DOE/DP-0001-6

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Semi-Annual Report on Strategic Special Nuclear Material Inventory Differences

July 1980

U.S. Department of Energy
Assistant Secretary for Defense Programs
Office of Safeguards and Security

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Printed in the United States of America

Available from

National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161

NTIS price codes

Printed Copy: $ 6.~~00~~ 50
Microfiche Copy: $ 3.50

DOE/DP-0001-6
UC-16

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STATEMENT OF THE

DEPARTMENT OF ENERGY (DOE) DIRECTOR OF SAFEGUARDS AND SECURITY

The Department of Energy has specified accounting requirements as part of its integrated safeguards system for the protection of special nuclear materials. This report provides and explains the generally small differences between the amounts of nuclear materials charged to DOE facilities and the amounts that could be physically inventoried.

These Inventory Differences, previously called Material Unaccounted For (MUF), are being publicly released on a semiannual basis, as required by the National Security Council. This report covers data for the period from April 1, 1979, through September 30, 1979, and includes accounting corrections for data from earlier periods. It is the sixth such semi-annual report, subsequent to the August 4, 1977 publication (by DOE's predecessor, Energy Research and Development Administration) of all historical Inventory Difference data prior to October 1, 1976. All Inventory Differences reported here have been analyzed, investigated when necessary, and resolved.

These data and explanations, together with the absences of physical indications of any theft attempt, support a finding that during this period no theft or diversion of strategic special nuclear material has occurred.

George Weisz
Director
Office of Safeguards and Security
Defense Programs
Department of Energy

UNITED STATES DEPARTMENT OF ENERGY
REPORT ON STRATEGIC SPECIAL NUCLEAR MATERIAL INVENTORY DIFFERENCES
APRIL 1, 1979 THROUGH SEPTEMBER 30,1979

This sixth periodic semiannual report of Inventory Differences (ID) covers the last six months of fiscal year 1979 (April 1, 1979, through September 30, 1979), for the Department of Energy (DOE) and DOE contractor facilities possessing significant quantities of strategic special nuclear material (SSNM)*. The initial ID report, issued as ERDA 77-68 in August 1977, contained data for fiscal year 1976 (July 1, 1975, through September 30, 1976), for the Energy Research and Development Administration (ERDA) and ERDA contractor facilities and also contained historical data for ERDA/AEC and ERDA/AEC contractor facilities from 1947 through fiscal year 1975 and for AEC licensees from 1954 through calendar year 1967, including cumulative IDs by facility. The first semiannual ID report was issued as DOE/DP-000-1 in January 1978, and covered the first six months of fiscal year 1977.

Inventory Differences are simply the differences between the amount of material shown in the accounting records and the amount of material reported in the physical inventory. These differences are generally due to errors in estimating material in unmeasurable form at the time of an inventory, unmeasurable holdup in equipment, measurement imprecisions, inaccuracies in initial determinations of SSNM produced or used in nuclear reactors, and inventory or bookkeeping errors. Both DOE and contractors operating DOE facilities carefully maintain, analyze, and investigate ID data.

IDs are expected in nuclear material processing and are not, in and of themselves, evidence of lost or stolen material. On the other hand, ID analysis provides valuable information on the effectiveness of the safeguards system's physical protection and material control measures as well as a check on the process controls and material management procedures. IDs outside safeguards control limits or involving a missing SSNM discrete item are investigated. If necessary, an operation may be shut down until an ID is resolved.

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* Strategic special nuclear material is plutonium or uranium-233 or uranium-235 in material whose uranium-235 content is 20% or greater (known as highly enriched uranium). A significant quantity is either 2 kilograms of plutonium or uranium-233 or 5 kilograms of uranium-235 in highly enriched uranium or the appropriate weighted combination.

Analysis of accounting statistics alone, however, cannot show with absolute certainty that theft has not occurred. Therefore, DOE relies on a safeguards system that integrates stringent physical security and material control measures with material measurement and accounting to ensure that material is not misappropriated. It is this total integrated safeguards system coupled with analysis and, when necessary, investigations of IDs, that DOE and DOE contractors operating DOE facilities use to arrive at a judgment of whether theft of significant amounts of SSNM has occurred.

Analyses of the data as they were generated, in each case, have resulted in the explanations for the IDs provided in this report. These explanations, together with the absence of physical indications of any theft attempt, support a finding that during this period no theft or diversion of nuclear material has occurred.

The Inventory Differences reported during this period represent the summation of numerical gains and losses. The volume of materials measured while in process, transferred and or in inventory has an effect upon the reported inventory differences. The ratio of inventory differences to the amount of material in inventory is a measure of the acceptability of the inventory differences. In addition, analyses are made of each ID, to determine whether the explanations given are reasonable. In this report all the IDs are considered well within expected measurement variations. The explanations for the IDs in the report columns headed "Analysis Findings" indicate that there has not been any new unexplained variations from the reported IDs of previous years.

The IDs of the uranium processed through the gaseous diffusion facilities at Portsmouth, Paducah, and Oak Ridge, involve the measurement of materials largely in gas-tight process equipment in a reactive gaseous form under elevated temperature and pressure. The IDs for this period are reasonable and consistent with expected normal operations and the very large amounts of materials handled in these types of facilities. Not included in this report are data for the Rocky Flats and Y-12 nuclear weapons production facilities, in order to protect classified nuclear weapons information. However, the classified ID data from these facilities receive the same scrutiny and analysis as the unclassified data and similar conclusions were reached.

INVENTORY DIFFERENCE DATA

APRIL 1, 1979 TO SEPTEMBER 30, 1979

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and Contractor	Inventory Difference in Kilograms	Analysis findings
Albuquerque		
Los Alamos National Scientific Laboratory, Los Alamos, New Mexico	.4	Cumulative Inventory differences as a result of measurement differences for difficult to measure processing residues.
Mason & Hanger-Silas Mason co., Inc., Amarillo, Texas	None	All material contained in weapons parts and have been accounted for.
Monsanto Research Corporation Mound Facility Miamisburg, Ohio	<0.1	Cumulative inventory differences due to measurement uncertainties for low-level residues.
Sandia National Laboratories Albuquerque, New Mexico	None	All material is contained in discrete identifiable forms and have been accounted for.
Chicago		
Argonne National Laboratory Argonne, Illinois	0.1	Cumulative inventory difference due to rounding and remeasurement of discrete material in inventory.

<0.1 Means inventory difference amount is less than 50 grams.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Chicago (continued)		
Argonne National Laboratory Idaho National Engineering Laboratory Idaho Falls, Idaho	<0.1	Cumulative inventory difference due to rounding.
Battelle, Columbus Laboratories Columbus, Ohio	(0.1)	Cumulative inventory difference due to remeasurement adjustments.
Brookhaven National Laboratory Upton, New York	None	All material accounted for.
Idaho		
Exxon Nuclear Idaho Co., Inc. ICPP Idaho National Engineering Laboratory Idaho Falls, Idaho	(0.1)	Cumulative amounts of produced plutonium measured during recovery of irradiated high enriched uranium fuel elements.
EG&G Idaho, Inc. TRA Idaho National Engineering Laboratory Idaho Falls, Idaho	<0.1	Difference due to rounding.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and contractor	Inventory Difference in Kilograms	Analysis findings
Idaho (continued)		
EG&G Idaho, Inc. ARA, LOFT, PBF, TAN Idaho National Engineering Laboratory Idaho Falls, Idaho	None	All material accounted for.
Nevada		
Nevada Test Site Mercury, Nevada	None	All material contained in test devices has been accounted for.
Oak Ridge		
Oak Ridge National Laboratory Oak Ridge, Tennessee	(<0.1)	Cumulative inventory difference due to small measurement inaccuracies.
Pittsburgh Naval Reactors		
Duquesne Light Company Shippingport, Pennsylvania	None	Contained in irradiated fuel elements. All elements accounted for.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Pittsburgh Naval Reactors (continued)		
Westinghouse, Naval Reactors Facility Idaho National Engineering Laboratory Idaho Falls, Idaho	None	Contained in irradiated fuel elements. All elements accounted for.
Westinghouse, Bettis Atomic Power Laboratory West Mifflin, Pennsylvania	None	Contained in irradiated sample, standards and sources. All items accounted for.
Richland		
Rockwell Hanford Operations Richland, Washington	(3.6)	Cumulative inventory differences resulting from the remeasurement of Plutonium inventories associated with conversion and reprocessing facilities.
Hanford Engineering Development Laboratory Richland, Washington	(0.5)	Cumulative small inventory differences resulting from the remeasurement of Plutonium.
Battelle Pacific Northwest Laboratories Richland, Washington	(0.3)	Cumulative small inventory differences as results of remeasured values of Plutonium taken at different inventory periods.

( ) Means an inventory increase.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Richland (continued)		
United Nuclear Industries, Inc. Richland, Washington	(0.1)	Cumulative small inventory differences from periodic inventory evaluations of Plutonium contained in irradiated fuel elements.
San Francisco		
Atomics International Canoga Park, California	<0.1	Cumulative inventory differences resulting from measurements uncertainty and rounding.
Lawrence Livermore National Laboratory, Livermore, California	(<0.1)	Cumulative inventory differences resulting from redetermination of material in process, equipment holdup and rounding differences.
Savannah River		
E. I. duPont de Nemours Aiken, South Carolina	1.5	Cumulative inventory differences resulting from remeasurement adjustments, shipper/receiver adjustments, adjustments from prior recording and reporting errors, and many small measurement inaccuracies.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM*

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Schenectady Naval Reactors		
General Electric Co. Knolls Atomic Power Lab. Schenectady, New York	(<0.1)	Inventory differences resulting from redetermination of material in identifiable items.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.
* This and subsequent Plutonium tables exclude Pu-238 which is reported separately.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Albuquerque		
Los Alamos National Scientific Laboratory, Los Alamos, New Mexico	7.8	Cumulative inventory differences due to remeasurement of uranium fuel element scrap, and measurement uncertainties for difficult-to-measure residues.
Mason & Hanger-Silas Mason Co., Inc. Amarillo, Texas	None	Contained in weapons parts. All parts accounted for.
Monsanto Research Corporation Mound Facility Miamisburg, Ohio	<0.1	Cumulative inventory differences due to remeasurement and rounding.
Sandia National Laboratories Albuquerque, New Mexico	<0.1	Cumulative inventory differences due to rounding.
Chicago		
Argonne National Laboratory Argonne, Illinois	None	All material accounted for.
Argonne National Laboratory Idaho National Engineering Laboratory Idaho Falls, Idaho	(<0.1)	Cumulative inventory differences due to recording and reporting errors, rounding, and shipper/receiver differences.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Chicago (continued)		
Battelle, Columbus Laboratories Columbus, Ohio	(<0.1)	Cumulative inventory differences due to remeasurement adjustments and rounding.
Brookhaven National Laboratory Upton, New York	(<0.1)	Inventory difference due to rounding.
Idaho		
Exxon Nuclear Idaho Co., Inc. ICPP Idaho National Engineering Laboratory Idaho Falls, Idaho	1.4	Cumulative inventory differences resulting from adjustments to inventory records based on plant cleanout and physical inventory, and minor differences from remeasurement and rounding.
EG&G Idaho, Inc. TRA Idaho National Engineering Laboratory Idaho Falls, Idaho	(<0.1)	Cumulative inventory differences due to recording errors and rounding.
EG&G Idaho, Inc. ARA, LOFT, PBF, TAN Idaho National Engineering Laboratory Idaho Falls, Idaho	(<0.1)	Cumulative differences due to rounding.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Nevada		
Nevada Test Site Mercury, Nevada	None	Inventory consists principally of test devices and nuclear rocket fuel. All material accounted for.
Oak Ridge		
Goodyear Atomic Corporation Piketon, Ohio (except cascades)	(0.6)	Cumulative inventory differences due to remeasurement, sampling, and measurement uncertainties.
Oak Ridge National Laboratory Oak Ridge, Tennessee	<0.1	Cumulative inventory difference due to remeasurement, rounding, sampling and measurement uncertainties.
Pittsburgh Naval Reactors		
Pittsburgh Naval Reactors Office West Mifflin, Pennsylvania	None	Contained in unirradiated fuel elements. All elements accounted for.
Westinghouse, Bettis Atomic Power Laboratory West Mifflin, Pennsylvania	0.7	Cumulative inventory difference due to differences between estimated scrap value and measured material recovered, rounding, and measurement adjustments.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Pittsburgh Naval Reactors (continued)		
Westinghouse, Naval Reactors Facility Idaho National Engineering Laboratory Idaho Falls, Idaho	None	Contained in unirradiated and irradiated fuel elements. All elements accounted for.
Richland		
Rockwell Hanford Operations Richland, Washington	<0.1	Contained in scrap in static storage under seal. Inventory differences due to an adjustment to the records for improperly reported material types.
Hanford Engineering Development Laboratory Richland, Washington	0.4	Cumulative small inventory differences resulting from the remeasurement of enriched uranium.
Battelle, Pacific Northwest Laboratories Richland, Washington	(1.2)	Cumulative small inventory differences resulting from the remeasurement of enriched uranium.
San Francisco		
Atomics International Canoga Park, California	None	All items accounted for.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
San Francisco (continued)		
Lawrence Livermore National Laboratory, Livermore, California	(0.1)	Cumulative inventory differences resulting from redetermination of material in process, equipment holdup and rounding.
Lawrence Livermore National Laboratory, Mercury, Nevada	None	Contained in reactor fuel. All items acccounted for.
Savannah River		
E. I. duPont de Nemours Aiken, South Carolina	(20.8)	Cumulative inventory differences resulting from measurement uncertainties in the processing and inventorying of scrap material from fuel fabrication, measurement uncertainties in the recovery process, shipper/receiver adjustments, and adjustments from prior recording and reporting errors.
Schenectady Naval Reactors		
General Electric Company Kesselring Site West Milton, New York	None	Invertory consists of prototype reactor fuel. All material accounted for.

( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
U-235 IN 20% AND GREATER ENRICHED URANIUM

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Schenectady Naval Reactors (continued)		
General Electric Company Knolls Atomic Power Laboratory Schenectady, New York	(<0.1)	Cumulative inventory difference due to many small measurement differences and rounding.
General Electric Company Windsor Site Windsor, Connecticut	None	Inventory consists of prototype reactor fuel. All material accounted for.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
FOR THE URANIUM GASEOUS DIFFUSION CASCADES

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Oak Ridge		
Goodyear Atomic Corporation Piketon, Ohio (Average Enrichment = 1.4%)	30.0	The inventory differences at all facilities are due to equipment holdup, the combined uncertainties of sampling and measurement of receipts, removals, gas phase inventory, and rounding of inventories to the nearest kilogram in various material accountability areas.
Union Carbide, Nuclear Division Oak Ridge, Tennessee (Average Enrichment = 1.00%)	(18.0)	
Union Carbide, Nuclear Division Paducah, Kentucky (Average Enrichment = 0.69%)	(2.0)	

( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
URANIUM-233

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Albuquerque		
Los Alamos National Scientific Laboratory, Los Alamos, New Mexico	<0.1	Cumulative inventory differences due to rounding.
Monsanto Research Corporation Mound Facility Miamisburg, Ohio	<0.1	Cumulative inventory differences due to rounding.
Chicago		
Argonne National Laboratory Argonne, Illinois	None	All material accounted for.
Argonne National Laboratory Idaho National Engineering Laboratory Idaho Falls, Idaho	(<0.1)	Inventory differences due to rounding.
Idaho		
Exxon Nuclear Idaho Co., Inc. ICPP Idaho National Engineering Laboratory Idaho Falls, Idaho	<0.1	Inventory differences due to rounding.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
URANIUM-233

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Idaho (continued)		
EG&G Idaho, Inc. TRA Idaho National Engineering Laboratory Idaho Falls, Idaho	None	All material accounted for.
Oak Ridge		
Oak Ridge National Laboratory Oak Ridge, Tennessee	<0.1	Cumulative inventory dfferences due to measurement uncertainties.
Pittsburgh Naval Reactors		
Duquesne Light Company Shippingport, Pennsylvania	None	Contained in irradiated fuel elements within an operating reactor. All elements accounted for.
Westinghouse, Bettis Atomic Power Laboratory West Mifflin, Pennsylvania	(0.2)	Cumulative inventory difference due to redetermination of discrete items and roundings.
Westinghouse Electric Corporation Naval Reactors Facility Idaho Falls, Idaho	None	Contained in unirradiated and irradiated fuel elements. All elements accounted for.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
URANIUM-233

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
San Francisco		
Lawrence Livermore National Laboratory, Livermore, California	<0.1	Cumulative inventory differences resulting from redetermination of discrete items on inventory and measurement adjustment.
Savannah River		
E. I. duPont de Nemours Aiken, South Carolina	None	Inventory consists principally of irradiated fuel in storage basin. All material accounted for.

<0.1 Means inventory difference amount is less than 50 grams.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM-238

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Albuquerque		
Los Alamos National Scientific Laboratory, Los Alamos, New Mexico	(0.1)	Cumulative inventory differences from shutdown and cleanout of the facility.
Monsanto Research Corporation Mound Facility Miamisburg, Ohio	(<0.1)	Cumulative inventory differences from cleanup of equipment and "gloveboxes" in process area.
Sandia National Laboratories Albuquerque, New Mexico	None	Material contained in heat sources. All sources accounted for.
Oak Ridge		
Oak Ridge National Laboratory Oak Ridge, Tennessee	None	All material accounted for.
Idaho		
Exxon Nuclear Idaho Co., Inc. ICPP Idaho National Engineering Laboratory Idaho Falls, Idaho	None	All material accounted for.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

SECOND HALF OF FISCAL YEAR 1979 INVENTORY DIFFERENCES
DOE AND DOE CONTRACTOR SPECIAL NUCLEAR MATERIALS
PLUTONIUM-238

Field Office and Contractor	Inventory Difference in Kilograms	Analysis Findings
Idaho (continued)		
EG&G Idaho, Inc. ARA, LOFT, PBF, TAN Idaho National Engineering Laboratory Idaho Falls, Idaho	None	All material accounted for.
Richland		
Rockwell Hanford Operations Richland, Washington	(<0.1)	Contained in scrap in static storage under seal. Inventory differences due to rounding of quantities for individual items after decay adjustments.
Savannah River		
E. I. duPont de Nemours Aiken, South Carolina	1.8	Cumulative inventory differences due to remeasurements, shipper/receiver adjustments and many small measurement inaccuracies in the recovery process.

<0.1 Means inventory difference amount is less than 50 grams.
( ) Means an inventory increase.

ABBREVIATIONS

CPP	Chemical Processing Plant
TRA	Test Reactor Area
ARA	Auxiliary Reactor Area
LOFT	Loss of Fluid Test
PBF	Power Burst Facility
TAN	Test Area North

*U S GOVERNMENT PRINTING OFFICE: 1980 341-076/1112