
LICENSED FUEL FACILITY STATUS REPORT

INVENTORY DIFFERENCE DATA
JULY 1983 - DECEMBER 1983

UNITED STATES NUCLEAR REGULATORY COMMISSION



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ABSTRACT

NRC is committed to the periodic publication of licensed fuel facilities inventory difference data, following agency review of the information and completion of any related investigations. Information in this report includes inventory difference data for active fuel fabrication facilities possessing more than one effective kilogram of high enriched uranium, low enriched uranium, plutonium, or uranium-233.

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ABBREVIATIONS

CFR	Code of Federal Regulations
HEU	high enriched uranium
ID	inventory difference
LEID	limit of error of the inventory difference
LEU	low enriched uranium
MUF	material unaccounted for
NRC	U.S. Nuclear Regulatory Commission
SNM	special nuclear material
S-R	shipper-receiver

LICENSED FUEL FACILITY STATUS REPORT INVENTORY DIFFERENCE DATA

Inventory Difference Data

An inventory difference (ID), also referred to as material unaccounted for (MUF), is the difference between the quantity of special nuclear material (SNM) that a licensee's accounting records show should be on hand and that which a licensee's physical inventory shows is actually on hand.

The inventory difference data presented are for active, licensed facilities that are authorized to possess, in an unsealed form, at least one effective kilogram of special nuclear material (that is, high enriched uranium, plutonium, and uranium-233) or at least one effective kilogram of low enriched uranium (for example, the nuclear fuel used in commercial light-water nuclear power reactors). The U.S. Nuclear Regulatory Commission (NRC) requires licensees possessing significant quantities of high enriched uranium, plutonium, or uranium-233 to conduct an inventory every 2 months. Licensees possessing one effective kilogram of low enriched uranium are required to inventory every 6 months, except for General Electric Co., Wilmington, NC, which is required to inventory every 12 months.

It is important to understand the distinction between the low strategic value of low enriched uranium (LEU) and the higher strategic value of high enriched uranium (HEU) and plutonium. Most low enriched uranium (the nuclear fuel for commercial light-water power reactors) is enriched to a level of 1 to 4 percent in the isotope uranium-235. At this level of enrichment, the uranium is not capable of sustaining the kind of nuclear reaction that takes place in a nuclear explosion.

NRC safeguards requirements covering low enriched uranium are graded to reflect its low strategic value. They include a formal structured system for material control and accounting and minimal physical security measures. On the other hand, because of the higher strategic importance of significant quantities of high enriched uranium and plutonium, NRC requires licensees to provide substantial physical protection of this material in addition to controlling and accounting for it. Physical protection of this material includes safeguards measures such as barriers, intrusion alarms, armed guards, and offsite police response capabilities. Internal systems to control the movement of this nuclear material are also required by NRC.

Inventory differences arise when nuclear materials are processed (particularly when chemical operations are involved). These differences can result from variations in measuring and processing, measurement inaccuracy or imprecision, unmeasured flows from the process, unmeasured inventory, bookkeeping errors, or loss or theft. Although an inventory difference larger than its overall measurement uncertainty (limit of error of the inventory difference - LEID)

may signal an abnormal situation requiring determination of cause, the fact that an inventory difference falls within its associated limit of error--even an inventory difference of zero--provides no automatic or conclusive proof that loss or theft of material has not occurred. Therefore, NRC relies on information provided not only by the material accounting system but also by the internal control system, the physical security system, NRC inspections and evaluations, and NRC and licensee investigations.

A method that licensees and NRC currently use to determine the significance of the inventory difference is a concept called LEID, or limit of error of the inventory difference. LEID is a calculated estimate of the measurement uncertainties that are associated with a plant's processing activity. The inventory difference theoretically should be less than LEID 19 out of 20 times, if the inventory difference results only from measurement uncertainty.

Because an inventory difference that exceeds its associated LEID may be an indication of processing problems, biased or otherwise inaccurate measurements, book-keeping errors, or loss or theft of material, NRC accordingly requires licensees to take increasingly stronger investigative actions depending on how much the inventory difference exceeds LEID. During this reporting period (July 1 through December 31, 1983) five of twenty-two inventories resulted in inventory differences that exceeded their associated limits of error. There were four gains and one loss of SNM. An inventory gain that occurred during one of three HEU inventories at GA Technologies resulted from recovery of material held up in production process equipment. Reanalysis of data from prior reporting periods was the cause of a gain for one of three HEU inventories conducted at United Nuclear Corporation. Decontamination and decommissioning activities at Rockwell, ESG produced a gain of HEU for one inventory because of material recovered from filters and ducting. The first of three HEU inventories at the Nuclear Fuel Services facility indicated that the inventory difference (a gain) exceeded the limit of error, but the licensee's subsequent investigation identified the contributing factors. The next HEU inventory resulted in a loss that exceeded the limit of error, but which was within other applicable regulatory limits. The subsequent investigation did not completely explain the inventory difference, but corrective actions were initiated by the licensee.

Definitions of Terms

1. Source material: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) uranium, (ii) thorium, or (iii) any combination thereof. Source material does not include special nuclear material.
2. Special nuclear material (SNM): (1) Plutonium, uranium-233, uranium enriched in the isotope 235, and any other material that the Commission, pursuant to the provisions of Section 51 of the Atomic Energy Act of 1954, as amended, determined to be special nuclear material, but does not include source material; or (2) any material artificially enriched in any of the foregoing, but does not include source material.
3. Effective kilogram of special nuclear material: (1) For plutonium and uranium-233, their weight in kilograms; (2) for uranium with an enrichment in the isotope uranium-235 of 0.01 (1%) and above, its element weight in kilograms multiplied by the square of its enrichment expressed as a decimal weight fraction; and (3) for uranium with an enrichment in the isotope uranium-235 below 0.01 (1%), its element weight in kilograms multiplied by 0.0001.
4. Strategic special nuclear material: Uranium-235 (contained in uranium enriched to 20 percent or more in the U-235 isotope), uranium-233, or plutonium.
5. Isotope: One of two or more atoms with the same number of protons, but different numbers of neutrons in their nuclei.
6. High enriched uranium (HEU): Uranium whose isotope content is 20 percent or more uranium-235 by weight.
7. Low enriched uranium (LEU): Uranium whose isotope content is less than 20 percent uranium-235 by weight.
8. Inventory difference (ID): The arithmetic difference between a book inventory and the corresponding physical inventory, calculated by subtracting ending inventory (EI) plus removals (R) from beginning inventory (BI) plus additions (A). Mathematically, this becomes
$$ID = (BI + A) - (EI + R).$$
9. Limit of error: The uncertainty component used in constructing a 95 percent confidence interval associated with a quantity after any recognized bias has been eliminated or its effect accounted for.

10. Limit of error of the inventory difference (LEID): That limit of error associated with the inventory difference after the material balance data have been adjusted for any recognized bias.
11. "The inventory difference falls within the applicable regulatory limit": The ID does not exceed 1.5 times any applicable LEID limits specified in 10 CFR 70.51(e)(5) or other LEID limits approved by the NPC under 10 CFR 70.51(e)(6).
12. Negative inventory difference: A situation that occurs when the amount of material on hand, as determined by physical inventory, exceeds the amount of material being carried on the books (that is, there appears to be a gain of material). Mathematically, a negative ID is written as -ID or is shown in parentheses. A negative ID is also referred to as an "ID gain."
13. Positive inventory difference: A situation that occurs when the amount of material on hand, as determined by physical inventory, is less than the amount of material being carried on the books (that is, there appears to be a loss of material). Mathematically, a positive ID is written as +ID or ID (without designation of sign). A positive ID is also referred to as an "ID loss."
14. Shipper-receiver difference (S-R difference): The arithmetic difference between the quantity of special nuclear material measured by the shipper and the quantity measured by the receiver.

Tabulation of Inventory Differences

Licensee	Licensee No. SNM-	Material Type	Inventory Date	Inventory Difference (Grams of U-235)	Explanation
Babcock & Wilcox, Naval Nuclear Fuel Div., Lynchburg, VA	42	HEU	8/26/83	-881	The inventory difference falls within the applicable regulatory limit.
		LEU	8/26/83	19	The inventory difference falls within the applicable regulatory limit.
		HEU	10/28/83	251	The inventory difference falls within the applicable regulatory limit.
		LEU	10/28/83	22	The inventory difference falls within the applicable regulatory limit.
Babcock & Wilcox, Apollo, PA	145	LEU			No inventory was conducted during the reporting period.
Babcock & Wilcox, Lynchburg Research Center, Lynchburg, VA	778	LEU			No inventory was conducted during the reporting period.
Babcock & Wilcox, Commercial Nuclear Fuel Plant, Lynchburg, VA	1168	LEU			No inventory was conducted during the reporting period.
Combustion Engineer- ing, Hematite, MO	33	LEU			No inventory was conducted during the reporting period.

Licensee	Licensee No. SNM -	Material Type	Inventory Date	Inventory Difference (Grams of U-235)	Explanation
Combustion Engineering, Windsor, CT	1067	LEU	10/13/83	4,187	The inventory difference falls within the applicable regulatory limit.
Exxon Nuclear Co., Richland, WA	1227	LEU	11/10/83	-20,184	The inventory difference falls within the applicable regulatory limit.
GA Technologies, La Jolla, CA	696	HEU	7/11/83	597	The inventory difference falls within the applicable regulatory limit.
		HEU	9/12/83	-1,188	The inventory gain resulted from the recovery of material held up in production process equipment.
		LEU	9/12/83	24	The inventory difference falls within the applicable regulatory limit.
		HEU	11/14/83	-271	The inventory difference falls within the applicable regulatory limit.
General Electric, Wilmington, NC	1097	LEU	8/8/83	50,612	The inventory difference falls within the applicable regulatory limit.
Nuclear Fuel Services, Erwin, TN	124	LEU	10/20/83	-3,184	The inventory difference falls within the applicable regulatory limit.
		HEU	8/26/83	-1,729	The inventory difference exceeded the limit of error, but the licensee's subsequent investigation identified the contributing factors.

Licensee	Licensee No. SNM-	Material Type	Inventory Date	Inventory Difference (Grams of U-235)	Explanation
Nuclear Fuel Services, Erwin, TN (Continued)	124	HEU	10/27/83	2,808	The inventory difference exceeded the limit of error, but was within other applicable regulatory limits and license conditions. The licensee's subsequent investigation did not completely explain the inventory difference, but corrective actions were initiated for the identified sources of difference.
		HEU	12/28/83	1,212	The inventory difference falls within the applicable regulatory limit.
Rockwell, ESG, Canoga Park, CA	21	HEU	7/5/83	*	The inventory difference falls within the applicable regulatory limit.
		LEU	7/5/83	*	The inventory difference falls within the applicable regulatory limit.
		Pu	7/5/83	-2	The inventory difference falls within the applicable regulatory limit.
		HEU	9/6/83	-154	The inventory difference falls within the applicable regulatory limit.
		Pu	9/6/83	-29	The inventory difference falls within the applicable regulatory limit.

* Represents a negligible quantity.

Licensee	Licensee No. SNM-	Material Type	Inventory Date	Inventory Difference (Grams of U-235)	Explanation
Rockwell, ESG, Canoga Park, CA (Continued)	21	HEU	11/7/83	-722	The gain of special nuclear material is attributed to recovery of residual holdup concentrated in filters and ducting from areas undergoing decontamination and decommissioning.
		LEU	11/7/83	-23	The inventory difference falls within the applicable regulatory limit.
		U-233	11/7/83	*	The inventory difference falls within the applicable regulatory limit.
		Pu	11/7/83	-15	The inventory difference falls within the applicable regulatory limit.
Union Carbide, Tuxedo, NY	639	HEU	7/5/83	-66	The inventory difference falls within the applicable regulatory limit.
		HEU	9/1/83	-90	The inventory difference falls within the applicable regulatory limit.
		HEU	11/4/83	-17	The inventory difference falls within the applicable regulatory limit.

* Represents a negligible quantity.

Licensee	Licensee No. SNM-	Material Type	Inventory Date	Inventory Difference (Grams of U-235)	Explanation
United Nuclear Corp., Montville, CT	368	HEU	7/9/83	284	The inventory difference falls within the applicable regulatory limit.
		HEU	9/9/83	268	The inventory difference falls within the applicable regulatory limit.
		HEU	11/11/83	-860	The gain, which exceeds the LEID, is because of corrections resulting from reanalysis of data from prior reporting periods.
Westinghouse, Columbia, SC	1107	LEU	10/22/83	-12,810	The inventory difference falls within the applicable regulatory limit.

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NRC is committed to the periodic publication of licensed fuel facilities inventory difference data, following agency review of the information and completion of any related NRC investigations. Information in this report includes inventory difference data for active fuel fabrication facilities possessing more than one effective kilogram of high enriched uranium, low enriched uranium, plutonium, or uranium-233.

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