes that a system to protect against and detect unauthorized enrichment is needed. Of particular concern is that a small fraction of a plant's separative work capacity arranged in an unauthorized system, together with a small fraction of the authorized feed (or of the authorized product used as feed), might be sufficient to produce unacceptable quantities of high enriched uranium (see appendix).

A licensee system to protect against unauthorized enrichment might be designed to have the following capabilities:

- Detect unauthorized portable feed and withdrawal equipment in the cascade area.

- Detect unauthorized gas cylinders in the cascade area.

- Detect unauthorized reconfiguration of piping in the cascade area.

- Perform gamma scan of product streams from enrichment machines.

- Control all outgoing gas cylinders and gamma scan the cylinders to detect unauthorized uranium.

- Detect indications of unauthorized enrichment through safeguards review of plant data:
  - material control and accounting data
  - process control data
  - quality assurance data
  - sampling and assay data

- Protect against protracted, unmonitored access to enrichment equipment by one or a small group people.

- Inventory enrichment machines and monitor value positions.

The labor and equipment needs for a system with these capabilities is estimated in the table that follows.

Labor and Equipment Needs for Detection of Unauthorized Enrichment

Task	Units	Value
Detect unauthorized portable feed and withdrawal equipment in the cascade area. Detect unauthorized gas cylinders in the cascade area:		
Number of inspections annually	#/yr	12

Task	Units	Value
Labor for one inspection	staff·hr	48
Annual labor	staff·hr/yr	576
Detect unauthorized reconfiguration of piping in cascade area:		
Number of inspections annually	#/yr	2
Labor for one inspection	staff·hr	1,250
Annual labor	staff·hr/yr	2,500
Gamma scan enrichment machines:		
Number of inspections annually	#/yr	12
Labor for one inspection	staff·hr	75
Annual labor	staff·hr/yr	900
Annual equipment cost	$/yr	9,000
Control and gamma scan all outgoing gas cylinders:		
Labor for feed and bleels cylinders	staff·hr/yr	208
Labor for other cylinders	staff·hr/yr	200
Annual equipment cost	$/yr	2,500
Control and gamma scan all incoming gas cylinders other than those containing UF_6:		
Labor	staff·hr/yr	100
Annual equipment cost	$/yr	500
Detect indications of unauthorized enrichment by review of plant data:		
Labor to review MC&A data	staff·hr/yr	0
Labor to review process control data	staff·hr/yr	312
Labor to review quality assurance data	staff·hr/yr	312
Labor to review sampling and assay data	staff·hr/yr	312
Protect against protracted, unmonitored access to enrichment equipment by one or a small group of people (procedure):	staff·hr/yr	0
Inventory machines:		
Number of inventories annually	#/yr	2
Labor of one inventory	staff·hr	1,250
Annual labor	staff·hr/yr	2,500
Total labor, annual:	staff·hr/yr	7,920
Total equipment cost, annual:	$/yr	12,000

An average labor rate of $40/staff·hr is again assumed. The annual labor cost to protect against unauthorized enrichment, and thus satisfy Objectives 2 and 3, is estimated to be $316,800 annually. The total cost (labor and equipment) is estimated to be $328,800 annually. The present value of $328,800 annually over the estimated 40-year life of the plant is calculated to be $5.64 million at a 5 percent interest rate and $3.21 million at a 10 percent interest rate.

A final common factor is radiation exposure. Radiation exposure is essentially independent of the alternative chosen. This follows from the fact that licensee employees and NRC employees would carry out certain prescribed safeguards-related tasks independent of whether regulation is by rule or by license condition. There will be some small occupational exposure from safeguards-related activities such as data recording, inspecting, or sample taking, but the exposure is expected to be too low to be measured or to lead to identifiable health effects.

4.2 Regulation Through Rulemaking

Regulation through rulemaking is characterized by the following features:

- It is more in harmony with the Administrative Procedures Act than the rival alternative. The staff holds that Congress intended agencies to regulate in accordance with that legislation absent good cause for doing otherwise.

- The resulting regulation would likely benefit from the comments and views offered by citizens, industry, institutions, government agencies, and public interest groups. Any important conflicts between NRC policies and other government agency policies would be exposed early and taken into account during the rulemaking process.

- The rulemaking process includes public participation.

- The resulting regulation would apply to a class of facilities rather than to a single facility. Thus, an applicable regulation would be in place if Congress elects to require DOE to obtain NRC licenses for DOE facilities producing low enriched uranium.

- The regulation and the staff's intentions would be explained comprehensively in accompanying guidance documents.

- Once in place, the regulation would be less vulnerable to intervention for technical reasons than license conditions.

The cost to the NRC of the alternative is estimated as follows. The annual cost of an NRC senior professional per year is taken as $73,800. This figure takes into account supervisory and secretarial support but does not include full overhead. Work on the regulation is to start in April 1990 and continue through July 1991, at which time a final fule is to be published. During that period it is estimated than an average of two senior professionals (not necessarily the same two) would be working on the rule at all times except during the 75-day (2 1/2 month) comment period. During that period no NRC time would be expended. Using these data the cost of the alternative is calcuated to be:

$$2 \text{ persons} \times \frac{\$73,800}{\text{person/year}} \times \frac{(16\text{-}2.5) \text{ months}}{12 \text{ months/year}}$$

$$= \$166,050 = \$166,000 \text{ (rounded)}$$

4.3 Regulation Through License Conditions

Regulation through license conditions is characterized by the following features:

- License conditions would be less costly than the rival alternative because the license condition process requires fewer mandatory, formal steps.

- They could be drafted in less time and be ready for use on a more timely basis than the rival alternative.

- They could be tailored to the specific site and to the enrichment technology that would be used at that site.

- The development of a regulation specifically for enrichment plants at the present time is only based on an announcement of interest from one prospective applicant. The other (DOE) could well be deferred indefinitely or otherwise dropped.

The cost of the alternative is estimated as follows. Again, the cost on an NRC senior professional is taken as $73,800. The license conditions could be drafted in six months by two professional. The resulting costs are $74,000 (rounded).

License conditions for an additional licensee would cost about 60 percent of the cost of conditions for the first licensee, leading to an estimated cost of 0.6 x $74,000 = $44,000 (rounded) for each additional licensee.

5 DECISION RATIONALE AND CONCLUSIONS

The staff assigns greatest weight to the concepts that:

- Regulation should be by rule, absent good cause for proceeding otherwise.
- The public comment process serves to improve the quality of the regulatory process.
- Sufficient time exists for a formal rulemaking process.

For these reasons the staff concludes that material control and accounting at licensed enrichment plants should be regulated through requirements codified in Title 10, Chapter 1 of the Code of Federal Regulations. A suitable rule should be drafted and put through the formal rulemaking process.

The proposed rule sets forth the NRC staff's definitive position on material control and accounting at licensed enrichment plants. The staff does not foresee the need for a series of followup requirements on that subject. However, some additional safeguards and security topics remain to be addressed. These include:

Fitness For Duty. Failure to properly carry out certain activities (such as measures to detect unauthorized enrichment) at enrichment facilities could adversely affect the common defense and security. The NRC staff is developing a proposed rulemaking which will impose requirements to assure that personnel assigned to carry out these activities are not drug impaired.

Personnel security. The enrichment program will likely involve access to Restricted Data and National Security Information and equivalent information from foreign nations. Access to this information must be limited to persons who have been granted an access authorization by the NRC or by the DOE and who have a need to know the information involved.

Information security. Certain information in the form of documents and process data must be protected against theft and unauthorized disclosure.

Equipment security. Enrichment machines must be protected against theft. Certain critical components of enrichment machines must be protected against theft and unauthorized viewing.

6 IMPLEMENTATION

6.1 Schedule for Implementing the Proposed Requirements

The rule is expected to be issued in final form in July 1991. No facilities exist that would be required to implement the rule. Accordingly, there are no issues pertaining to implementation at existing facilities.

6.2 Relationship to Other Existing or Proposed Requirements

There are no known impacts on or conflicts with other existing or proposed requirements.

Appendix
Model Centrifuge Enrichment Plant
for Regulatory Calculations

This regulatory analysis examines the costs and benefits of a material control and accountability rule that would apply to enrichment plants not yet designed. In order to examine the costs and impacts of the rulemaking, it was necessary to first specify the main features of a model enrichment plant typical of a plant to be regulated under the rule. This appendix assigns or calculates various plant parameters and estimates the material control and accounting costs. The tables that follow provide information on:

- Feed, product, and tails estimates.
- Example of unauthorized enrichment concern.
- Gas cylinder movements and numbers.
- Estimated labor to carry out Objective 1 of the material control and accounting program (see Section 4.1).

Model Centrifuge Enrichment Plant for Regulatory Calculations

Factor	Units	Value
Plant capacity	SWU/yr	1.5×10^6
Feed to yield 1 kg 3%	kg. nat	6
Separative work to yield 1 kg 3%	SWU	4
Plant product, annual	kg 3%/yr	375,000
Feed, annual	kg. nat/yr	2.25×10^6
Tails annual	kg. 0.25%/yr	1.875×10^6
Separative work to yield 1 kg 90%	SWU	200
Separative work to yield 5 kg 90%	SWU	1,000
Fraction of plant capacity for 5 kg 90%	factor	6.67×10^{-4}
	percent	0.067
Feed to yield 1 kg 90%	kg nat	200
Feed to yield 5 kg 90%	kg nat	1,000
Fraction of plant feed for 5 kg 90%	factor	4.44×10^{-4}
	percent	0.044

Gas Cylinders and Cylinder Movements

Factor	Units	Value
Feed, type 48X, capacity	kg/cyl	11,250
Tails, type 48G, capacity	kg/cyl	11,430
Product, type 30B, capacity	kg/cyl	2,050
Feed heels, type 48X	kg/cyl	22.68
Product heels, type 30B	kg/cyl	11.34
Incoming, feed in 48X	#/yr	200
Incoming, product heels in 30B	#/yr	182
Incoming, clean, for tails, 48G	#/yr	164
Stored on site, tails 48G	#/yr	164
Outgoing, product in 30B	#/yr	182
Outgoing, feed heels in 48X	#/yr	200

Cost of Satisfying Objective 1 of the Material Control and Accounting Program

Parameter	Units	Value
Incoming feed cyl, 48X	#/yr	200
add 25% (Note 1)	#/yr	250
Incoming product heel cyl, 30B	#/yr	182
add 25%	#/yr	228
Incoming, clean, for tails, cyl 48G	#/yr	164
add 25%	#/yr	205
Stored on site, tails, cyl 48G	#/yr	164
add 25%	#/yr	205
Outgoing product cyl, 30B	#/yr	182
add 25%	#/yr	228
Outgoing feed heels, 48X	#/yr	200
add 25%	#/yr	250
No. cyls. to be weighed	#/yr	1,366
Labor to weigh 1 cyl	staff·hr	1
Labor to weigh 1,366 cyl	staff·hr	1,366
Labor to draw 1 sample	staff·hr	0.5
Samples needed: feed	#/yr	500
tails	#/yr	410
product	#/yr	456
total	#/yr	1,366
Labor to draw 1,366 samples	staff·hr/yr	684
Labor to assay 1 sample U + U235* (Note 2)	staff·hr	2
Labor to assay 1,366 samples, U + U235	staff·hr/yr	2,732
Cylinders in active inventory (Note 3)	#	228
Labor to inventory 228 cyl	staff·hr/yr	32
Labor to evaluate inventory difference	staff·hr/yr	80
Labor to estimate meas. uncertainty of ID	staff·hr/yr	160
Mgt. labor to evaluate MC&A	staff·hr/yr	160
Labor to evaluate in-process inventory	staff·hr/yr	80
Labor: accountability representative	staff·hr/yr	1,040
Labor: MC&A oversight	staff·hr/yr	1,040
Drum of solid waste, 30 gal.	#/yr	200

Parameter	Units	Value
Labor to assay 1 drum	staff·hr	0.5
Labor to assay 200 drums	staff·hr/yr	100
Labor to draw 1 sample, liquid waste	staff·hr	0.25
Number of liquid samples, annual	#/yr	50
Labor to assay 1 liquid waste sample	staff·hr	0.5
Number of liquid waste assays, annual	#/yr	100
Labor to account liquid waste, annual	staff·hr/yr	63
Labor to take 1 gas sample	staff·hr	0.25
Number of gas samples, annual	#/yr	208
Number of gas assays, annual	staff·hr/yr	208
Labor to take gas samples, annual	staff·hr/yr	52
Labor to assay gas samples, annual	staff·hr/yr	104
Number of NRC inspections, annual	#/yr	3
Duration of 1 NRC inspection	hr	24
Licensee support for 1 NRC inspection	staff·hr	24
Licensee support for NRC inspections, annual	staff·hr/yr	72

Notes

1. 200 type 48x feed cylinders is the minimum needed to supply feed for the plant. That number of cylinders has been increased by a factor of 25% to account for the possibility that not all cylinders will be filled to capacity or that smaller cylinders may be used sometimes. This note also applies to product and tails cyliners.

2. Each sample is subjected to a dual analysis.

3. The number of cylinders in active inventory at any one time is taken as 1/6 of the number of cylinders that move through the plant annually.

Enclosure 4

Draft Environmental Assessment

ENVIRONMENTAL ASSESSMENT AND FINDING OF NO SIGNIFICANT IMPACT

For the Proposed Rule

Amending 10 CFR Parts 2, 40, 50, 70, and 74

Material Control and Accounting Requirements for Uranium Enrichment Facilities Producing Special Nuclear Material of Low Strategic Significance

I. Introduction

The Nuclear Regulatory Commission (NRC) is proposing to add a new section to 10 CFR Part 74, with conforming amendments to Parts 2, 40, 50, and 70, containing performance-based material control and accounting (MC&A) requirements that would be applicable to uranium enrichment facility licensees that produce special nuclear material of low strategic significance. The proposed requirements are built on those found in 10 CFR Part 74.31, which apply to licensees who produce fuel for commercial power reactors, but if adopted would impose additional requirements to assure that enrichment facilities would produce only enriched uranium of low strategic significance as authorized.

II. The Need for the Proposed Action

The existing MC&A rules do not provide requirements for enrichment facilities because (1) NRC had not received an application for a uranium enrichment facility, and at the time the rules were written, no prospects for receiving an application were apparent, and (2) it was felt that the safeguards issues pertaining to enrichment facilities were somewhat different and more complex than for fuel fabrication facilities. Now a joint venture has indicated intent to apply for a license to build and operate a commercial uranium enrichment facility. Thus, the NRC needs to develop and formalize its regulatory position with respect to MC&A requirements applicable to uranium enrichment facilities producing uranium enriched to less than 10 percent in the U-235 isotope.

III. The Environmental Impact of the Proposed Action

The proposed amendments will have some, but likely not measurable or identifiable, affect on the safety of facility operation and the routine release of, or exposure to, radioactivity and fluorine and fluoride compounds from a commercial uranium enrichment facility. However, the atomic vapor laser isotope separation (AVLIS) technology uses uranium in alloy form so fluorine and fluoride hazards do not exist for those type facilities. The proposed amendments are only intended to provide material control and accounting requirements for a uranium enrichment facility to protect against unauthorized enrichment, and thus reduce the risk to the public health and safety and protect the common defense.

There will be some, but likely not measurable or identifiable, increase in occupational radiation exposure and exposure to fluorine and fluoride compounds resulting from safeguards related activities such as data recording, inspection support, sample taking, and laboratory support. All of these activities are normal for uranium enrichment plant operations and the safeguards related activities are expected to be a tiny fraction of those required for overall plant operations. Thus, the safeguards activities which will take place at a commercial uranium enrichment plant are procedural in nature and are a minor fraction of overall plant operations. This fact supports a finding that the proposed amendments involve no significant environmental impact.

IV. Alternatives to the Proposed Action

Section 102(2)(e) of NEPA provides that agencies of the Federal Government shall "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." The objective of this amendment is to provide MC&A requirements and to provide additional measures to prevent, with high assurance, unauthorized enrichment at commercial uranium enrichment plants. To date uranium enrichment plants have been operated only by the government in this country; however a joint venture, Louisiana Energy Services, has indicated that it intends to apply for a license to own and operate a commercial uranium enrichment plant. This proposed rulemaking will provide the required MC&A safeguards regulatory base for licensing

uranium enrichment plants producing uranium enriched to less than 10 percent in the U-235 isotope.

Two alternatives to the proposed amendments were examined. The first was to take no action and regulate uranium enrichment facilities using existing requirements in 10 CFR Part 70.51(b),(c), and (d). This alternative was rejected because the existing regulations would not provide adequate safeguards commensurate with the potential danger of operating enrichment facilities. The second alternative was to regulate uranium enrichment facilities by license condition. This alternative was rejected because it would provide neither the benefits of a comprehensive internal NRC review nor the benefits of public notice and comment.

V. Alternative Use of Resources

The NRC will use about _____ staff years to review and approve the MC&A system for a commercial uranium enrichment facility, as documented by the license or applicant in its fundamental nuclear material control plan.

VI. Agencies and Persons Consulted

During development of the proposed amendments, the Commission staff has consulted with personnel from the joint venture which has indicated intent to apply for a license to build and operate a commercial uranium enrichment plant. Also consulted were personnel with extensive uranium enrichment knowledge from Martin Marietta Energy Systems, Inc. (Oak Ridge, TN), which operates a Department of Energy enrichment facility.

VII. Finding of No Significant Impact: Availability

The Commission has determined under the National Environmental Policy Act of 1969, as amended, and the Commission's regulations in Subpart A of 10 CFR Part 51, that the proposed amendments are not a major Federal action significantly affecting the quality of the human environment, and therefore, an environmental impact statement is not required. The proposed amendments would establish MC&A requirements for commercial uranium enrichment facilities, are procedural in nature, and of themselves would have no significant impact on the environment.

Enclosure 5

Draft Public Announcement

DRAFT

NRC PROPOSES REGULATIONS ON MATERIAL CONTROL AND ACCOUNTING FOR ENRICHMENT FACILITIES

The Nuclear Regulatory Commission is considering amending its regulations to establish material control and accounting requirements for facilities that would produce enriched uranium for commercial nuclear power plants.

The proposed new regulations would include requirements to ensure that the uranium produced by enrichment facilities licensed by the NRC would be of only low enrichment (i.e., have a uranium-235 concentration of less than 10 percent).

Naturally occurring uranium must be enriched in the isotope uranium-235, whose atoms readily undergo fission and are therefore suitable for a chain reaction, before it can be used as a fuel in nuclear power plants. Natural uranium contains about 99.3 percent uranium-238, which is not fissionable, and only about 0.7 percent uranium-235. Most U.S. nuclear power reactors use uranium that is enriched to about 2 to 4 percent in uranium-235.

The current regulations for nuclear material control and accounting are not specifically designed for uranium enrichment licensees. There are no NRC-licensed enrichment plants in the country at the present time. All U.S. enrichment facilities are owned by the Department of Energy and are not subject to NRC regulation. However, there now exists a near-term potential for applications to the NRC from private companies for new enrichment facilities. There is also a possibility, over a longer term, that legislation will be enacted that would put all or part of the Department of Energy's (DOE's) enrichment facilities under the jurisdiction of NRC regulations.

Although the current regulations provide adequate protection for low-enriched uranium at other types of facilities, the Commission believes that additional safeguards are needed for uranium enrichment facilities because they could be used secretly for production of high-enriched uranium or for unauthorized production of low-enriched uranium using source material that was not entered into the accounting system.

The proposed new regulation would require licensees to implement traditional material control and accounting measures, as well as additional measures to provide specific protection at enrichment facilities. It would require enrichment facility licensees to establish a material control and accounting system that would:

- Maintain accurate, current and reliable knowledge of source material and special nuclear material;

- Protect against and detect any production of uranium enriched to 10 percent or more in the isotope uranium-235;

- Protect against and detect unauthorized production of uranium of low strategic significance;

- Resolve indications of missing uranium;

- Resolve indications of production of uranium enriched to 10 percent or more in the isotope uranium-235 and

- Resolve indications of unauthorized production of uranium of low strategic significance.

Further details of the proposed rule are contained in a Federal Register notice published on _____. Interested persons are invited to submit written comments to the Secretary, U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Docketing and Service Branch, by _____ (75 days following publication of the Federal Register notice).

#

Enclosure 6

Draft Congressional Letters

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DRAFT

The Honorable Morris K. Udall, Chairman
Subcommittee on Energy and the Environment
Committee on Interior and Insular Affairs
United States House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

In a few days the Nuclear Regulatory Commission will publish in the Federal Register the enclosed proposed amendment to the NRC's regulations in 10 CFR Part 74 concerning material control and accounting of special nuclear material at uranium enrichment facilities. This proposed rule is being promulgated in anticipation of applications for construction and operation of new uranium enrichment facilities and to formalize the NRC's regulatory position with respect to material control and accounting requirements applicable to these facilities.

The proposed amendment would require licensees who build or operate enrichment facilities to establish a written, performance-based, material control and accounting program which includes measures to maintain current knowledge of source material and special nuclear material, and assure that only low enriched uranium is produced, as authorized.

The NRC is issuing the proposed rule for public comment for 75 days and has specifically requested comments on the proposed rule, draft regulatory guide, draft regulatory analysis, and recordkeeping and reporting requirements.

Sincerely,

Eric S. Beckjord

Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

Enclosure:
Federal Register Notice

cc: Representative James V. Hansen

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DRAFT

The Honorable Philip R. Sharp, Chairman
Subcommittee on Energy and Power
Committee on Energy and Commerce
United States House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

In a few days the Nuclear Regulatory Commission will publish in the Federal Register the enclosed proposed amendment to the NRC's regulations in 10 CFR Part 74 concerning material control and accounting of special nuclear material at uranium enrichment facilities. This proposed rule is being promulgated in anticipation of applications for construction and operation of new uranium enrichment facilities and to formalize the NRC's regulatory position with respect to material control and accounting requirements applicable to these facilities.

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Sincerely,

Eric S. Beckjord

Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

Enclosure:
Federal Register Notice

cc: Representative Carlos J. Moorhead

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DRAFT

The Honorable Bob Graham, Chairman
Subcommittee on Nuclear Regulation
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

In a few days the Nuclear Regulatory Commission will publish in the Federal Register the enclosed proposed amendment to the NRC's regulations in 10 CFR Part 74 concerning material control and accounting of special nuclear material at uranium enrichment facilities. This proposed rule is being promulgated in anticipation of applications for construction and operation of new uranium enrichment facilities and to formalize tne NRC's regulatory position with respect to material control and accounting requirements applicable to these facilities.

The proposed amendment would require licensees who build or operate enrichment facilities to establish a written, performance-based, material control and accounting program which includes measures to maintain current knowledge of source material and special nuclear material, and assure that only low enriched uranium is produced, as authorized.

The NRC is issuing the proposed rule for public comment for 75 days and has specifically requested comments on the proposed rule, draft regulatory guide, draft regulatory analysis, and recordkeeping and reporting requirements.

Sincerely,

Eric S. Beckjord

Eric S. Beckjord, Director
Office of Nuclear Regulatory Research

Enclosure:
Federal Register Notice

cc: Senator Alan K. Simpson

TRANSMITTAL TO: X Document Control Desk, P1-24

ADVANCE COPY TO: _____ Public Document Room*

DATE: 10/11/90

FROM: SECY, Operations Branch

Attached are copies of SECY papers and related documents. They are being forwarded for entry on the Daily Accession List and placement in the Public Document Room. No other distribution is requested or required.

1.	SECY-90-277	11.	
	SRM on 90-277		
2.	dtd 9/27/90	12.	
	Com. Rogers' vote		
3.	Sheet on 90-277	13.	
	Com. Curtiss' vote		
4.	Sheet on 90-277	14.	
5.	SECY-90-307	15.	
	SRM on 90-307		
6.	dtd 9/28/90	16.	
7.	SECY 90-332	17.	
8.	" 90-334	18.	
9.	" 90-335	19.	
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