ORNL/TM-6010

Bulk Shielding Facility Quarterly Report October, November, and December of 1976

S. S. Hurt, III
E. D. Lance
J. R. Thomas

OAK RIDGE NATIONAL LABORATORY
OPERATED BY UNION CARBIDE CORPORATION FOR THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

DISCLAIMER

Printed in the United States of America. Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road, Springfield, Virginia 22161
Price: Printed Copy $4.00; Microfiche $3.00

Abu Dhabi
USE United Arab Emirates

ACOUSTIC MEASUREMENTS
UF Sonic Measurements
RT Acoustic Monitoring
RT Acoustic Testing
RT Seismic Surveys
RT Seismographs
RT Sonic Logging
RT Sonic Probes
RT Ultrasonic Testing
DEF Measurement of properties, quantities, or conditions of acoustical i.e., mechanical waves.

ACTINIUM 227 TARGET [01]
BT1 Targets

Activity Transport
USE Radioactivity Transport

Added Mass Effect
USE Hydrodynamic Mass Effect

ADVERSARIES
RT Nuclear Materials Diversion
RT Sabotage
RT Security
RT Theft

AERATION
RT Air
RT Gases
RT Mixing

→ **AFTERLOADING [01]**
BT1 Radiotherapy

Agglomerating Burner Gasification Process
USE Agglomerating Ash Process

AGUIRRE REACTOR [01]
(Relocated and renamed North Coast-1 Reactor)
BT1 Power Reactors
BT1 PWR Type Reactors
RT North Coast-1 Reactor

Air-Fuel Ratio
USE Fuel-Air Ratio

AIR POLLUTION MONITORS
UF Monitors (Air Pollution)
NT1 Air Samplers
RT Aerosol Monitoring
RT Air Filters
RT Cascade Impactors
RT Electrostatic Precipitators

AIRCRAFT COMPONENTS
BT1 Aircraft

Ajman
USE United Arab Emirates

ALDRIN [01]
BT1 Chlorinated Aromatic Hydrocarbons
BT1 Insecticides

ALKALI METAL ISOTOPES
BT1 Isotopes
NT1 Cesium Isotopes
NT1 Francium Isotopes
NT1 Lithium Isotopes
NT1 Potassium Isotopes
NT1 Rubidium Isotopes
NT1 Sodium Isotopes

ALKALINE EARTH ISOTOPES
BT1 Isotopes
NT1 Barium Isotopes
NT1 Beryllium Isotopes
NT1 Calcium Isotopes
NT1 Magnesium Isotopes
NT1 Radium Isotopes
NT1 Strontium Isotopes

ALUMINIUM 27 TARGET [01]
BT1 Targets

AMERICIUM 241 TARGET [01]
BT1 Targets

AMERICIUM 242 TARGET [01]
BT1 Targets

AMERICIUM 243 TARGET [01]
BT1 Targets

AMMONIUM PERCHLORATES
BT1 Ammonium Compounds
BT1 Perchlorates
RT Propellants

ANTIMONY 120 TARGET [01]
BT1 Targets

ANTIMONY 121 TARGET [01]
BT1 Targets

ANTIMONY 123 TARGET [01]
BT1 Targets

APPENNINES [01]
BT1 Italy
BT1 Mountains

ARCTIC GAS PIPELINES
UF Polar Gas Project
BT1 Pipelines
RT Natural Gas
RT Transport
RT Transportation Systems

ARGON 36 TARGET [01]
BT1 Targets

ARGON 38 TARGET [01]
BT1 Targets

ARGON 40 TARGET [01]
BT1 Targets

ARMATURES
RT Electric Generators
RT Electric Motors

ARMOR
RT Guns
RT Projectiles

ARSENIC 75 TARGET [01]
BT1 Targets

ASPENS
BT1 Trees

ASTHMA
BT1 Respiratory System Diseases

Atomic Shells (K)
USE K Shell

Atomic Shells (L)
USE L Shell

Atomic Shells (M)
USE M Shell

BAHRAIN
BT1 Asia
BT1 Developing Countries
BT1 Middle East

BAILIE PROCESS
BT1 Waste Processing
RT Pyrolysis
RT Solid Wastes
RT Waste Processing Plants
DEF Fluidized-bed pyrolysis process using air for conversion of municipal solid waste into intermediate Btu gas.

BARIUM 130 TARGET [01]
BT1 Targets

BARIUM 134 TARGET [01]
BT1 Targets

BARIUM 136 TARGET [01]
BT1 Targets

BARIUM 138 TARGET [01]
BT1 Targets

BARIUM 139 TARGET [01]
BT1 Targets

BATTELLE PACIFIC NORTHWEST LABORATORIES
BT1 US ERDA
RT Hanford Reservation
RT HAPO

BATTERY PASTE
RT Electric Batteries
RT Electrodes
RT Grids

BEDROCK PROJECT
BT1 Nuclear Explosions
BT1 Underground Explosions

BENTHOS
RT Aquatic Ecosystems
DEF Aquatic bottom dwelling organisms.

→ **BERKELIUM 249 TARGET [01]**
BT1 Targets

BERYLLIUM 9 TARGET [01]
BT1 Targets

BERYLLIUM 10 TARGET [01]
BT1 Targets

Biblis-C Reactor
USE Biblis-3 Reactor

Biblis-D Reactor
USE Biblis-4 Reactor

→ **BIBLIS-3 REACTOR [01]**
UF Biblis-C Reactor
UF Kernkraftwerk Biblis-3
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors

→ **BIBLIS-4 REACTOR [01]**
UF Biblis-D Reactor
UF Kernkraftwerk Biblis-4
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors

BICYCLES
BT1 Vehicles

Biofouling

USE Fouling

BIOLOGICAL FUNCTIONS [01]
(Coordinate with descriptors for the organs or functions involved.)
UF Function (Biological)
RT Dynamic Function Studies
RT Metabolism
RT Physiology

BIOMASS PLANTATIONS
RT Agriculture
RT Algae
RT Biomass
RT Crops
RT Trees
DEF Terrestrial or marine area and plants for the growing, harvesting, and collection of energy or combined energy/food crops for conversion into fuels.

BISMUTH 209 TARGET [01]
BT1 Targets

BISMUTH 210 TARGET
BT1 Targets

BLISTERS [01]
RT Bubbles
RT Surfaces

BORON 10 TARGET [01]
BT1 Targets

BORON 11 TARGET [01]
BT1 Targets

BORON 12 TARGET [01]
BT1 Targets

BORON 13 TARGET [01]
BT1 Targets

BREEDING PELLETS [01]
UF Pellets (Breeding)
RT Breeder Reactors
RT Breeding
RT Breeding Blankets
RT Thermonuclear Reactors

→ **BROKDORF REACTOR [01]**
UF Kernkraftwerk Brokdorf
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors

BROMINE 79 BEAMS [01]
BT1 Ion Beams
RT Bromine 79

BROMINE 79 TARGET [01]
BT1 Targets

BROMINE 81 TARGET [01]
BT1 Targets

BRUNEI
(Sultanate and British Protectorate, NW Borneo.)
BT1 Asia

BUOYS
RT Meteorology
RT Navigational Instruments
RT Oceanography
RT Offshore Operations
RT Water Pollution

CABLES
NT1 Electric Cables

CADMIUM CARBIDES
BT1 Cadmium Compounds
BT1 Carbides

CADMIUM 106 TARGET [01]
BT1 Targets

CADMIUM 108 TARGET [01]
BT1 Targets

CADMIUM 110 TARGET [01]
BT1 Targets

CADMIUM 111 TARGET [01]
BT1 Targets

CADMIUM 112 TARGET [01]
BT1 Targets

CADMIUM 113 TARGET [01]
BT1 Targets

CADMIUM 114 TARGET [01]
BT1 Targets

CADMIUM 116 TARGET [01]
BT1 Targets

→ **CALCIUM 40 BEAMS [01]**
BT1 Ion Beams

CALCIUM 40 TARGET [01]
BT1 Targets

CALCIUM 41 TARGET [01]
BT1 Targets

CALCIUM 42 TARGET [01]
BT1 Targets

CALCIUM 43 TARGET [01]
BT1 Targets

CALCIUM 44 TARGET [01]
BT1 Targets

CALCIUM 46 TARGET [01]
BT1 Targets

CALCIUM 48 TARGET [01]
BT1 Targets

CALDERAS
RT Volcanoes
DEF Large, basin-shaped volcanic depressions, more or less circular in form, the diameter of which is many times greater than that of the included vent or vents.

→ **CALIFORNIUM 255**
BT1 Actinide Nuclei
BT1 Beta-Minus Decay Radioisotopes
BT1 Californium Isotopes
BT1 Even-Odd Nuclei
BT1 Hours Living Radioisotopes

CALIFORNIUM 249 TARGET [01]
BT1 Targets

CALIFORNIUM 251 TARGET [01]
BT1 Targets

CALIFORNIUM 252 TARGET [01]
BT1 Targets

CALIPER LOGGING
BT1 Well Logging

CARBON 12 TARGET [01]
BT1 Targets

CARBON 13 TARGET [01]
BT1 Targets

CARBON 14 TARGET [01]
BT1 Targets

CARBON TETRAFLUORIDE
UF Tetrafluoromethane
BT1 Fluorinated Aliphatic Hydrocarbons

CARBONATE ROCKS
BT1 Reservoir Rock
NT1 Dolomite
NT1 Limestone
DEF Rocks composed principally of carbonates, especially if at least 50% by weight; one type of petroleum or natural gas trap.

Carbonyl Sulfide
USE Carbon Oxysulfide

CARBOXYHEMOGLOBIN
RT Carbon Monoxide
RT Hemoglobin

CELL FLOW SYSTEMS
UF Flow Cytometers
RT Animal Cells
RT Cytology
RT Plant Cells

CERIUM 136 TARGET [01]
BT1 Targets

CERIUM 138 TARGET [01]
BT1 Targets

CERIUM 140 TARGET [01]
BT1 Targets

CERIUM 141 TARGET [01]
BT1 Targets

CERIUM 142 TARGET [01]
BT1 Targets

CESIUM 133 TARGET [01]
BT1 Targets

CFFC PROCESS
UF Clean Fuel from Coal Process
BT1 Coal Liquefaction
DEF Coal liquefaction process developed by C-E Lummus, a subsidiary of Combustion Engineering to produce low sulfur, low ash, synthetic boiler fuel.

CHARGE DENSITY [01]
UF Density (Charge)
RT Electric Charges

→ **CHARMONIUM [01]**

CHI-3410 RESONANCES
BT1 Meson Resonances

CHLORINE 35 TARGET [01]
BT1 Targets

CHLORINE 37 TARGET [01]
BT1 Targets

CHROMIUM SELENIDES
BT1 Chromium Compounds
BT1 Selenides

CHROMIUM 50 TARGET [01]
BT1 Targets

CHROMIUM 52 TARGET [01]
BT1 Targets

CHROMIUM 53 TARGET [01]
BT1 Targets

CHROMIUM 54 TARGET [01]
BT1 Targets

Clean Fuel from Coal Process
USE CFFC Process

CLOSED-LOOP CONTROL [01]
BT1 Control

CLUSTER BEAMS [01]
BT1 Beams
RT Cluster Beam Injection

COALTEK Process
USE Fuel Feeding Systems

COBALT ARSENIDES
BT1 Arsenides
BT1 Cobalt Compounds

COBALT 58 TARGET [01]
BT1 Targets

COBALT 59 TARGET [01]
BT1 Targets

COBALT 60 TARGET [01]
BT1 Targets

COLD EFFLUENTS
RT Thermal Effluents

→ **COLONY FORMATION [01]**

COMBUSTION INSTABILITY
BT1 Instability
RT Combustion

COMBUSTION KINETICS
BT1 Chemical Reaction Kinetics
RT Flame Propagation

COMBUSTION WAVES
RT Combustion
RT Detonation Waves
RT Explosions
RT Ignition
RT Shock Waves
DEF Zone of burning propagated through a combustible medium.

→ **COMBUSTORS**
RT Burners
RT Combustion Chambers
RT Ignition Systems

COMMERCIAL NUCLEAR SHIPS [01]
BT1 Nuclear Ships

COMPETITION
RT Behavior
RT Economics
RT Population Dynamics

→ **COMPLIANCE**
RT Laws
RT Legal Aspects
RT Recommendations
RT Regulations
RT Standards

COMPRESSED AIR ENERGY STORAGE
BT1 Energy Storage
RT Compressed Air
RT Compressed Gases
RT Compression

→ **COMPUTER NETWORKS [01]**
UF Networks (Computer)

→ **CONOCO PROCESS**
RT Desulfurization
RT Low BTU Gas
DEF Desulfurization of low Btu gas from coal gasification by reacting H_2S with $CaCO_3.MgO$ at 1775°F and 15 atm to form CaS.MgO.

→ ***CONTROL THEORY [01]***

→ **CONVEX MANIFOLDS [01]**
BT1 Mathematical Manifolds

COPPER 61 TARGET [01]
BT1 Targets

COPPER 63 TARGET [01]
BT1 Targets

COPPER 65 TARGET [01]
BT1 Targets

COUPLINGS
RT Fasteners
RT Joining

CRNL MP TANDEM ACCELERATOR [01]
UF Mp Tandem Accelerator
BT1 Van de Graaff Accelerators

Crude Carriers
USE Tanker Ships

CURIUM 242 TARGET [01]
BT1 Targets

CURIUM 244 TARGET [01]
BT1 Targets

CURIUM 245 TARGET [01]
BT1 Targets

CURIUM 246 TARGET
BT1 Targets

CURIUM 248 TARGET [01]
BT1 Targets

CURIUM 250 TARGET [01]
BT1 Targets

→ **CURIUM TELLURIDES**
BT1 Curium Compounds
BT1 Tellurides

DECISION MAKING
RT Decision Tree Analysis
RT Planning

DELPHI METHOD
BT1 Forecasting
RT Management
RT Planning
RT Technology Assessment

Density (Charge)
USE Charge Density

→ **DEPARTMENT OF TRANSPORTATION**
BT1 US Organizations

→ **DESTRUGAS PROCESS**
BT1 Waste Processing
DEF Gasification in complete absence of air with indirect heating of the pyrolysis chamber with char and pyrolysis gas (fuel gas) as the only products.

DETONATION WAVES
BT1 Shock Waves
RT Combustion
RT Combustion Waves
RT Explosions
RT Ignition
DEF A shock wave that accompanies detonation and has a shock front followed by a region of decreasing pressure in which the reaction occurs.

Deuterium Oxides
USE Heavy Water

DEWAR FLASKS [01]
BT1 Containers
BT1 Cryogenics

→ **DICTIONARIES**
UF Glossaries
BT1 Document Types

Dip Logging
USE Dipmeter Logging

DIPMETER LOGGING
UF Dip Logging
BT1 Well Logging

DISTILLATION EQUIPMENT
BT1 Equipment
RT Distillation
RT Petroleum Refineries

Drill Ships
USE Offshore Platforms
AND Ships

DRILLING RISERS
BT1 Pipes
RT Offshore Platforms
DEF A pipe through which fluid travels in an upward direction. On an offshore operation the term refers to a large diameter pipe which extends from the blowout prevent stack on the sea floor to under the derrick floor of an offshore platform.

Dubai
USE United Arab Emirates

DYNAMIC LOADS
UF Loads, Dynamic
RT Mechanical Tests
RT Stresses

DYSPROSIUM 156 TARGET [01]
BT1 Targets

DYSPROSIUM 158 TARGET [01]
BT1 Targets

DYSPROSIUM 160 TARGET [01]
BT1 Targets

DYSPROSIUM 161 TARGET [01]
BT1 Targets

DYSPROSIUM 162 TARGET [01]
BT1 Targets

DYSPROSIUM 163 TARGET [01]
BT1 Targets

DYSPROSIUM 164 TARGET [01]
BT1 Targets

E-BEAM TYPE REACTORS
UF Electron Beam Type Reactors
BT1 Thermonuclear Reactors

EARTH PENETRATORS
BT1 Penetrators
RT Projectiles
RT Subterrene Penetrators

EEV RANGE
BT1 Energy Range

EFR REACTOR [01]
UF Oarai Reactor
BT1 Enriched Uranium Reactors
BT1 FBR Type Reactors
BT1 Sodium Cooled Reactors

EINSTEINIUM 256
BT1 Actinide Nuclei
BT1 Beta-Minus Decay Radioisotopes
BT1 Einsteinium Isotopes
BT1 Hours Living Radioisotopes
BT1 Odd-Odd Nuclei

EINSTEINIUM 254 TARGET [01]
BT1 Targets

Electric Power Substations
USE Power Substations

ELECTRO-OPTICAL EFFECTS
RT Electrical Properties
RT Magneto-Optical Effects
RT Optical Properties

Electron Beam Type Reactors
USE E-Beam Type Reactors

Electronics (Quantum)
USE Quantum Electronics

Elevation
USE Levels

ENERGY-MOMENTUM TENSOR
BT1 Tensors
RT Energy
RT General Relativity Theory
RT Linear Momentum

ENERGY POLICY AND CONSERVATION ACT
UF EPCA
BT1 Laws
RT Energy Conservation
RT Energy Policy

ENERGY STORAGE SYSTEMS
NT1 Electric Batteries
RT Energy Storage
RT Heat Storage

→ **ENFORCEMENT**
RT Laws
RT Legal Aspects
RT Pollution Control Agencies
RT Pollution Regulations
RT Regulations

→ **ENVIRONMENTAL TRANSPORT**
BT1 Mass Transfer
NT1 Radionuclide Migration
RT Ecological Concentration
RT Environment
RT *Radioecological Concentration*

→ **ENZYME REACTIVATION**
RT Chemical Activation
RT Enzymes

EPCA
USE Energy Policy and Conservation Act

EPILEPSY
BT1 Diseases

→ **ERBIUM 150**
BT1 Beta-Plus Decay Radioisotopes
BT1 Erbium Isotopes
BT1 Even-Even Nuclei
BT1 Rare Earth Nuclei

ERBIUM 163 TARGET [01]
BT1 Targets

ERBIUM 164 TARGET [01]
BT1 Targets

ERBIUM 166 TARGET [01]
BT1 Targets

ERBIUM 167 TARGET [01]
BT1 Targets

ERBIUM 168 TARGET [01]
BT1 Targets

ERBIUM 170 TARGET [01]
BT1 Targets

ERUPTION
RT Volcanism
DEF The ejection of volcanic materials (lava, pyroclastics,

and volcanic gases) onto the Earth's surface.

→ **ESARDA [01]**
UF European Safeguard Research Development Association
BT1 International Organizations

European Safeguard Research Development Association
USE ESARDA

EUROPIUM ARSENIDES
BT1 Arsenides
BT1 Europium Compounds

EUROPIUM 151 TARGET [01]
BT1 Targets

EUROPIUM 153 TARGET [01]
BT1 Targets

EUTROPHICATION [01]
RT Algae
RT Aquatic Ecosystems
RT Estuaries
RT Fertilizers
RT Lakes
RT Nutrients
RT Water Pollution

→ **EXTREME-VALUE PROBLEMS [01]**

EXXON GASIFICATION PROCESS
BT1 Coal Gasification
RT SNG Processes
DEF Coal is reacted with steam in a Fluidized-bed gasifier at 1500-1700°F. To provide the necessary heat, a stream of circulating char is withdrawn from the gasifier and partially burned with air in a char heater to raise its temperature. The heated char is returned to the gasifier after separation from the flue gas. The product gas is a medium BTU gas suitable for methanation to S.N.G.

EXXON LIQUEFACTION PROCESS
BT1 Coal Liquefaction
DEF Crushed coal is slurried with a recycle solvent, preheated to about 800°F, and then pumped into the liquefaction reactor operating at about 2,000 p.s.i. Preheated hydrogen is also added to the reactor. The product from the liquefaction reactor is sent to the separation step where gas, naphtha, recycle solvent, distillate, and heavy bottoms are separated by distillation.

FEDERAL POWER COMMISSION
UF FPC
BT1 US Organizations

FERMIUM 254 TARGET [01]
BT1 Targets

FERMIUM 255 TARGET [01]
BT1 Targets

FERMIUM 257 TARGET [01]
BT1 Targets

FERROMAGNETIC RESONANCE [01]
BT1 Magnetic Resonance

→ **FINNISH ORGANIZATIONS [01]**
BT1 National Organizations

→ **FLAME CHAMBER PROCESS**
BT1 Waste Processing
DEF High temperature waste combustion process in which waste is fed into ring column created between two concentric cylinders causing combustion steps to be above each other rather than following each other.

FLAME PROPAGATION
RT Combustion Kinetics
RT Flames

FLASH HYDROPYROLYSIS PROCESS
BT1 Coal Gasification
BT1 Coal Liquefaction
DEF Process for converting coal to liquid and gaseous hydrocarbons directly by rapidly heating coal with preheated hydrogen to reaction temperatures followed by rapid cooling.

→ **FLINTLOCK OPERATION**
BT1 Nuclear Explosions
BT1 Underground Explosions

Flow Cytometers
USE Cell Flow Systems

FLUIDIZED-BED COMBUSTORS
BT1 Burners
RT Coal
RT Fluidized Bed
RT Fluidized-Bed Combustion
RT Pollution Control Equipment

→ **FLUIDIZED BED REFUSE GASIFICATION**
BT1 Waste Processing
RT Coal Gasification
RT Oil Shales
DEF Partial oxidation pyrolysis using air and air or steam for gasification and catalysts to increase thermal efficiency. May be used for coal or oil shale gasification. Produces fuel gas.

→ **FLUORINE 19 BEAMS [01]**
BT1 Ion Beams

FLUORINE 19 TARGET [01]
BT1 Targets

FLYWHEEL ENERGY STORAGE
BT1 Energy Storage
RT Flywheels

FOOD AND DRUG ADMINISTRATION
BT1 US Organizations

FOOD PROCESSING
RT Food
RT Radiopreservation
RT Storage Life

FOREIGN POLICY
BT1 Government Policies
RT Economic Policy
RT Energy Policy
RT International Agreements
RT International Cooperation

FORMED COKE PROCESSES
RT Coke
RT Coke Ovens
DEF Processes for forming compressed coal briquets of uniform size and with sufficient strength after carbonization for blast furnace use.

→ **FORSMARK-3 REACTOR [01]**
BT1 BWR Type Reactors
BT1 Enriched Uranium Reactors
BT1 Power Reactors

FOUNDRIES
BT1 Industrial Plants
RT Casting

FPC
USE Federal Power Commission

FRANCIUM 226 [01]
BT1 Beta-Minus Decay Radioisotopes
BT1 Francium Isotopes
BT1 Heavy Nuclei
BT1 Odd-Odd Nuclei
BT1 Seconds Living Radioisotopes

FREEDOM OF INFORMATION ACT
BT1 Laws
RT Legislation

FUEL-AIR RATIO
UF Air-Fuel Ratio
RT Air
RT Fuels

FUEL FEEDING SYSTEMS
UF COALTEK Process
BT1 Fuel Systems
RT Fossil Fuels
RT Materials Handling

Fujaira
USE United Arab Emirates

Function (Biological)
USE Biological Functions

→ **FUNCTIONAL ANALYSIS [01]**
BT1 Mathematics

GADOLINIUM PHOSPHIDES
BT1 Gadolinium Compounds
BT1 Phosphides

GADOLINIUM SELENIDES
BT1 Gadolinium Compounds
BT1 Selenides

GADOLINIUM 152 TARGET [01]
BT1 Targets

GADOLINIUM 154 TARGET [01]
BT1 Targets

GADOLINIUM 155 TARGET [01]
BT1 Targets

GADOLINIUM 156 TARGET [01]
BT1 Targets

GADOLINIUM 157 TARGET [01]
BT1 Targets

GADOLINIUM 158 TARGET [01]
BT1 Targets

GADOLINIUM 159 TARGET [01]
BT1 Targets

GADOLINIUM 160 TARGET [01]
BT1 Targets

GALLIUM 81
BT1 Beta-Minus Decay Radioisotopes
BT1 Gallium Isotopes
BT1 Intermediate Mass Nuclei
BT1 Odd-Even Nuclei
BT1 Seconds Living Radioisotopes

GALLIUM 82
BT1 Beta-Minus Decay Radioisotopes
BT1 Gallium Isotopes
BT1 Intermediate Mass Nuclei
BT1 Odd-Odd Nuclei
BT1 Seconds Living Radioisotopes

GALLIUM 83
BT1 Beta-Minus Decay Radioisotopes
BT1 Gallium Isotopes
BT1 Intermediate Mass Nuclei
BT1 Odd-Even Nuclei
BT1 Seconds Living Radioisotopes

GALLIUM ANTIMONIDES
BT1 Antimony Compounds
BT1 Gallium Compounds

GALLIUM 65 TARGET [01]
BT1 Targets

GALLIUM 67 TARGET [01]
BT1 Targets

GALLIUM 69 TARGET [01]
BT1 Targets

GALLIUM 71 TARGET [01]
BT1 Targets

GALVESTON BAY
BT1 Bays
BT1 Gulf of Mexico

GAS SPILLS
RT Natural Gas
RT Pollution

GASOHOL PROGRAM
(Program for blending agriculturally derived ethanol and unleaded gasoline.)
RT Ethanol
RT Gasoline
RT Synthetic Fuels

GEARS

GENETIC MAPPING
RT Chromosomes
RT Genes
DEF Graphically representing the

linear arrangement of genes on a chromosome.

Geoisotherm
USE Isotherm

Geophones
USE Seismic Detectors

GERMANIUM 70 TARGET [01]
BT1 Targets

GERMANIUM 71 TARGET [01]
BT1 Targets

GERMANIUM 72 TARGET [01]
BT1 Targets

GERMANIUM 73 TARGET [01]
BT1 Targets

GERMANIUM 74 TARGET [01]
BT1 Targets

GERMANIUM 75 TARGET [01]
BT1 Targets

GERMANIUM 76 TARGET [01]
BT1 Targets

GERMANY
(For use in indexing Pre-World War II research.)

→GLOSSARIES
USE Dictionaries

GOLD 197 TARGET [01]
BT1 Targets

GONORRHEA [01]
BT1 Infectious Diseases
RT Urogenital System Diseases

GREAT SALT LAKE
BT1 Lakes
RT Utah

GROHNDE REACTOR [01]
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors

→H-2050 RESONANCES [01]
BT1 Meson Resonances

→HABITAT
RT Environment
DEF The area or type of environment in which a plant or animal normally lives or occurs.

HAFNIUM 176 TARGET [01]
BT1 Targets

HAFNIUM 177 TARGET [01]
BT1 Targets

HAFNIUM 178 TARGET [01]
BT1 Targets

HAFNIUM 179 TARGET [01]
BT1 Targets

HAFNIUM 180 TARGET [01]
BT1 Targets

HANFORD RESERVATION
BT1 US ERDA
RT Battelle Pacific Northwest Laboratories
RT HAPO

HARVESTING
RT Biomass
RT Crops
RT Wood

HEART FAILURE
BT1 Diseases
RT Coronaries

HEAT PIPE WICKS
RT Capillary Flow
RT Heat Pipes

Heat Storage Systems
USE Thermal Energy Storage Equipment

Heat Transfer Properties
USE Thermodynamic Properties

HELIUM 3 TARGET [01]
BT1 Targets

HELIUM 4 TARGET [01]
BT1 Targets

→HIGGS BOSONS [01]
BT1 Intermediate Bosons

HOLMIUM 165 TARGET [01]
BT1 Targets

HUMECA URANIUM MILL
BT1 Nuclear Facilities
RT Uranium Ores

HYDRAULIC TRANSPORT
BT1 Transport
RT Hydraulics

HYDRODYNAMIC MASS EFFECT [01]
UF Added Mass Effect
UF Virtual Mass Effect
RT Damping
RT Eigenfrequency
RT Hydrodynamics
RT Mechanical Vibrations
DEF A virtual increase of the mass of solids when vibrating in fluids

HYDROGEN 1 TARGET [01]
BT1 Targets

HYPERTHERMIA
BT1 Body Temperature
RT Hypothermia

I-BEAM TYPE REACTORS
UF Ion Beam Type Reactors
BT1 Thermonuclear Reactors

IMPLEMENTATION
RT Legislation
RT Regulations

INDAN
BT1 Aromatics
BT1 Hydrocarbons

INDIUM 110 TARGET [01]
BT1 Targets

INDIUM 113 TARGET [01]
BT1 Targets

INDIUM 115 TARGET [01]
BT1 Targets

INFORMATION NEEDS [01]
(Identification of subject areas or types of data on which information is needed in order to further specific areas of research. Coordinate with descriptors for the specific areas of research.)
RT Data
RT Research Programs
RT Tables

INNER-SHELL IONIZATION [01]
BT1 Ionization
RT Auger Effect
RT Autoionization

INTERNATIONAL REGULATIONS [01]
BT1 Regulations

INTERSTITIAL WATER
BT1 Ground Water
NT1 Connate Water
RT Natural Gas Wells
RT Oil Wells
RT Reservoir Rock
RT Sandstones
DEF Subsurface water contained in pore spaces between the grains of rock and sediments.

IODINE ADDITIONS [01]
RT Iodine

IODINE 127 TARGET [01]
BT1 Targets

IODINE 129 TARGET [01]
BT1 Targets

Ion Beam Type Reactors
USE I-Beam Type Reactors

ION RINGS [01]
RT Confinement
RT Minimum-B Configurations

IONOGRAPHIC IMAGING [01]
BT1 Biomedical Radiography
DEF A process whereby a pattern of electrical charges is formed on a foil by the accumulation of ions from a gas of high atomic number ionized by the incident radiation.

→IRANIAN ATOMIC ENERGY ORGANIZATION [01]
BT1 Iranian Organizations

→IRANIAN ORGANIZATIONS [01]
BT1 National Organizations
NT1 Iranian Atomic Energy Organization
NT1 Tehran Nuclear Research Centre

IRIDIUM SULFATES
BT1 Iridium Compounds
BT1 Sulfates

IRIDIUM 191 TARGET [01]
BT1 Targets

IRIDIUM 193 TARGET [01]
BT1 Targets

→IRON 58 BEAMS [01]
BT1 Ion Beams

→IRON 58 REACTIONS [01]
BT1 Heavy Ion Reactions

IRON SILICIDES
BT1 Iron Compounds
BT1 Silicides

IRON 54 TARGET [01]
BT1 Targets

IRON 55 TARGET [01]
BT1 Targets

IRON 56 TARGET [01]
BT1 Targets

IRON 57 TARGET [01]
BT1 Targets

IRON 58 TARGET [01]
BT1 Targets

ISOMERIZATION [01]
BT1 Chemical Reactions
DEF Process for converting hydrocarbon or other organic compound to an isomer.

ISOTHERM
UF Geoisotherm
RT Temperature Distribution
RT Temperature Measurement
DEF A line connecting points of equal temperature.

Jaeri Fusion Torus-2A
USE JFT-2A Tokamak

→JET MODEL [01]
UF UJM
UF Uncorrelated-Jet Model
BT1 Particle Models

→JFT-2A TOKAMAK [01]
UF Jaeri Fusion Torus-2A
BT1 Tokamak Devices

K SHELL [01]
UF Atomic Shells (K)
BT1 Electronic Structure

KAON MINUS-NEUTRON INTERACTIONS
BT1 Kaon-Neutron Interactions

KAON MINUS-PROTON INTERACTIONS
BT1 Kaon-Proton Interactions

KAON MINUS REACTIONS
BT1 Kaon Reactions

KAON NEUTRAL-NEUTRON INTERACTIONS
BT1 Kaon-Neutron Interactions

KAON NEUTRAL-PROTON INTERACTIONS
BT1 Kaon-Proton Interactions

KAON NEUTRAL REACTIONS
BT1 Kaon Reactions

KAON PLUS-NEUTRON INTERACTIONS
BT1 Kaon-Neutron Interactions

KAON PLUS-PROTON INTERACTIONS
BT1 Kaon-Proton Interactions

KAON PLUS REACTIONS
BT1 Kaon Reactions

Kernkraftwerk Biblis-3
USE Biblis-3 Reactor

Kernkraftwerk Biblis-4
USE Biblis-4 Reactor

Kernkraftwerk Brokdorf
USE Brokdorf Reactor

KIZILDERE GEOTHERMAL FIELD
BT1 Geothermal Fields
RT Turkey

KRYPTON 78 TARGET
BT1 Targets

KRYPTON 80 TARGET [01]
BT1 Targets

KRYPTON 82 TARGET
BT1 Targets

KRYPTON 83 TARGET
BT1 Targets

KRYPTON 84 TARGET [01]
BT1 Targets

KRYPTON 86 TARGET [01]
BT1 Targets

L SHELL [01]
UF Atomic Shells (L)
BT1 Electronic Structure

Land Fills
USE Sanitary Landfills

LAND POLLUTION ABATEMENT
RT Land Pollution
RT Land Reclamation

LANTHANUM 139 TARGET [01]
BT1 Targets

LASER DRILLING [01]
BT1 Materials Drilling
RT Laser Radiation

LASER FUSION REACTORS
BT1 Thermonuclear Reactors

→ LATCHKEY OPERATION
BT1 Nuclear Explosions
BT1 Underground Explosions

→ LAWRENCIUM 259
BT1 Actinide Nuclei
BT1 Alpha Decay Radioisotopes
BT1 Lawrencium Isotopes
BT1 Odd-Even Nuclei
BT1 Seconds Living Radioisotopes

Lead-Free Gasoline
USE Unleaded Gasoline

LEAD 204 TARGET [01]
BT1 Targets

LEAD 206 TARGET [01]
BT1 Targets

LEAD 207 TARGET [01]
BT1 Targets

LEAD 208 TARGET [01]
BT1 Targets

→ LEAD 209 TARGET [01]
BT1 Targets

LEAD 210 TARGET [01]
BT1 Targets

LEADING PARTICLES
BT1 Elementary Particles
BT1 Particle Production
DEF Charged interaction products with large longitudinal momentum.

Liapunov Method
USE Lyapunov Method

Life (Service)
USE Service Life

LINDANE [01]
BT1 Chlorinated Alicyclic Hydrocarbons
BT1 Insecticides

LINE NARROWING [01]

LINEAR PINCH TYPE REACTORS
BT1 Thermonuclear Reactors
RT Linear Pinch Devices

LITHIUM 6 TARGET [01]
BT1 Targets

LITHIUM 7 TARGET [01]
BT1 Targets

LITHIUM 9 TARGET [01]
BT1 Targets

Loads, Dynamic
USE Dynamic Loads

Loads, Static
USE Static Loads

LOVIISA-1 REACTOR [01]
(Prior to 1976, LOVIISA REACTOR was used.)
BT1 Power Reactors
BT1 WWER Type Reactors

LOVIISA-2 REACTOR [01]
BT1 Power Reactors
BT1 WWER Type Reactors

→ LOW LEVEL COUNTING [01]
BT1 Counting Techniques

LUTETIUM 156
BT1 Alpha Decay Radioisotopes
BT1 Lutetium Isotopes
BT1 Millisec Living Radioisotopes
BT1 Odd-Odd Nuclei
BT1 Rare Earth Nuclei

LUTETIUM 174 TARGET [01]
BT1 Targets

LUTETIUM 175 TARGET [01]
BT1 Targets

LUTETIUM 176 TARGET [01]
BT1 Targets

→ LYAPUNOV METHOD [01]
UF Liapunov Method

M SHELL [01]
UF Atomic Shells (M)
BT1 Electronic Structure

MAGNESIUM 23 TARGET [01]
BT1 Targets

MAGNESIUM 24 TARGET [01]
BT1 Targets

MAGNESIUM 25 TARGET [01]
BT1 Targets

MAGNESIUM 26 TARGET [01]
BT1 Targets

MAGNETIC MIRROR TYPE REACTORS
BT1 Thermonuclear Reactors
RT Magnetic Mirrors

MALI [01]
BT1 Africa
BT1 Developing Countries

MANGANESE 59
BT1 Intermediate Mass Nuclei
BT1 Manganese Isotopes
BT1 Odd-Even Nuclei

MANGANESE SILICIDES
BT1 Manganese Compounds
BT1 Silicides

MANGANESE 51 TARGET [01]
BT1 Targets

MANGANESE 53 TARGET [01]
BT1 Targets

MANGANESE 55 TARGET [01]
BT1 Targets

MANUFACTURING
RT Fabrication
RT Industry

MARINE TRANSPORT
BT1 Transport

Marlite
USE Marlstone

MARLSTONE
UF Marlite
RT Calcium Carbonates
RT Clays
DEF An indurated mixture of clay materials and Ca carbonate (rarely dolomite) usually containing from 25 to 75% clays.

MARSHES
BT1 Aquatic Ecosystems
RT Surface Waters
RT Swamps

→ MEA LINAC [01]
BT1 Linear Accelerators

MEASLES [01]
UF Rubeola
BT1 Infectious Diseases
RT Measles Virus

MEASLES VIRUS [01]
BT1 Viruses
RT Measles

MEGA AMP BEAM CURRENTS [01]
(Above 10^6 amperes.)
BT1 Beam Currents
BT1 Currents

→ MENDELEVIUM 253
BT1 Actinide Nuclei
BT1 Electron Capture Radioisotopes
BT1 Mendelevium Isotopes
BT1 Odd-Even Nuclei

MERCURY 177 [01]
BT1 Alpha Decay Radioisotopes
BT1 Even-Odd Nuclei
BT1 Intermediate Mass Nuclei
BT1 Mercury Isotopes
BT1 Millisec Living Radioisotopes

MERCURY 198 TARGET [01]
BT1 Targets

MERCURY 199 TARGET [01]
BT1 Targets

MERCURY 200 TARGET [01]
BT1 Targets

MERCURY 201 TARGET [01]
BT1 Targets

MERCURY 202 TARGET [01]
BT1 Targets

MERCURY 204 TARGET [01]
BT1 Targets

→ METHYL BROMIDE [01]
BT1 Brominated Aliphatic Hydrocarbons

Microcomputers
USE Microprocessors

MICROEMULSIONS
BT1 Emulsions
RT Micellar Systems
RT Well Stimulation
DEF Optically isotropic, clear, and stable dispersions of oil, water, surfactant, and cosurfactant; the latter is often an alcohol.

MICROPROCESSORS
UF Microcomputers
RT Computers

MINERAL CYCLING
RT Ecological Concentration
RT Ecosystems

→ MINERAL INDUSTRY

BT1 Industry
RT Chemical Industry
RT Coal Industry
RT Metal Industry
RT Oil Sand Industry
RT Oil Shale Industry
RT Petroleum Industry

MINERAL WOOL
RT Fibers
RT Thermal Insulation

MOLTEN CARBONATE PROCESS
RT Desulfurization
DEF Process for removal of sulfur dioxide from flue gas using ternary eutectic alkali metal carbonate melt; reduction of sulfite and sulfate reaction products with petroleum coke; and reaction of resulting sulfide with steam and carbon dioxide to regenerate carbonate and form hydrogen sulfide, which can be converted to sulfur.

MOLYBDENUM 88
BT1 Beta-Plus Decay Radioisotopes
BT1 Even-Even Nuclei
BT1 Intermediate Mass Nuclei
BT1 Minutes Living Radioisotopes
BT1 Molybdenum Isotopes

MOLYBDENUM PHOSPHIDES
BT1 Molybdenum Compounds
BT1 Phosphides

MOLYBDENUM 92 TARGET [01]
BT1 Targets

MOLYBDENUM 94 TARGET [01]
BT1 Targets

MOLYBDENUM 95 TARGET [01]
BT1 Targets

MOLYBDENUM 96 TARGET [01]
BT1 Targets

MOLYBDENUM 97 TARGET [01]
BT1 Targets

MOLYBDENUM 98 TARGET [01]
BT1 Targets

MOLYBDENUM 100 TARGET [01]
BT1 Targets

Monitors (Air Pollution)
USE Air Pollution Monitors

MOORINGS
RT Deep Water Oil Terminals
RT Harbors

Mp Tandem Accelerator
USE CRNL Mp Tandem Accelerator

MT BAKER
RT Washington

MULLERS
BT1 Equipment
RT Grinding
RT Mixing
DEF Equipment used for agitating, grinding, and mixing.

MUON PROBES [01]
BT1 Probes
RT Muon Beams
RT Muonium
RT Muons Plus
DEF Polarized positive muon beams used to investigate properties of condensed matter.

N-Ethyl Maleimide
USE NEM

NATURAL GAS DISTRIBUTION SYSTEMS
RT Energy Transport
RT Natural Gas
RT Pipelines

NATURAL GAS PROCESSING PLANTS
UF Natural Gasoline Plants
BT1 Industrial Plants
RT Natural Gas Industry

Natural Gasoline
USE Natural Gas Liquids

Natural Gasoline Plants
USE Natural Gas Processing Plants

NEM [01]
UF N-Ethyl Maleimide
BT1 Imides
BT1 Radiosensitizers

NEODYMIUM 142 TARGET [01]
BT1 Targets

NEODYMIUM 143 TARGET [01]
BT1 Targets

NEODYMIUM 144 TARGET [01]
BT1 Targets

NEODYMIUM 145 TARGET [01]
BT1 Targets

NEODYMIUM 146 TARGET [01]
BT1 Targets

NEODYMIUM 148 TARGET [01]
BT1 Targets

NEODYMIUM 150 TARGET [01]
BT1 Targets

NEON 20 TARGET [01]
BT1 Targets

NEON 21 TARGET [01]
BT1 Targets

NEON 22 TARGET [01]
BT1 Targets

NEPTUNIUM 232 TARGET [01]
BT1 Targets

NEPTUNIUM 237 TARGET [01]
BT1 Targets

NETWORK ANALYSIS
RT Configuration
RT Coordinates
RT Mathematics

Networks (Computer)
USE Computer Networks

NEUTRON LOGGING
BT1 Radioactivity Logging
NT1 Neutron-Gamma Logging
NT1 Neutron-Neutron Logging

NEWBOLD ISLAND-1 REACTOR [01]
(Name changed to Hope Creek-1 Reactor in November, 1973, and more recent material should be so indexed.)
BT1 BWR Type Reactors
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 Thermal Reactors

NEWBOLD ISLAND-2 REACTOR [01]
(Name changed to Hope Creek-2 Reactor in November, 1973, and more recent material should be so indexed.)
BT1 BWR Type Reactors
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 Thermal Reactors

NICKEL 53 [01]
BT1 Even-Odd Nuclei
BT1 Intermediate Mass Nuclei
BT1 Nickel Isotopes

NICKEL ARSENIDES
BT1 Arsenides
BT1 Nickel Compounds

NICKEL 58 BEAMS [01]
BT1 Ion Beams

NICKEL 60 REACTIONS [01]
BT1 Heavy Ion Reactions

NICKEL 58 TARGET [01]
BT1 Targets

NICKEL 59 TARGET [01]
BT1 Targets

NICKEL 60 TARGET [01]
BT1 Targets

NICKEL 61 TARGET [01]
BT1 Targets

NICKEL 62 TARGET [01]
BT1 Targets

NICKEL 64 TARGET [01]
BT1 Targets

NIGER RIVER [01]
BT1 Rivers
RT Africa

NIOBIUM 104
BT1 Beta-Minus Decay Radioisotopes
BT1 Electron Capture Radioisotopes
BT1 Intermediate Mass Nuclei
BT1 Niobium Isotopes
BT1 Odd-Odd Nuclei
BT1 Seconds Living Radioisotopes

NIOBIUM PHOSPHIDES
BT1 Niobium Compounds
BT1 Phosphides

NIOBIUM 93 TARGET [01]
BT1 Targets

NIOBIUM 94 TARGET [01]
BT1 Targets

NIOBIUM 96 TARGET [01]
BT1 Targets

NITINOL
BT1 Nickel Alloys
BT1 Titanium Alloys
DEF Shape memory alloys of Ti and Ni.

NITROGEN 12 TARGET [01]
BT1 Targets

NITROGEN 13 TARGET [01]
BT1 Targets

NITROGEN 14 TARGET [01]
BT1 Targets

NITROGEN 15 TARGET [01]
BT1 Targets

NITROMETHANE
BT1 Chemical Explosives
BT1 Nitro Compounds

NORD COMPUTERS [01]
BT1 Computers

NORTH STAR PROJECT
RT International Agreements
RT Liquefied Natural Gas
DEF Proposal to ship natural gas from North Central Siberia to U. S. East Coast.

NS ARKTIKA [01]
BT1 Nuclear Ships

NUCLEAR FUEL RECOVERY AND RECYCLING CENTER
(Exxon Nuclear Facility Roane County, Tennessee.)
BT1 Fuel Reprocessing Plants
RT Tennessee

OAPEC
BT1 International Organizations
RT Middle East
RT OPEC
RT Petroleum
DEF Organization of Arab Petroleum Exporting Countries.

Oarai Reactor
USE EFR Reactor

OCCIDENTAL FLASH PYROLYSIS PROCESS
(Before July 1976 information was indexed to Garrett pyrolysis process.)
BT1 Waste Processing
RT Pyrolysis
RT Waste Processing Plants

OIL SATURATION
RT Reservoir Rock
DEF Degree of filling of reservoir pore structure by reservoir oil.

OIL SHALE FINES
RT Oil Shales

OMAN
BT1 Asia
BT1 Developing Countries
BT1 Middle East

ONCOVIN [01]
BT1 Alkaloids
BT1 Antimitotic Drugs

OPEN-LOOP CONTROL [01]
BT1 Control

OPTICAL DEPTH CURVE [01]
BT1 Diagrams
NT1 Spectroscopic Curve of Growth
RT Absorption Spectra
RT Cosmic Gases
RT Line Broadening
RT Optical Properties
RT Oscillator Strengths

OPTIMAL CONTROL [01]
BT1 Control

OSMIUM 196
BT1 Beta-Minus Decay Radioisotopes
BT1 Even-Even Nuclei
BT1 Heavy Nuclei
BT1 Osmium Isotopes

OSMIUM 184 TARGET [01]
BT1 Targets

OSMIUM 186 TARGET [01]
BT1 Targets

OSMIUM 187 TARGET [01]
BT1 Targets

OSMIUM 188 TARGET [01]
BT1 Targets

OSMIUM 189 TARGET [01]
BT1 Targets

OSMIUM 190 TARGET [01]
BT1 Targets

OSMIUM 192 TARGET [01]
BT1 Targets

OVERHEAD POWER TRANSMISSION
BT1 Power Transmission
RT Power Transmission Towers

OXYGEN 15 TARGET [01]
BT1 Targets

OXYGEN 16 TARGET [01]
BT1 Targets

OXYGEN 17 TARGET [01]
BT1 Targets

OXYGEN 18 TARGET [01]
BT1 Targets

PAH
USE Polycyclic Aromatic Hydrocarbons

PALLADIUM ARSENIDES
BT1 Arsenides
BT1 Palladium Compounds

PALLADIUM 102 TARGET [01]
BT1 Targets

PALLADIUM 104 TARGET [01]
BT1 Targets

PALLADIUM 105 TARGET [01]
BT1 Targets

PALLADIUM 106 TARGET [01]
BT1 Targets

PALLADIUM 108 TARGET [01]
BT1 Targets

PALLADIUM 110 TARGET [01]
BT1 Targets

PARACHARGE [01]
BT1 Particle Properties

PARATHION [01]
BT1 Insecticides
BT1 Organic Nitrogen Compounds
BT1 Thiophosphoric Acid Esters

PARTICLE RESUSPENSION
BT1 Particles
RT Aerodynamics
RT Aerosols
RT Air Pollution
RT Chemical Effluents
RT Diffusion
RT Dispersions
RT Dusts
RT Earth Crust
RT Radioactive Aerosols
RT Radioactive Effluents
RT Radionuclide Migration
RT Surface Air

PATGAS PROCESS
BT1 Coal Gasification
RT SNG Processes
DEF Coal gasification process to produce a fuel gas containing 36% H_2 and 64% CO at 1000 psig and 1000°F.

PELLETS
NT1 Fuel Pellets

Pellets (Breeding)
USE Breeding Pellets

PEROVSKITES
BT1 Minerals
NT1 Perovskite
RT Ferrimagnetic Materials
DEF Minerals with a close-packed lattice and the general formula ABX_3 where A and B are metals and X is a nonmetal, usually O.

PEROXYACETYL NITRATE
BT1 Nitric Acid Esters
RT Peroxides

PETRA STORAGE RING [01]
BT1 Storage Rings

PETROLEUM SULFONATES
BT1 Sulfonates
BT1 Sulfonic Acid Esters
DEF Mixtures of many surfactant compounds of the alkylaryl sulfonate type.

PEV RANGE
BT1 Energy Range

PHOSPHATE ROCKS
BT1 Rocks
RT Calcium Carbonates
RT Calcium Phosphates

PHOSPHORUS 31 TARGET [01]
BT1 Targets

PHOSPHORUS 32 TARGET [01]
BT1 Targets

PHOTOCOMPOSITION

PHOTOELECTRON COUNTING [01]
BT1 Counting Techniques

PHYSICS
NT1 High Energy Physics
NT1 Nuclear Physics
NT1 Solid State Physics

PION MINUS-NEUTRON INTERACTIONS
BT1 Pion-Neutron Interactions

PION MINUS-PROTON INTERACTIONS
BT1 Pion-Proton Interactions

PION MINUS REACTIONS
BT1 Pion Reactions

PION NEUTRAL-NEUTRON INTERACTIONS
BT1 Pion-Neutron Interactions

PION NEUTRAL-PROTON INTERACTIONS
BT1 Pion-Proton Interactions

PION NEUTRAL REACTIONS
BT1 Pion Reactions

PION PLUS-NEUTRON INTERACTIONS
BT1 Pion-Neutron Interactions

PION PLUS-PROTON INTERACTIONS
BT1 Pion-Proton Interactions

PION PLUS REACTIONS
BT1 Pion Reactions

PITTSBURGH
BT1 Pennsylvania

PLANETARY MAGNETOSPHERES [01]
BT1 Planetary Atmospheres

PLATE TECTONICS
BT1 Tectonics
RT Earth Crust
RT Sea-Floor Spreading
DEF Global tectonics based on an Earth model characterized by a small number (10-25) of large, broad, thick plates (blocks composed of areas of both continental and oceanic crust and mantle) each of which "floats" on some viscous underlayer in the mantle and moves more or less independently of the others.

PLATINUM SULFATES
BT1 Platinum Compounds
BT1 Sulfates

PLATINUM 194 TARGET [01]
BT1 Targets

PLATINUM 195 TARGET [01]
BT1 Targets

PLATINUM 196 TARGET [01]
BT1 Targets

PLATINUM 198 TARGET [01]
BT1 Targets

PLATINUM 235 TARGET [01]
BT1 Targets

PLUTONIUM 235 TARGET [01]
BT1 Targets

PLUTONIUM 238 TARGET [01]
BT1 Targets

PLUTONIUM 239 TARGET [01]
BT1 Targets

PLUTONIUM 240 TARGET [01]
BT1 Targets

PLUTONIUM 241 TARGET [01]
BT1 Targets

PLUTONIUM 242 TARGET [01]
BT1 Targets

PLUTONIUM 244 TARGET [01]
BT1 Targets

PNICTIDES
NT1 Antimony Alloys
NT1 Arsenides
NT1 Nitrides
NT1 Phosphides

PO RIVER [01]
BT1 Rivers
RT Italy

Polar Gas Project
USE Arctic Gas Pipelines

POLLUTION CONTROL AGENCIES
RT Enforcement
RT Organizing
RT Personnel

POLONIUM 210 TARGET [01]
BT1 Targets

POLYCYCLIC AROMATIC HYDROCARBONS
UF PAH
UF Polynuclear Aromatic Hydrocarbons
BT1 Aromatics
BT1 Hydrocarbons
RT Carcinogens
RT Mutagens

Polynuclear Aromatic Hydrocarbons
USE Polycyclic Aromatic Hydrocarbons

POROUS MATERIALS
BT1 Materials
RT Porosity

POTASIUM 39 BEAMS [01]

BT1 Ion Beams
RT Potassium 39

POTASSIUM 39 BEAMS [01]
BT1 Ion Beams

POTASSIUM 41 BEAMS [01]
BT1 Ion Beams
RT Potassium 41

POTASSIUM 39 TARGET [01]
BT1 Targets

POTASSIUM 40 TARGET [01]
BT1 Targets

POTASSIUM 41 TARGET [01]
BT1 Targets

POWER SUBSTATIONS
(Term is used for an assembly of equipment in an electric power system for the transmission, transformation, or switching of electric energy.)
UF Electric Power Substations
RT Power Generation
RT Power Plants
RT Power Systems
RT Power Transmission
RT Power Transmission Lines

POWER TRANSMISSION TOWERS
UF Transmission Towers
BT1 Mechanical Structures
RT Overhead Power Transmission

PRASEODYMIUM 141 TARGET [01]
BT1 Targets

Preequilibrium Nuclear Processes
USE Precompound-Nucleus Emission

Pressure Maintenance
USE Pressurizing

Pressurization
USE Pressurizing

PRESSURIZING
UF Pressure Maintenance
UF Pressurization
UF Repressuring
RT Fluid Injection

PRICE-ANDERSON ACT
BT1 Laws
RT Civil Liability
RT Legal Aspects
RT Nuclear Insurance

PRIVACY ACT
(The U. S. Privacy Act of 1974.)
BT1 Laws
RT Documentation
RT Information

PROMETHIUM 149 TARGET [01]
BT1 Targets

PROTACTINIUM PHOSPHATES
BT1 Phosphates
BT1 Protactinium Compounds

PROTACTINIUM 231 TARGET [01]
BT1 Targets

PROTON PROBES
BT1 Probes
RT Ion Probes
RT Proton Beams

→ **PSI RESONANCES [01]**
BT1 Vector Mesons
NT1 Psi-3105 Resonances
NT1 Psi-3695 Resonances
NT1 PSI-4100 Resonances
NT1 Psi-4300 Resonances

Q-SHIFT [01]
RT Betatron Oscillations
RT Particle Beams

QATAR
BT1 Asia
BT1 Developing Countries
BT1 Middle East

QUANTUM ELECTRONICS
UF Electronics (Quantum)
RT Lasers
RT Masers
RT Optics
RT Quantum Mechanics
RT Spectroscopy
DEF Unites the classical areas of electronics with those of optics, spectroscopy, and quantum mechanics and is based upon the quantum nature of waves and atomic and molecular systems.

Quark Confinement
USE Bag Model

Radiation Curing
USE Chemical Radiation Effects
AND Cross-Linking

→ **RADIATION PROTECTION LAWS [01]**
BT1 Laws

RADIOACTIVITY TRANSPORT [01]
UF Activity Transport
RT Contamination
DEF The processes by which radioactive materials move and become deposited throughout a reactor or reprocessing plant system.

RADIUM 226 TARGET [01]
BT1 Targets

Ras al Khaima
USE United Arab Emirates

RASPBERRIES [01]
BT1 Fruits

RATCHETING
BT1 Deformation
RT Mechanical Structures
DEF Progressive distortion resulting from or enhanced by cyclic loading.

→ **RDF**
USE Refuse Derived Fuels

RECTAL ADMINISTRATION [01]
BT1 Intake
RT Intestinal Absorption
RT Uptake

REDUCING AGENTS
RT Reagents
RT Reduction

→ **REFUSE DERIVED FUELS**
UF RDF
BT1 Fuels
RT Industrial Wastes
RT Municipal Wastes
RT Solid Wastes
RT Synthetic Fuels
DEF Fuels prepared from solid municipal or industrial wastes by removing all non-combustible materials, shredding to a desired size, and possibly pelleting or briquetting.

REMERSCHEN REACTOR [01]
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors

Repressuring
USE Pressurizing

RESIDUAL PETROLEUM
BT1 Petroleum
DEF The amount of liquid petroleum remaining in the formation at the end of a specified production process.

RESOURCE RECOVERY ACT
BT1 Laws
RT Energy Conservation
RT Regulations
RT Resource Conservation

REWETTING [01]
RT Dryout
RT Heat Transfer
RT Hot Spots
RT Surfaces

RHENIUM 185 TARGET [01]
BT1 Targets

RHENIUM 186 TARGET [01]
BT1 Targets

RHENIUM 187 TARGET [01]
BT1 Targets

RHODIUM PHOSPHIDES
BT1 Phosphides
BT1 Rhodium Compounds

RHODIUM 96 TARGET [01]
BT1 Targets

RHODIUM 103 TARGET [01]
BT1 Targets

RHODIUM TELLURIDES
BT1 Rhodium Compounds
BT1 Tellurides

RIO GRANDE RIFT
RT Colorado
RT New Mexico
RT Rift Zones

Riser Cracking
USE Coal Liquefaction

RMPROCESS
BT1 SNG Processes
RT Coal Gasification
RT High BTU Gas
RT Petroleum
DEF Methanation process which catalytically converts mixtures of carbon oxides obtained from coal or naphtha gasification to methane at high temperatures without recycle.

ROOF BOLTS
BT1 Mining Equipment
RT Supports

ROSE PROCESS
RT Residual Fuels
DEF Residuum Oil Supercritical Extraction process involves use of variety of selective solvents for extractive treatment of reduced crude oils and vacuum residues.

Rubeola
USE Measles

→ **RUBIDIUM SILICATES**
BT1 Rubidium Compounds
BT1 Silicates

RUBIDIUM 84 TARGET [01]
BT1 Targets

RUBIDIUM 85 TARGET [01]
BT1 Targets

RUBIDIUM 87 TARGET [01]
BT1 Targets

RUTHENIUM 96 TARGET [01]
BT1 Targets

RUTHENIUM 100 TARGET [01]
BT1 Targets

→ **RUTHENIUM 101 TARGET [01]**
BT1 Targets

RUTHENIUM 102 TARGET [01]
BT1 Targets

RUTHENIUM 104 TARGET [01]
BT1 Targets

Safety Research Experiment Facility Reactor
USE SAREF Reactor

SAMARIUM 144 TARGET [01]
BT1 Targets

SAMARIUM 145 TARGET [01]
BT1 Targets

SAMARIUM 146 TARGET [01]
BT1 Targets

SAMARIUM 147 TARGET [01]
BT1 Targets

SAMARIUM 148 TARGET [01]
BT1 Targets

SAMARIUM 149 TARGET [01]
BT1 Targets

SAMARIUM 150 TARGET [01]
BT1 Targets

SAMARIUM 151 TARGET [01]
BT1 Targets

SAMARIUM 152 TARGET [01]
BT1 Targets

SAMARIUM 154 TARGET [01]
BT1 Targets

SAMARIUM TELLURIDES
BT1 Samarium Compounds
BT1 Tellurides

→ **SAMARIUM TUNGSTATES**
BT1 Samarium Compounds
BT1 Tungstates

SAREF REACTOR
UF Safety Research Experiment Facility Reactor
BT1 Fast Reactors
BT1 Research and Test Reactors
BT1 Zero Power Reactors

→ **SCANDIUM BROMIDES [01]**
BT1 Bromides
BT1 Scandium Compounds

→ **SCANDIUM PHOSPHATES [01]**
BT1 Phosphates
BT1 Scandium Compounds

SCANDIUM 45 TARGET [01]
BT1 Targets

SEA-FLOOR SPREADING
RT Earth Crust
RT Plate Tectonics
RT Seas
DEF A hypothesis that the oceanic crust is increasing by convective upwelling of magma along the mid-oceanic ridges or world rift system, and a moving away of the new material at a rate of from one to ten centimeters per year. This movement provides the source of power in the hypothesis of plate tectonics.

→ **SECURITY SEALS [01]**
BT1 Physical Protection Devices

SEISMIC DETECTORS
UF Geophones
NT1 Seismographs
RT Ground Motion
RT Seismic Detection
RT Seismic Surveys
RT Seismic Waves

SEISMIC SOURCES
RT Seismic Surveys
RT Seismic Waves
RT Sonic Logging
RT Sound Waves
DEF Devices for generating seismic pulses.

SELENIUM 72 TARGET [01]
BT1 Targets

SELENIUM 74 TARGET [01]
BT1 Targets

SELENIUM 76 TARGET [01]
BT1 Targets

SELENIUM 77 TARGET [01]
BT1 Targets

SELENIUM 78 TARGET [01]
BT1 Targets

SELENIUM 80 TARGET [01]
BT1 Targets

SELENIUM 82 TARGET [01]
BT1 Targets

SELF-POTENTIAL SURVEYS
BT1 Electrical Surveys
DEF Electrical surveys based on the detection of electric potentials developed in the earth.

SERVICE LIFE
UF Life (Service)
UF Useful Life
RT Lifetime

→ **SEX DEPENDENCE [01]**

SHALE TAR ACIDS
BT1 Organic Acids
RT Shale Tar

SHALE TAR BASES
BT1 Bases
BT1 Organic Compounds
RT Shale Tar

Sharja
USE United Arab Emirates

→ **SHIPPER-RECEIVER DIFFERENCES [01]**

SI UNITS
BT1 Units
RT Metric System

SILICON 28 TARGET [01]
BT1 Targets

SILICON 29 TARGET [01]
BT1 Targets

SILICON 30 TARGET [01]
BT1 Targets

SILVER SELENIDES
BT1 Selenides
BT1 Silver Compounds

SILVER 107 TARGET [01]
BT1 Targets

SILVER 108 TARGET
BT1 Targets

SILVER 109 TARGET [01]
BT1 Targets

SITE PREPARATION
RT Site Selection

SKIMMERS
BT1 Equipment
RT Offshore Operations
RT Oil Spills
DEF Equipment of oil spill cleanup and removal.

→ **SLAGGING PYROLYSIS PROCESS**
BT1 Waste Processing
DEF Andco-Torrax process for gasification of unprocessed solid waste and recovery of energy in waste heat boiler of special design for steam and/or power generation.

SNG PLANTS
BT1 Industry
RT High BTU Gas
RT SNG Processes

SNR Reactor
(Changed to SNR-1 Reactor in 1977.)
USE SNR-1 Reactor

SNR-1 REACTOR
(Prior to 1977, SNR Reactor was used.)
UF SNR Reactor
UF SNR-300 Reactor
BT1 LMFBR Type Reactors
BT1 Power Reactors
BT1 Sodium Cooled Reactors

SNR-2 REACTOR
BT1 LMFBR Type Reactors
BT1 Power Reactors
BT1 Sodium Cooled Reactors

SODIUM 23 BEAMS [01]
BT1 Ion Beams
RT Sodium 23

SODIUM SILICIDES
BT1 Silicides
BT1 Sodium Compounds

→ **SODIUM 22 TARGET [01]**
BT1 Targets

SODIUM 23 TARGET [01]
BT1 Targets

→ **SODIUM TELLURIDES**
BT1 Sodium Compounds
BT1 Tellurides

SOIL MECHANICS
RT Overburden
RT Rock Mechanics
RT Sea Bed
DEF Mechanical properties of a mass of loose or undounded particles.

SOLAR ASSISTED HEAT PUMPS
BT1 Heat Pumps
BT1 Solar Air Conditioners
BT1 Solar Heating Systems

→ **SONAR**
UF Sound Navigation and Ranging
BT1 Range Finders
RT Electrical Equipment
RT Electronic Equipment
RT Frequency Range
RT Sound Waves

Sonic Measurements
USE Acoustic Measurements

SOOT
RT Air Pollution
RT Carbon Compounds
RT Coal
RT Smokes

SORPTION
NT1 Adsorption
NT1 Chemisorption
RT Sorptive Properties

Sound Navigation and Ranging
USE Sonar

SPACE VEHICLE COMPONENTS
BT1 Space Vehicles

SPARK DRILLS
BT1 Drilling Equipment
RT Drill Bits
RT Electric Sparks
RT Rock Drilling
RT Well Drilling

SPECIFICITY [01]
(The qualitative attribute of accurately distinguishing among different materials, properties, radiations, etc. as compared with the quantitative aspect of the threshold for detecting a given material, property, etc.; for which see SENSITIVITY.)
RT Accuracy
RT Sensitivity

SPECTROSCOPIC CURVE OF GROWTH [01]
BT1 Optical Depth Curve
RT Absorption Spectra
RT Cosmic Gases
RT Line Broadening
RT Optical Properties
RT Oscillator Strengths

→ **SPRAY COOLING [01]**
BT1 Cooling

ST LAWRENCE RIVER [01]
BT1 Rivers
RT New York
RT Ontario
RT Quebec

STAGNATION POINT
RT Flames
RT Fluid Mechanics
DEF Point in a field of flow about a body where the fluid particles have zero velocity with respect to the body.

→ **STAINLESS STEEL-422**
BT1 Stainless Steels

STATIC LOADS
UF Loads, Static
RT Mechanical Tests
RT Stresses

→ **STEARATES**

BT1 Carboxylic Acid Salts
RT Octadecanoic Acid

STEEL-IN-787
BT1 Carbon Steels
BT1 Copper Alloys
BT1 Molybdenum Alloys
BT1 Nickel Alloys
BT1 Niobium Alloys

STELLARATOR TYPE REACTORS
BT1 Thermonuclear Reactors
RT Stellarators

STOKERS
RT Boilers
RT Burners
RT Coal
RT Furnaces
DEF A mechanical device used in a boiler or furnace for feeding coal, removing refuse, controlling air supply, and mixing with combustibles for efficient combustion.

Stone and Webster Coal Solution Gasification Process
USE Stone and Webster Gasification Process

STONE AND WEBSTER GASIFICATION PROCESS
UF Stone and Webster Coal Solution Gasification Process
BT1 Coal Gasification
RT Hydrogenation
DEF Process for production of low-sulfur fuels from coal by stepwise addition of hydrogen to coal. Enough hydrogen is added in the first step to convert coal to liquids, which are then hydrogasified to methane, ethane, and aromatic liquid products.

STOVES
BT1 Appliances

STRONTIUM 84 TARGET [01]
BT1 Targets

STRONTIUM 86 TARGET [01]
BT1 Targets

STRONTIUM 87 TARGET [01]
BT1 Targets

STRONTIUM 88 TARGET [01]
BT1 Targets

→ STRONTIUM 90 TARGET
BT1 Targets

STRONTIUM TITANATES
BT1 Strontium Compounds
BT1 Titanates

→ SU-8 GROUPS [01]
BT1 SU Groups

SULFIBAN PROCESS
BT1 Desulfurization
DEF A process for coke oven gas desulfurization using mono-ethanolamine scrubbing.

SULFUR 32 TARGET [01]
BT1 Targets

SULFUR 33 TARGET [01]
BT1 Targets

SULFUR 34 TARGET [01]
BT1 Targets

SULFUR 36 TARGET [01]
BT1 Targets

→ SUPERCONDUCTING COLLOID DETECTORS [01]
BT1 Radiation Detectors

SWAMPS
BT1 Aquatic Ecosystems
RT Marshes
RT Surface Waters

→ SWEDISH ORGANIZATIONS [01]
BT1 National Organizations

→ SWIRL FLOW
BT1 Fluid Flow
RT Combustion

SYNTANS
RT Aromatics
RT Sulfonic Acids
DEF Any class of synthetic tanning materials that are sulfonated condensation products of aromatic compounds with formaldehyde or some other aldehyde.

SYNTHETIC FUELS INDUSTRY
BT1 Industry
RT Synthetic Fuels

TANTALUM PHOSPHIDES
BT1 Phosphides
BT1 Tantalum Compounds

TANTALUM 180 TARGET [01]
BT1 Targets

TANTALUM 181 TARGET [01]
BT1 Targets

→ TANTALUM 182 TARGET [01]
BT1 Targets

Tar Sand Oil
USE Bitumens

TECHNETIUM 99 TARGET [01]
BT1 Targets

TECHNOLOGY ASSESSMENT
RT Delphi Method
RT Feasibility Studies
RT Industry

TECHNOLOGY UTILIZATION
RT Feasibility Studies
RT Industry

→ TEHRAN NUCLEAR RESEARCH CENTRE [01]
BT1 Iranian Organizations

TELEPHONES
BT1 Communications
RT Public Utilities

TELLURIC SURVEYS
BT1 Electrical Surveys
RT Geothermal Exploration
DEF Electrical surveys in which the Earth's natural electric field is measured at two or more stations simultaneously and a quantitative estimate of the geoelectric section obtained thereby.

TELLURIUM 119 TARGET [01]
BT1 Targets

TELLURIUM 120 TARGET [01]
BT1 Targets

TELLURIUM 122 TARGET [01]
BT1 Targets

TELLURIUM 123 TARGET [01]
BT1 Targets

TELLURIUM 124 TARGET [01]
BT1 Targets

TELLURIUM 125 TARGET [01]
BT1 Targets

TELLURIUM 126 TARGET [01]
BT1 Targets

TELLURIUM 128 TARGET [01]
BT1 Targets

TELLURIUM 130 TARGET [01]
BT1 Targets

TENSIOMETERS
BT1 Measuring Instruments
RT Strain Gages
RT Surface Tension

TERBIUM ARSENIDES
BT1 Arsenides
BT1 Terbium Compounds

TERBIUM PHOSPHIDES
BT1 Phosphides
BT1 Terbium Compounds

TERBIUM 159 TARGET [01]
BT1 Targets

Tetrafluoromethane
USE Carbon Tetrafluoride

THALLIUM 203 TARGET [01]
BT1 Targets

THALLIUM 205 TARGET [01]
BT1 Targets

→ THERMODYNAMIC ACTIVITY [01]

THIXOTROPY
RT Gels
RT Plasticity
RT Rheology
RT Stability
RT Viscosity
DEF Property of certain gels which liquefy when subjected to vibratory forces.

THORIUM ARSENIDES
BT1 Arsenides
BT1 Thorium Compounds

THORIUM 229 TARGET [01]
BT1 Targets

THORIUM 230 TARGET [01]
BT1 Targets

THORIUM 232 TARGET [01]
BT1 Targets

THORIUM 239 TARGET [01]
BT1 Targets

THULIUM 169 TARGET [01]
BT1 Targets

TIN 104
BT1 Even-Even Nuclei
BT1 Intermediate Mass Nuclei
BT1 Tin Isotopes

TIN 112 TARGET [01]
BT1 Targets

TIN 114 TARGET [01]
BT1 Targets

TIN 116 TARGET [01]
BT1 Targets

TIN 117 TARGET [01]
BT1 Targets

TIN 118 TARGET [01]
BT1 Targets

TIN 119 TARGET [01]
BT1 Targets

TIN 120 TARGET [01]
BT1 Targets

TIN 122 TARGET [01]
BT1 Targets

TIN 124 TARGET [01]
BT1 Targets

TITANIUM 53
BT1 Even-Odd Nuclei
BT1 Intermediate Mass Nuclei
BT1 Titanium Isotopes

TITANIUM 46 TARGET [01]
BT1 Targets

TITANIUM 47 TARGET [01]
BT1 Targets

TITANIUM 48 TARGET [01]
BT1 Targets

TITANIUM 49 TARGET [01]
BT1 Targets

TITANIUM 50 TARGET [01]
BT1 Targets

TOKAMAK TYPE REACTORS
BT1 Thermonuclear Reactors
RT Tokamak Devices

TOLERANCE
RT Biological Adaptation

TOROIDAL PINCH TYPE REACTORS
BT1 Thermonuclear Reactors
RT Toroidal Pinch Devices

TRANSITION AMPLITUDES [01]
BT1 Amplitudes
NT1 Decay Amplitudes

Transmission Towers
USE Power Transmission Towers

TRITIUM TARGET [01]
BT1 Targets

TUNGSTEN PHOSPHIDES
BT1 Phosphides
BT1 Tungsten Compounds

TUNGSTEN 180 TARGET [01]
BT1 Targets

TUNGSTEN 182 TARGET [01]
BT1 Targets

TUNGSTEN 183 TARGET [01]
BT1 Targets

TUNGSTEN 184 TARGET [01]
BT1 Targets

TUNGSTEN 186 TARGET [01]
BT1 Targets

TURBOMACHINERY
NT1 Turbines
RT Compressors
RT Pumps

TVO-1 REACTOR [01]
(Prior to 1976, OLKILUOTO REACTOR was used.)
BT1 BWR Type Reactors
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 Thermal Reactors

TVO-2 REACTOR [01]
BT1 BWR Type Reactors
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 Thermal Reactors

→ **UJM**
USE Jet Model

ULCC
USE Tanker Ships

Umm al Qaiwan
USE United Arab Emirates

Uncorrelated-Jet Model
USE Jet Model

UNITED ARAB EMIRATES
UF Abu Dhabi
UF Ajman
UF Dubai
UF Fujeira
UF Ras al Khaima
UF Sharja
UF Umm al Qaiwan
BT1 Asia
BT1 Developing Countries

→ **UNLEADED GASOLINE**
UF Lead-Free Gasoline
BT1 Gasoline

URANIUM INSTITUTE [01]
(An international trade association.)
BT1 International Organizations

URANIUM 232 TARGET [01]
BT1 Targets

URANIUM 233 TARGET [01]
BT1 Targets

URANIUM 234 TARGET [01]
BT1 Targets

URANIUM 235 TARGET [01]
BT1 Targets

URANIUM 236 TARGET [01]
BT1 Targets

URANIUM 237 TARGET [01]
BT1 Targets

URANIUM 238 TARGET [01]
BT1 Targets

URANIUM 239 TARGET [01]
BT1 Targets

Useful Life
USE Service Life

VANADIUM 49 TARGET [01]
BT1 Targets

VANADIUM 50 TARGET [01]
BT1 Targets

VANADIUM 51 TARGET [01]
BT1 Targets

VIKING SPACE PROBES
BT1 Space Vehicles

Virtual Mass Effect
USE Hydrodynamic Mass Effect

→ **VISIBLE SPECTRA [01]**
BT1 Spectra

VLCC
USE Tanker Ships

VOLATILE MATTER
RT Coal
RT Organic Compounds
DEF Products, exclusive of moisture, given off by a material as gas and vapor, determined by definite prescribed methods.

WASTE OILS
BT1 Oils
RT Lubricating Oils
RT Recycling
RT Waste Management

WATER POLLUTION ABATEMENT
RT Pollution Control Equipment
RT Water Pollution

WATER REQUIREMENTS
RT Water
RT Water Resources

WATER TREATMENT
RT Water Quality

WATER WAVES
NT1 Tsunamis
RT Hurricanes
RT Seas
RT Storms
RT Tide

WAVE EQUATIONS
BT1 Differential Equations
NT1 Dirac Equation
NT1 Klein-Gordon Equation
NT1 Schroedinger Equation
RT Rarita-Schwinger Theory

→ **WEAK CHARGED CURRENTS [01]**
BT1 Charged Currents

WEINBERG-SALAM GAUGE MODEL
BT1 Particle Models

WELL SPACING
RT Geothermal Fields
RT Natural Gas Fields
RT Oil Fields
DEF Area location and interrelationship between producing oil, natural gas, or geothermal wells in a field; calculated for the maximum ultimate production from a given reservoir.

WENDELSTEIN-2B STELLARATOR [01]
BT1 Stellarators

WEST VALLEY UF6 FACILITY
BT1 Feed Materials Plants

WIDOWS CREEK STEAM PLANT
BT1 Fossil-Fuel Power Plants
RT Tennessee Valley Authority

X-RAY GALAXIES [01]
BT1 Cosmic X-Ray Sources
BT1 Galaxies
RT Cosmic Photons

→ **XENON 129 BEAMS [01]**
BT1 Ion Beams

→ **XENON 129 REACTIONS [01]**
BT1 Heavy Ion Reactions

XENON 123 TARGET [01]
BT1 Targets

XENON 124 TARGET [01]
BT1 Targets

XENON 126 TARGET [01]
BT1 Targets

XENON 128 TARGET [01]
BT1 Targets

XENON 130 TARGET [01]
BT1 Targets

XENON 132 TARGET [01]
BT1 Targets

XENON 134 TARGET [01]
BT1 Targets

XENON 136 TARGET [01]
BT1 Targets

XP CELLS [01]
BT1 Animal Cells

YELLOW CREEK-1 REACTOR [01]
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors
BT1 Thermal Reactors

YELLOW CREEK-2 REACTOR
BT1 Enriched Uranium Reactors
BT1 Power Reactors
BT1 PWR Type Reactors
BT1 Thermal Reactors

YTTERBIUM 154 [01]
BT1 Alpha Decay Radioisotopes
BT1 Even-Even Nuclei
BT1 Rare Earth Nuclei
BT1 Ytterbium Isotopes

YTTERBIUM 156
BT1 Alpha Decay Radioisotopes
BT1 Even-Even Nuclei
BT1 Rare Earth Nuclei
BT1 Seconds Living Radioisotopes
BT1 Ytterbium Isotopes

YTTERBIUM 168 TARGET [01]
BT1 Targets

YTTERBIUM 170 TARGET [01]
BT1 Targets

YTTERBIUM 171 TARGET [01]
BT1 Targets

YTTERBIUM 172 TARGET [01]
BT1 Targets

YTTERBIUM 173 TARGET [01]
BT1 Targets

YTTERBIUM 174 TARGET [01]
BT1 Targets

YTTERBIUM 176 TARGET [01]
BT1 Targets

YTTRIUM ARSENIDES
BT1 Arsenides
BT1 Yttrium Compounds

YTTRIUM PHOSPHIDES
BT1 Phosphides
BT1 Yttrium Compounds

YTTRIUM 89 TARGET [01]
BT1 Targets

ZINC 70
BT1 Beta-Minus Decay Radioisotopes
BT1 Even-Odd Nuclei
BT1 Intermediate Mass Nuclei
BT1 Seconds Living Radioisotopes
BT1 Zinc Isotopes

ZINC HALIDE PROCESS
BT1 Coal Liquefaction
RT Hydrocracking
RT Hydrogenation
DEF Conoco Coal Development Company process using zinc halide

catalyst for the hydrogenation and hydrocracking of coal extract and of subbituminous coal.

ZINC 64 TARGET [01]
BT1 Targets

ZINC 66 TARGET [01]
BT1 Targets

ZINC 67 TARGET [01]
BT1 Targets

ZINC 68 TARGET [01]
BT1 Targets

ZINC 70 TARGET [01]
BT1 Targets

ZIRCONIUM 90 TARGET [01]
BT1 Targets

ZIRCONIUM 91 TARGET [01]
BT1 Targets

ZIRCONIUM 92 TARGET [01]
BT1 Targets

ZIRCONIUM 94 TARGET [01]
BT1 Targets

ZIRCONIUM 96 TARGET [01]
BT1 Targets

ORNL/TM-6010

Contract No. W-7405-eng-26

OPERATIONS DIVISION

BULK SHIELDING FACILITY QUARTERLY REPORT

OCTOBER, NOVEMBER, AND DECEMBER OF 1976

Date Published - August 1977

S. S. Hurt, III
E. D. Lance
J. R. Thomas

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

CONTENTS

SUMMARY

The BSR operated at an average power level of 1,836 kw for 78.01% of the time during October, November, and December. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory.

The PCA was used in training programs and was operated on two occasions when the University of Kentucky students actively participated in training laboratories.

BULK SHIELDING REACTOR

Operations

During this quarter, the reactor operated 78.01% of the time primarily for the irradiation of research experiments. Basic operating data for this period are given in Table 1.

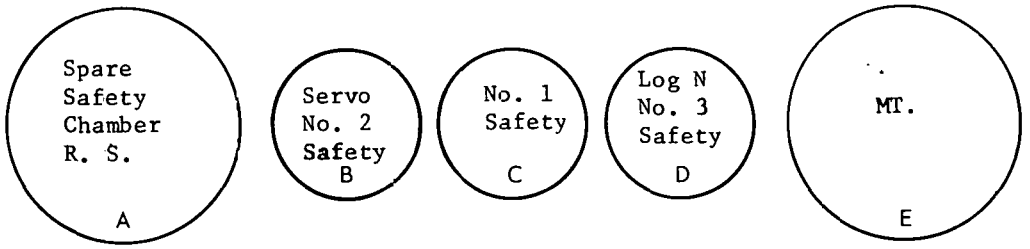
Table 1. Basic Operating Data
(October, November, and December of 1976)

	This Quarter	Last Quarter	Year To Date
Total energy, kwd	131,833	75,365	294,911
Average power, kw/operating hr	1,836	1,637	1,805
Time operating, %	78.01	50.50	45.16
Reactor availability, %	85.10	90.02	69.89
Reactor water radioactivity, counts min^{-1} ml^{-1} (av)	1,547	1,282	1,602
Reactor water resistivity, ohm-cm (av)	1,015,000	1,184,000	1,064,000
Standard fuel elements depleted	0	0	0
Control fuel elements depleted	0	0	0
Research samples	32	30	148

Core 31 (Test), (Figure 1), was converted back to the original core 31 loading (Figure 2) on October 13, 1976, by returning the core four rows east and reinstalling the west D_2O tank, after completion of the experimental run at the Low Temperature Irradiation Facility.

Core loading 31 (Figure 2) was replaced by core loading 32 (Figure 3) on November 29, 1976, to provide adequate excess reactivity for versatile operation. The initial operating mass (4995 g ^{235}U) of core loading 31 had been reduced to 4803 g due to burnup, thereby reducing the excess reactivity above xenon equilibrium).

Core loading 32 was accomplished by removing three partially depleted BSF-series fuel elements and adding two new MTR-series fuel elements. Core loading 32 had an initial operating mass of 4822 g which provided an excess reactivity of 5.25% $\Delta k/k$ (2.70% $\Delta k/k$ excess reactivity above xenon equilibrium). At the end of the quarter, the excess reactivity was $\sim$1.85% $\Delta k/k$ ($\sim$4.40% $\Delta k/k$ excess reactivity above xenon equilbrium).



East Side				M-192-D 130	FC	A1	A1	BSF-38 134
81	82	83	84	85	86	87	88	89
GRID				FZC 003T 188	A1	A1	A1	FZC 003U 188
71	72	73	74	75	76	77	78	79
HOLES				FZC 003N 178	BSF-S-9 67	BSF-36 139	BSF-S-10 67	FZC 003P 177
61	62	63	64	65	66	67	68	69
COVERED				M-13-H 202	M-194-D 153	FZC 003Q 182	M-195-D 153	M-14-H 203
51	52	53	54	55	56	57	58	59
BY				BSF-39 150	BSF-S-13 90	BSF-34 135	BSF-S-14 89	BSF-40 148
41	42	43	44	45	46	47	48	49
AN				FZC 003X 198	FZC 003R 179	BSF-35 135	FZC 003S 178	FZC 003Y 197
31	32	33	34	35	36	37	38	39
ALUMINUM				M-196-D 169	BSF-S-11 68	BSF-37 136	BSF-S-12 67	M-323-A 172
21	22	23	24	25	26	27	28	29
PLATE				BSF-28 132	FZC 003W 193	M-12-H 202	FZC 003V 196	EX
11	12	13	14	15	16	17	18	19

BSR CORE

31 (Test)

LOADING NO.

September 16, 1976

DATE

Excess Reactivity - 4.10%

CRITICAL MASS

4910 gm.

OPERATING MASS

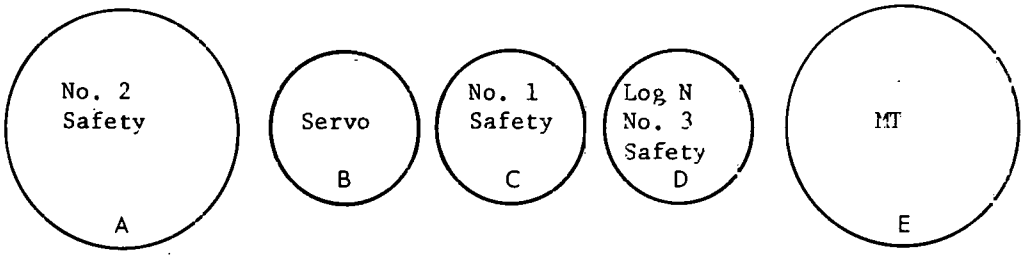
ROD POSITIONS AT CRITICAL
(With Operating Mass)

ROD NO.	IN. WITHDRAWN
1	10.50
2	10.50
3	10.50
4	10.50
5	23.00
6	23,00

REMARKS:

West D_2O tank replaced by LTIF D_2O tank.

Fig. 1. Core Loading 31 (Test) - BSR



M-192-D 130 81	FC 82	A1 83	A1 84	BSF-38 134 85	86	87	88	89
FZC 003T 188 71	A1 72	A1 73	A1 74	FZC 003U 188 75	76	77	78	79
FZC 003N 178 61	BSF-S-9 67 62	BSF-36 139 63	BSF-S-10 67 64	FZC 003P 177 65	66	67	68	69
M-13-H 202 51	M-194-D 153 52	FZC 003Q 182 53	M-195-D 153 54	M-14-H 203 55	56	57	58	59
BSF-39 150 41	BSF-S-13 90 42	BSF-34 135 43	BSF-S-14 39 44	BSF-40 148 45	46	D_2O Tanks 47	48	49
FZC 003X 198 31	FZC 003R 179 32	BSF-35 135 33	FZC 003S 178 34	FZC 003Y 197 35	36	37	38	39
M-196-D 169 21	BSF-S-11 68 22	BSF-37 136 23	BSF-S-12 67 24	M-323-A 172 25	26	27	28	29
BSR-28 132 11	FZC 003W 193 12	M-12-H 202 13	FZC 003V 196 14	Plug 15	16	17	18	19

BSR CORE

31
LOADING NO.

June 21, 1976
DATE

Excess Reactivity - 5.49%
CRITICAL MASS

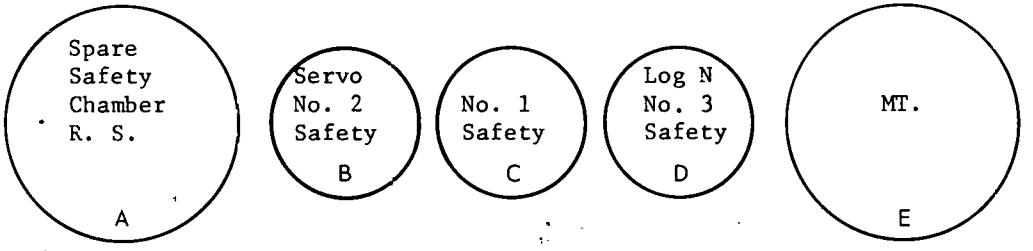
4995 gm
OPERATING MASS

ROD POSITIONS AT CRITICAL
(With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	10.86	9.12
2	10.86	9.12
3	10.86	9.12
4	10.86	9.12
5	10.86	23.00
6	10.86	23.00

REMARKS:

Fig. 2. Core Loading 31 - BSR



M-15-H 203 81	FC 82	Al 83	Al 84	Al 85	86	87	88	89
FZC 003T 185 71	FZC 003U 183 72	Al 73	Al 74	Al 75	76	77	78	79
FZC 003N 173 61	BSF-S-9 64 62	BSF-36 133 63	BSF-S-10 64 64	FZC 003P 171 65	66	67	68	69
M-13-H 195 51	M-194-D 145 52	FZC 003Q 172 53	M-14-H 195 54	M-195-D 145 55	56	57	D_2O 58	59
BSF-39 143 41	BSF-S-13 86 42	BSF-34 127 43	BSF-S-14 85 44	DSF-40 141 45	46	47	TANK 48	49
FZC 003R 170 31	FZC 003X 191 32	M-16-H 204 33	FZC 003Y 189 34	FZC 003S 169 35	36	37	38	39
M-196-D 164 21	BSF-S-11 66 22	BSF-37 129 23	BSF-S-12 65 24	M-323-A 165 25	26	27	28	29
BSF-28 129 11	FZC 003W 185 12	M-12-H 196 13	FZC 003V 190 14	Plug 15	16	17	18	19

BSR CORE

32

LOADING NO.

November 29, 1976

DATE

Excess Reactivity - 5.25%

CRITICAL MASS

4822 gm

OPERATING MASS

ROD POSITIONS AT CRITICAL
(With Operating Mass)

ROD NO.	IN. WITHDRAWN	
1	11.05	9.39
2	11.05	9.39
3	11.05	9.39
4	11.05	9.39
5	11.05	23.00
6	11.05	23.00

REMARKS:

Fig. 3. Core Loading 32 - BSR

Shutdowns

There were no unscheduled shutdowns during the quarter. Table 2 gives an analysis of the scheduled shutdowns.

Table 2. Analysis of Shutdowns

Description of Shutdown	Number	Downtime (hrs)
Scheduled		
Experimenters:		
No request to operate	4	139.117
Experiment insertion, removal, or data taking.	15	17.500
Repositioning of the reactor	3	2.717
Reactor Operations:		
Scheduled weekend shutdowns	3	150.617
Xenon decay for refueling	1	58.483
Refueling critical runs	7	35.300
Shim rod calibrations	2	20.200
Quarterly	1	53.900
Subtotal	36	485.834
Unscheduled		
Experimenters:	0	0
Reactor Operations:	0	0
Subtotal	0	0
Total	36	485.834

Maintenance and Changes

Maintenance or changes on the instrumentation and mechanical components in the complex are listed in Tables 3, 4, and 5. Table 6 presents the status of the ionization and fission chambers.

Table 3. Maintenance and Changes, Instrumentation and Controls

Date	Component	Trouble or Change	Reason or Maintenance
10-6-76	Facility radiation and contamination monitoring system	Routine	Bimonthly checkout.
10-19-76	Servo channel	Chart drive failure	The faulty chart drive motor was replaced to correct the trouble.
10-22-76	High bay monitron	False alarms	The amplifier was retubed and the alarm point reset to correct the trouble.
10-25-76	Log-N channel	Erratic readout	The Log-N amplifier was replaced to correct the trouble.
10-27-76	Secondary pH control system	The pH controller setpoint was set for a pH of 6.8 with alarm setpoints of a pH of 6.5 and 7.1	To comply with the pH requirement for polyphosphate treatment of the secondary cooling water.
11-1-76 through 11-3-76	Instrumentation	Routine	Quarterly checks.
12-2-76	Facility radiation and contamination monitoring system	Routine	Bimonthly checkout.

Table 3. (Continued)

Date	Component	Trouble or Change	Reason or Maintenance
12-13-76	Servo channel	Momentary faulty operation of servo due to sticking relay contacts	Replaced pilot servo relays RY-3 and RY-4 in the servo amplifier and servo insert and withdraw relays K-10 and K-23 to correct the trouble.
12-27-76	Log-N channel	Erratic period recorder readout	Replaced the Log-N amplifier

Table 4. Maintenance and Changes, Mechanical System

Date	Component	Trouble or Change	Reason or Maintenance
10-12-76 and 10-13-76	Shim-rod drive assemblies Nos. 1 through 6	Routine inspection	The shim-rod drive assemblies were inspected, the magnets and clutch switches cleaned, the drive tubes brushed and flushed, and the drive assemblies reinstalled.

Table 5. Maintenance and Changes, Process System

Date	Component	Trouble or Change	Reason or Maintenance
10-5-76 and 10-6-76	Secondary pH system	The pH probes were moved from outside the secondary cooling tower to inside the secondary pump house	To correct erratic operation.
10-27-76	Secondary cooling system	Discontinued use of chromate in the secondary cooling water	Chromate replaced with polyphosphate treatment of the secondary cooling tower water.

Table 6. Status of Ionization Chambers

Chamber Serial No.	Location	Date Present Service Started	Previous Service	Remarks
		Chambers in Service		
PCP-III-106, SN-72-1	Position B, servo and No. 2 safety	5-12-75	None	This new chamber was installed in the BSR in May, 1975.
CTC-4 (C-771)	Position C, No. 1 safety	12-1-69	LITR	The chamber was modified for underwater service in 1969.
PCP-III-106A, SN-72-2	Position D, Log-N and No. 3 safety	11-13-73	None	This new dual chamber was installed in the BSR in November, 1973.
C-1045	CP-81, fission chamber	10-1-69	PCA	This fission chamber assembly was transferred to the BSR from the PCA in October, 1969.
		Chambers Not in Service		
CTC-3 (J-118)	Position A, spare		LITR and BSR	The chamber was modified for underwater service in 1969. Removed from service as BSR No. 2 safety in August, 1976.
PCP (old type, no serial number)	Warehouse storage		BSR	This chamber is of the old type and will be repaired if needed.

Table 6. (Continued)

Chamber Serial No.	Location	Date Present Service Started	Previous Service	Remarks
CIC (No. 62)	BSR storage		BSR	This chamber is reserved for the PCA but can be used in an emergency for the BSR.
CIC (No. 63)	BSR storage		BSR	This chamber is reserved for the PCA but can be used in an emergency for the BSR.
PCP (Q975, No. 2)	BSR storage		BSR	This chamber is reserved for the PCA but can be used in an emergency for the BSR.
PCP-III-106, SN-66-1	BSR storage		BSR	Used as No. 2 safety and servo. Safety section failed in June, 1969; servo section failed in May, 1975.
PCP-III-106, SN-66-3	ORR beam tube storage		BSR and ORR	Used BSR and ORR 1967 through 1973. Last removed November, 1973.
PCP-III-106, SN-66-4	ORR instrument shop		BSR	Used in the BSR from 1968 to January, 1973. Repaired in 1969.

Fuel

Changes in the fuel inventory are reflected in Table 7.

Table 7. Fuel and Shim Rod Status

	This Quarter	Last Quarter	Year To Date
Fuel elements depleted	0	0	0
Control-rod fuel elements depleted	0	0	0
New fuel elements placed in service	2	0	7
New control-rod fuel elements placed in service	0	0	0
New fuel elements available for use	4	6	4
New control-rod fuel elements available for use	6	6	6
Partially depleted fuel elements available for use	5	2	5
New shim rods placed in service	0	0	0
Boron stainless steel shim rods in use	6	6	6
Boron stainless steel shim rods available for use	2	2	2

Experiment Facilities Assignment

Facility assignments are listed in Table 8. The tubes of the stationary D_2O tank are not permanently assigned; they are used by various Laboratory personnel for short-term sample irradiations.

Table 8. Facilities Assignment

Facility	Location	Division or Sponsor
Liquid helium cryostat	Southwest corner of pool using west D_2O tank	Solid State
Liquid nitrogen cryostat	On instrument bridge	Solid State
Ambient temperature facility	North face of core	Solid State
Front-face tube	North face of core	Solid State
Heavy section steel experiment	North and east faces of core	Metals and Ceramics
Fast-neutron tube	Core position 15	Solid State
Water-cooled tube	Core position 11	Solid State
Dry thermal-neutron tubes* (N-4 and S-3)	Stationary D_2O tank	Operations
Dry thermal-neutron tubes* (east, center, southwest, and northwest)	Stationary D_2O tank	Operations

*These facility tubes are for sample irradiations and are used by personnel of several divisions, primarily Analytical Chemistry and Solid State Division.

Demineralizer Performance

Table 9 gives detailed information on the condition of the primary water system for the preceding year and pertinent data on the performance of the bypass demineralizer.

Table 9. Demineralizer Performance Data

Run No.	Initiation Date	Termination Date	Throughput (gal)	Gross Gamma (Counts min^{-1} ml^{-1})		pH		Specific Resistance (ohm-cm)	
				In	Out	In	Out	In	Out
33	1-4-73	3-5-73	1,614,000	1,280	115	5.7	5.8	1,008,000	1,430,000
34	3-6-73	4-30-73	1,303,200	1,848	181	5.7	5.7	873,000	1,363,000
35	5-2-73	7-2-73	2,060,000	2,072	120	5.8	5.8	896,000	1,209,000
36	7-3-73	9-4-73	1,900,000	1,672	116	5.8	5.8	792,000	1,270,000
37	9-4-73	11-12-73	1,300,000	2,021	107	5.9	6.0	682,000	1,144,000
38	11-14-73	1-7-74	1,692,000	1,353	98	5.7	5.7	738,000	1,102,000
39	1-9-74	3-13-74	1,320,000	1,932	101	6.2	6.0	666,000	908,000
40*	3-15-74	7-30-74	1,400,000	9	0	6.2	6.0	364,000	1,132,000
41	8-16-74	12-4-74	1,500,000	2,316	385	5.8	5.8	630,000	895,000
42**	12-17-74	4-15-75	3,850,000	2,116	119	5.8	6.0	364,000	1,132,000
43	4-16-75	7-7-75	2,550,000	2,712	174	5.7	5.8	937,000	1,823,000
44	7-10-75	11-5-75	2,750,000	2,528	144	5.7	5.9	968,000	1,428,000
45	11-5-75	4-29-76	2,325,000	2,146	154	5.3	5.5	902,000	1,593,000
46	4-30-76	9-2-76	2,800,000	1,430	124	5.4	5.6	1,085,000	1,808,000
47	9-2-76	In Service	3,000,000	1,556	133	5.4	5.6	1,057,000	1,746,000

*The reactor was shut down the entire run.

**New resin in the demineralizer columns.

Operating Manual

Changes which were made in the BSR operating manual during this quarter are listed in Table 10.

Table 10. Revisions to BSR Operating Manual (ORNL-TM-2676)

Date	Section	Remarks
10-26-76	Section 2-2 - Requirements for Continuous Power Operation	The procedure for manning the reactor building with the Security Monitoring System in service was clarified.

Efficiency Tests

Tests were performed by Inspection Engineering on the cell ventilation filters. Details are given in Table 11.

Table 11. Efficiency Tests Results, Filters

Date	Unit	Type Test	Efficiency (%)
11-3-76	South Bank	Elemental Iodine	99.99
11-19-76	Center Bank	Elemental Iodine	99.96
12-14-76	North Bank	Methyl Iodide	42.93
12-14-76	Center Bank	Methyl Iodide	50.06
12-14-76	South Bank	Methyl Iodide	98.52
12-16-76	North Bank	DOP	99.990
12-16-76	Center Bank	DOP	99.995
12-16-76	South Bank	DOP	99.997

Operational Activities

Date	Remarks
10-12-76 and 19-13-76	All fuel elements including shim rod fuel elements were visually inspected with satisfactory results.
11-1-76	The emergency electrical power quarterly test was completed with satisfactory results. The test was performed by turning the emergency power transfer switch (circuit 18 in electrical power panel DP-1) to "OFF" thereby starting the ORR diesel generator which supplied electrical power to designated circuits in the control and pool rooms.
11-3-76	The containment system quarterly functional checks were performed with satisfactory results.
12-10-76	The skimmer filters were changed.

Building Evacuation Drill

An unannounced building evacuation drill of the BSF simulating a condition of an impending radiation problem from an experiment, to test the response of the personnel in the building and action of the local emergency squad, was successfully completed on December 7, 1976.

POOL CRITICAL ASSEMBLY

Operations

The PCA was used 27.6 hours as an experiment facility for the benefit of nuclear engineering students from the University of Kentucky. Operational activities in preparing the facility for use included a checkout of the reactor control instrumentation and preparation of the required loadings. The operational activities are listed in Table 12 (Usage of Pool Critical Facility). The PCA maintenance is listed in Table 13. Changes in the PCA Operating Manual are listed in Table 14.

Table 12. Usage of Pool Critical Facility

Date	Operational Activity	Purpose	Hours Used
12-2-76	Established Core No. 189 to obtain a critical mass following the standard approach-to-critical procedure. Established Core No. 190 to permit calibration of the regulating rod.	Training lab for the University of Kentucky nuclear engineering students.	14.3
12-3-76	Established Core No. 191 to obtain a critical mass following the standard approach-to-critical procedure. Established Core No. 192 to permit calibration of the regulating rod.	Training lab for the University of Kentucky nuclear engineering students.	13.3

Table 13. Pool Critical Facility Maintenance

Date	Component	Trouble or Change	Reason or Maintenance
11-15-76 through 11-15-76	Instrumentation	Routine	Quarterly checks.
11-15-76	Primary counting rate channel	Would not calibrate	Replaced the count rate meter.
11-15-76	Primary counting rate channel	Did not meet specifications	Replaced the pulse amplifier.
11-15-76	Auxiliary counting rate channel	Low gain	Replaced the pulse amplifier.
11-15-76	No. 2 safety channel	High output voltage	Replaced the No. 2 sigma amplifier.

Table 14. Revisions to PCA Operating Manual (ORNL-TM-2340)

Date	Section	Remarks
10-26-76	Appendix F - Qualification of PCA supervisors	The requirements for the position of PCA supervisor were clarified.

Experiments

Experiments were conducted at the PCA by students from the Nuclear Engineering Department of the University of Kentucky as indicated in Table 12. These experiments are described briefly and were directly supervised by the training supervisor of the Operations Division.

Approach-to-Critical

To demonstrate the technique of assembling a reactor core, a critical mass was loaded by the nuclear engineering students following the standard approach-to-critical procedure.

Regulating-Rod Calibration

A technique used in calibrating reactor control rods was demonstrated by using the period method in calibrating the regulating rod. The exercise was performed by the nuclear engineering students.

APPENDIX A

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

December 2, 1976

TO: F. T. Binford

FROM: T. P. Hamrick

SUBJECT: Calibration of BSR Shim Rods

The BSR shim rods were calibrated following the refueling operation to establish BSR loading No. 32. A new core configuration was established to increase the flux for the southeast HSST experiment; thereby, changing the reactivity worth of shim rods Nos. 5 and 6. The reactivity worth change of shim rod Nos. 1, 2, 3, and 4 was insignificant. The reactivity worth curves from the June, 1976, calibration are attached along with the reactivity worth curve changes for shim rod Nos. 5 and 6. Loading No. 32 resulted in a core with 5.25% Δk/k excess reactivity.

As determined from this most recent calibration of the shim rods, the minimum position of the shim rods at critical remains as follows:

1. All six rods ganged at 10.70 inches withdrawn; and
2. Rods 5 and 6 at 23 inches withdrawn, rods 1-4 ganged at 9.0 inches withdrawn.

Rod worths determined during the five most recent calibrations are compared in Table 1 below:

Table 1. Comparison of BSR Rod Worths (% Δk/k)

Rod No.	Jan. 1972	Sept. 1974	June 1975	June 1976	Nov. 1976
1	1.944	1.697	1.934	1.755	--
2	1.864	1.873	1.259	1.843	--
3	3.018	2.942	3.086	2.512	--
4	2.962	2.966	2.931	2.854	--
5	0.852	0.946	0.940	0.854	1.145
6	0.872	0.937	0.910	1.159	0.885
1-4	9.788	9.478	9.710	8.964	8.964
5-6	1.724	1.883	1.850	2.013	2.030
Total	11.512	11.361	11.560	10.977	10.994

T. P. Hamrick

T. P. Hamrick

E. D. Lance

E. D. Lance

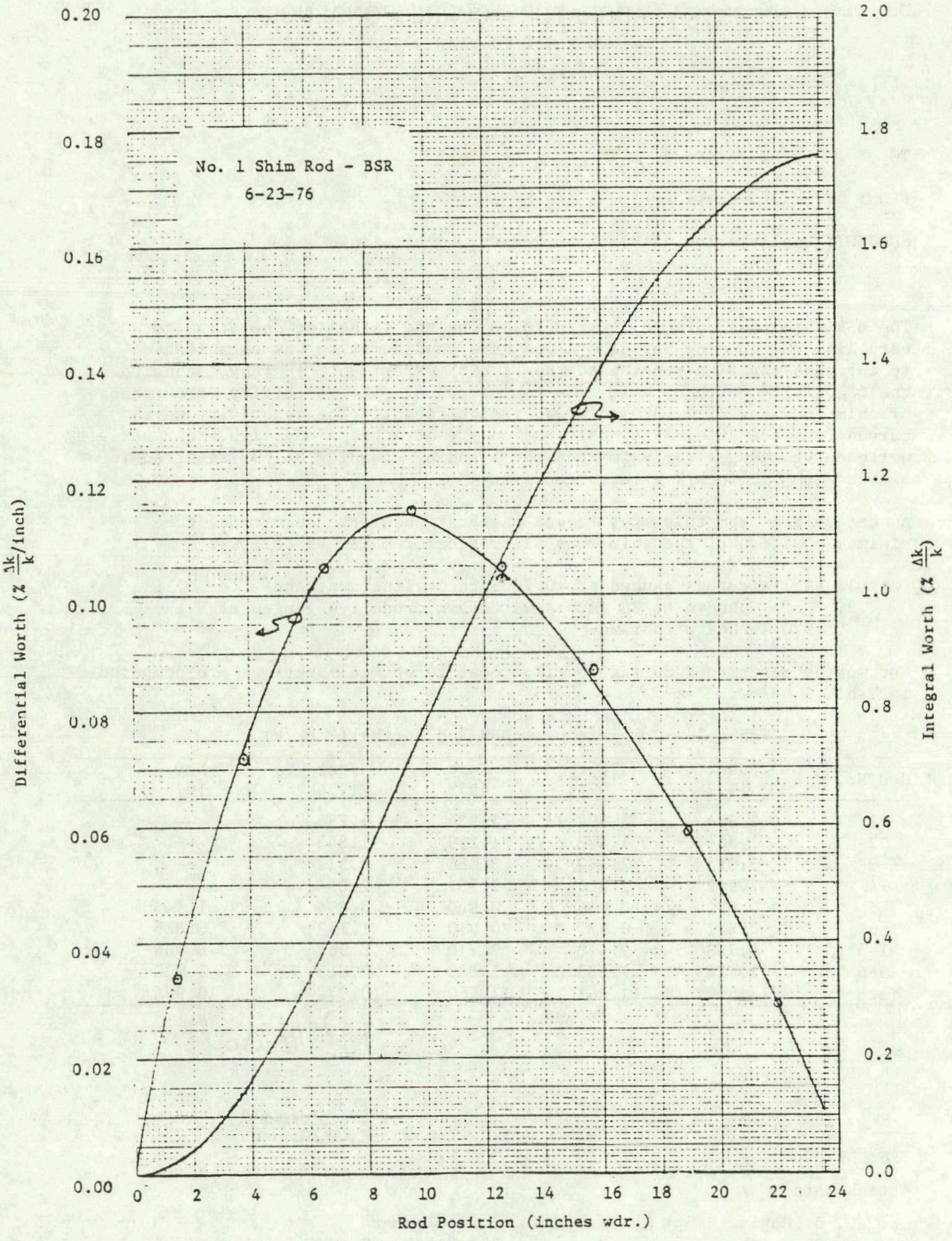
TPH:EDL:dsp

Attachments

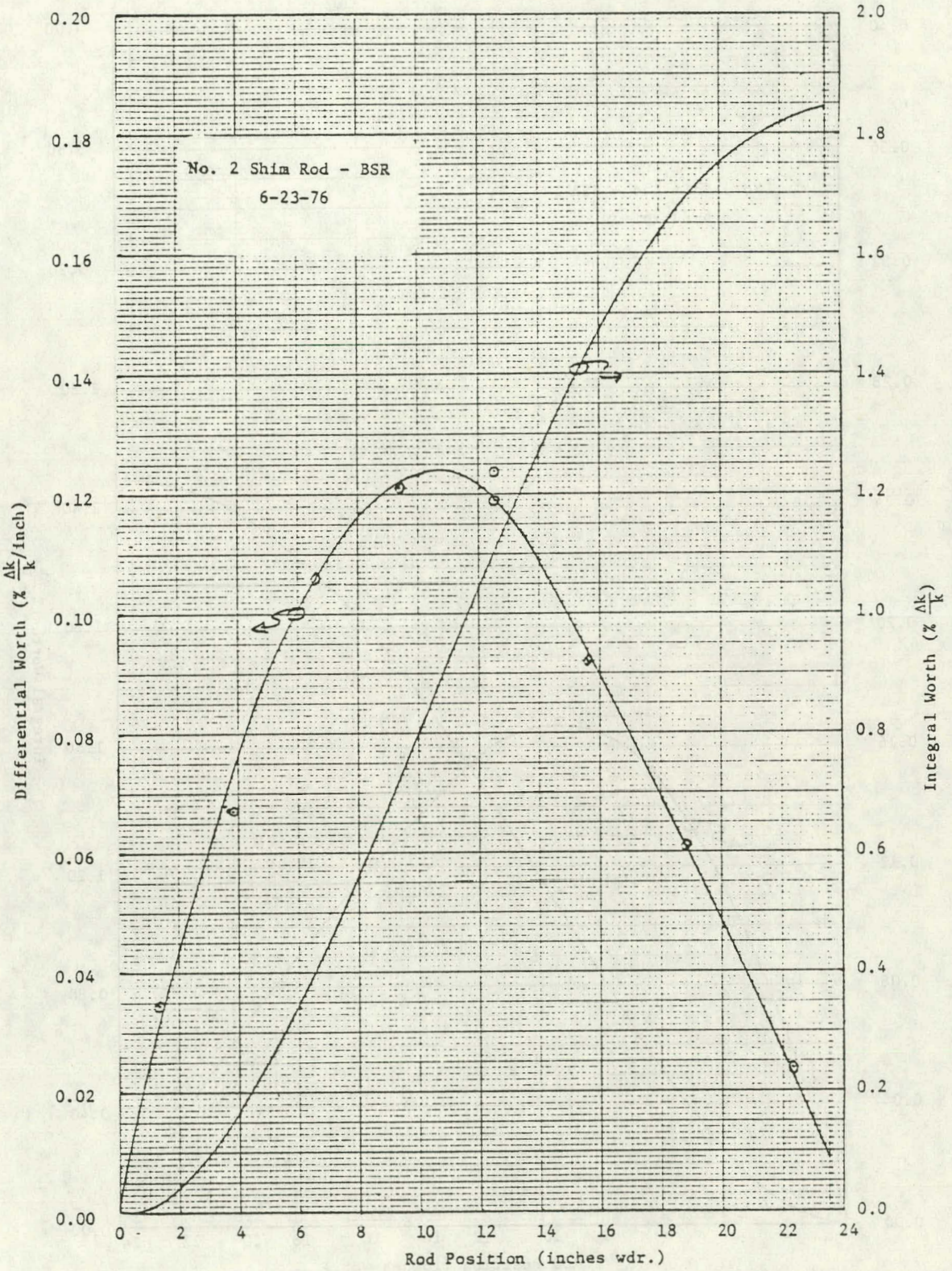
cc: C. D. Cagle
C. B. Gaither
S. S. Hurt, III
J. R. Thomas
BSR Control Room

UCN-430
(3 5-61)

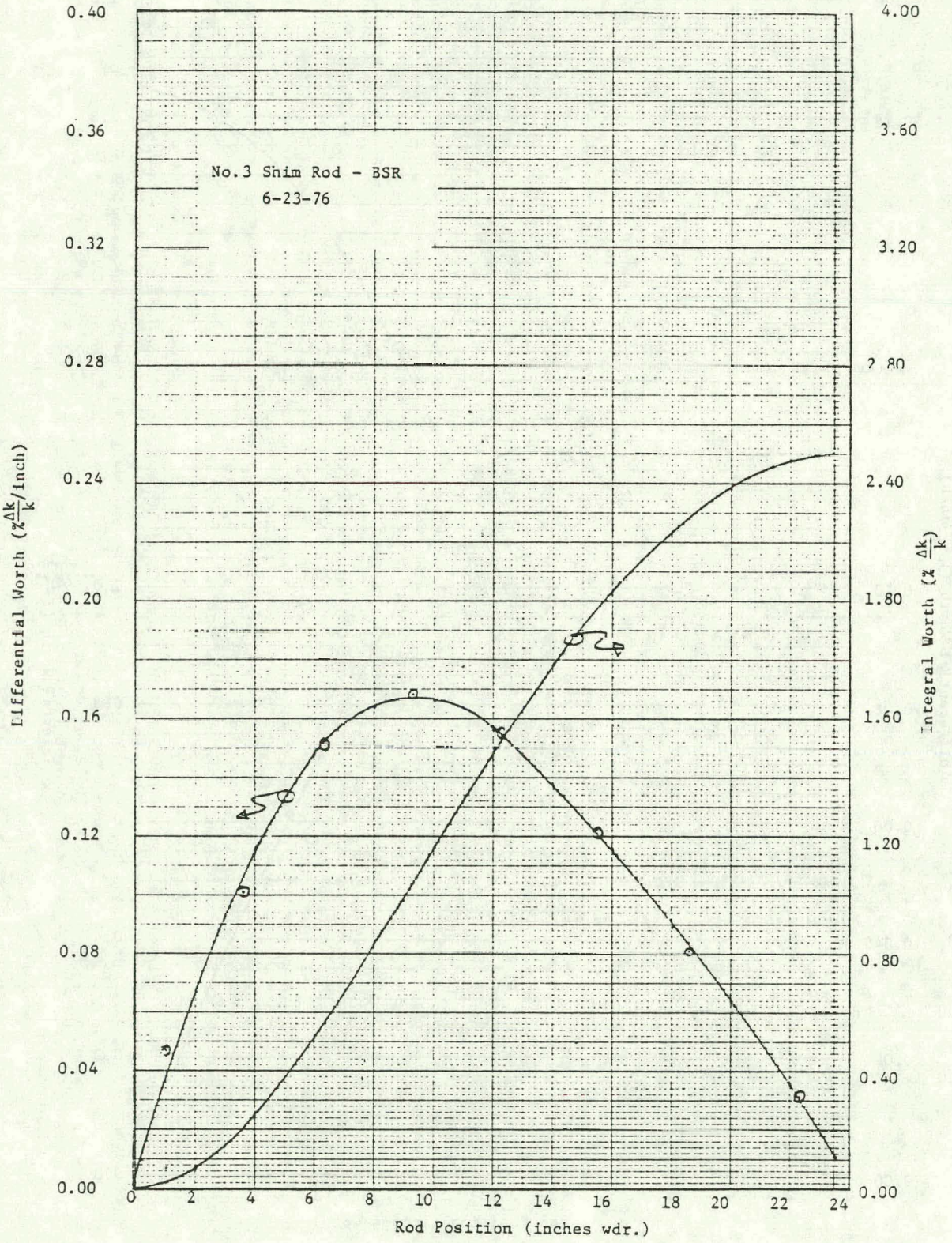
Appendix A. Calibration of BSR Shim Rods



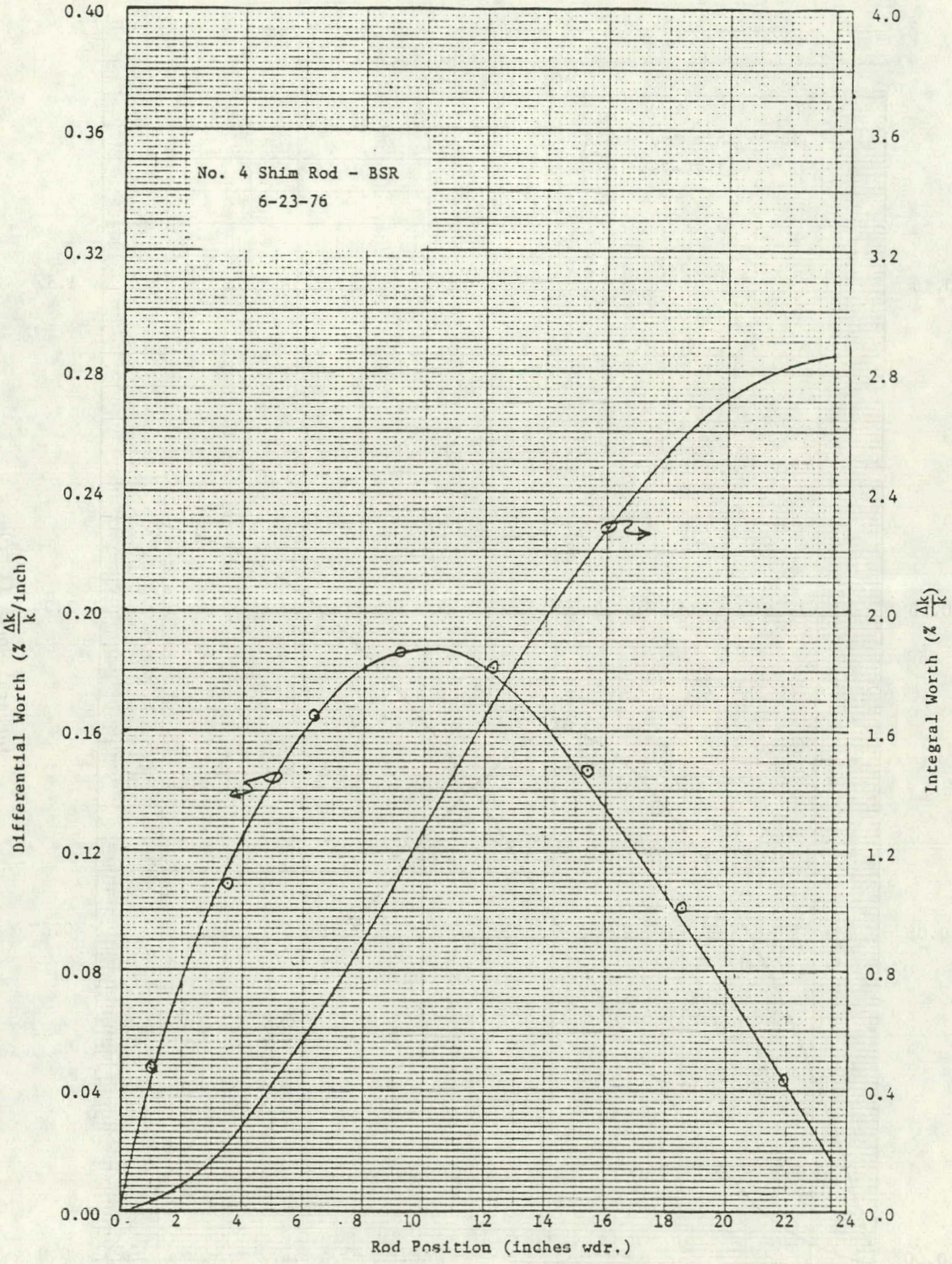
No. 1 Shim Rod - BSR



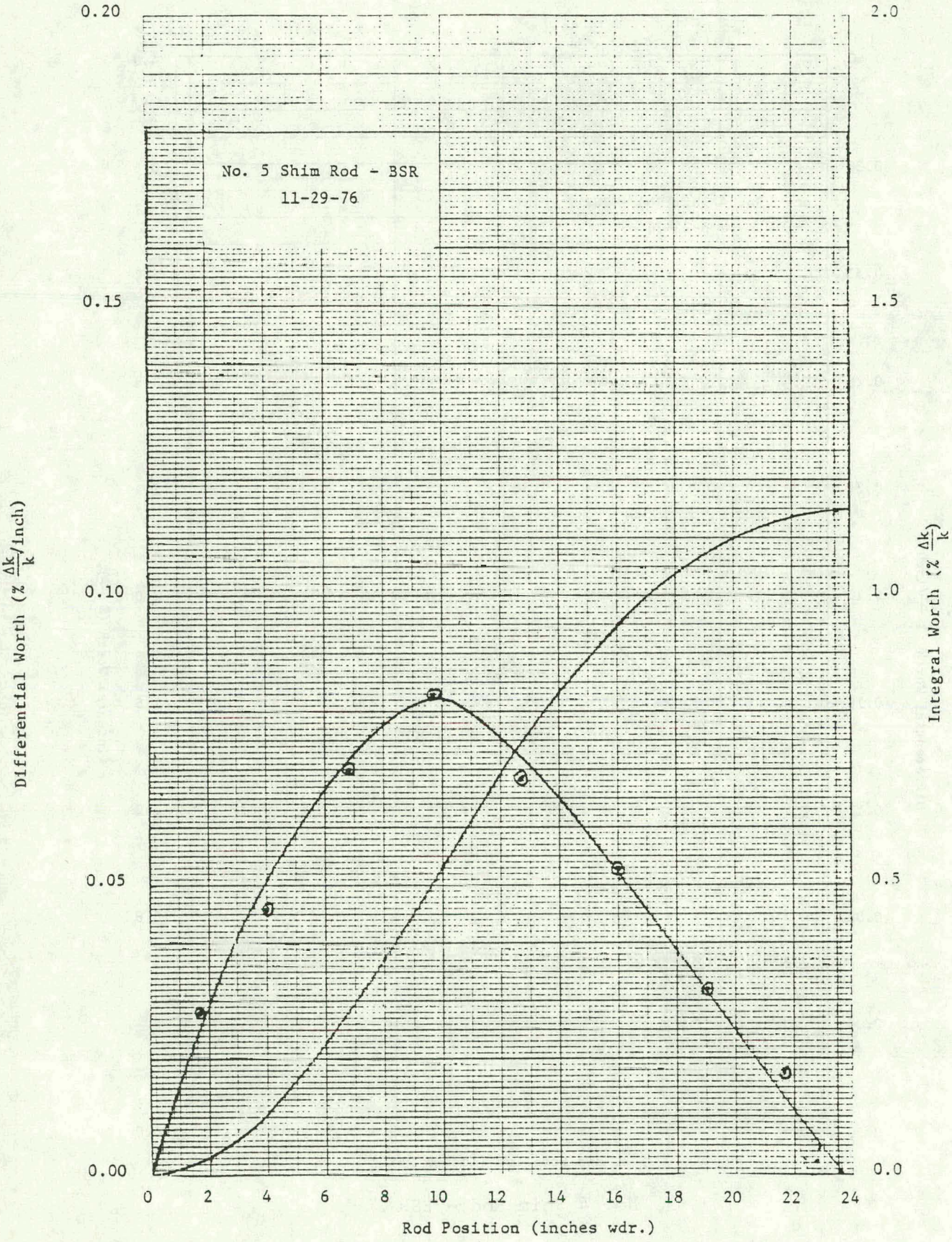
No. 2 Shim Rod - BSR

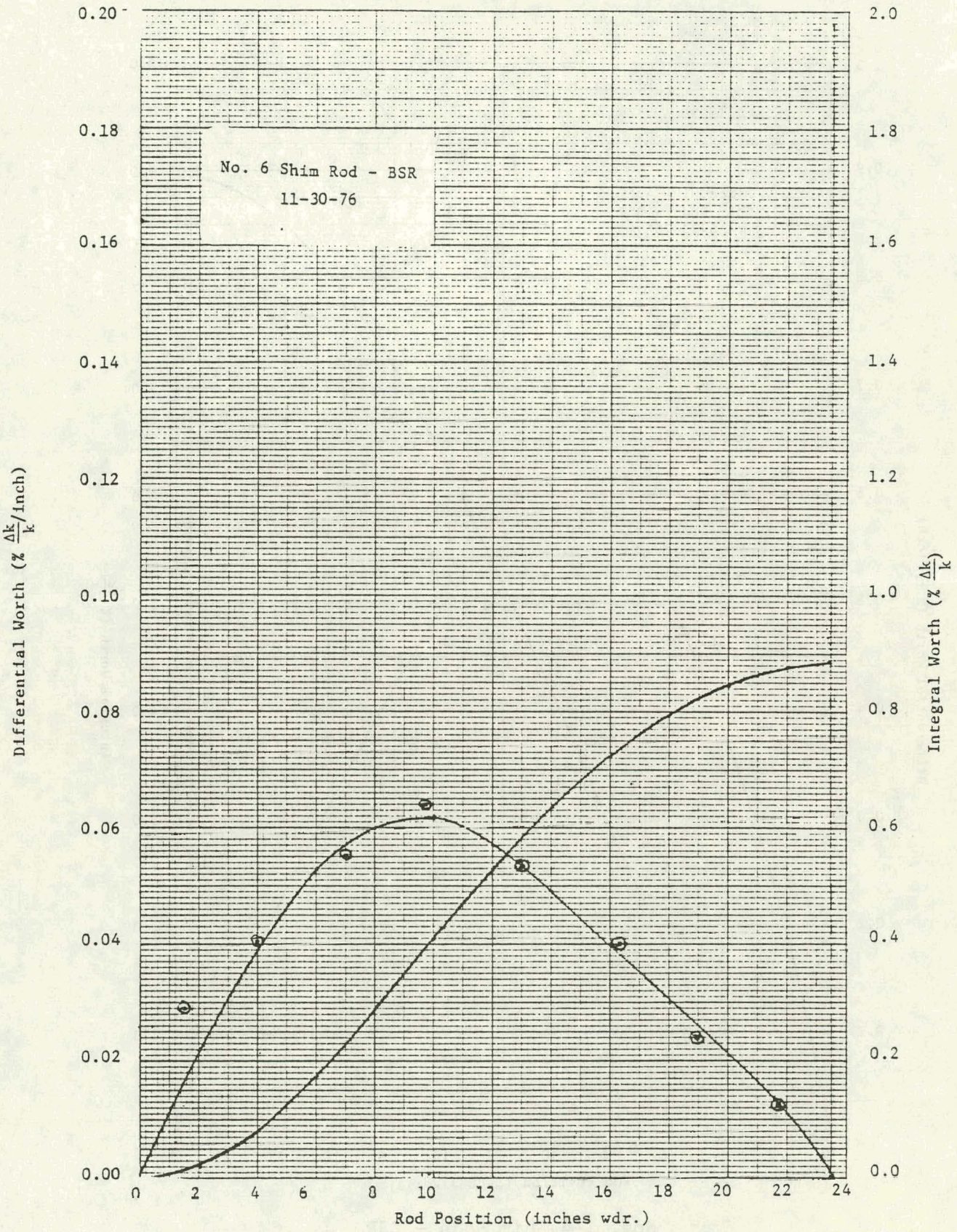


No. 3 Shim Rod - BSR

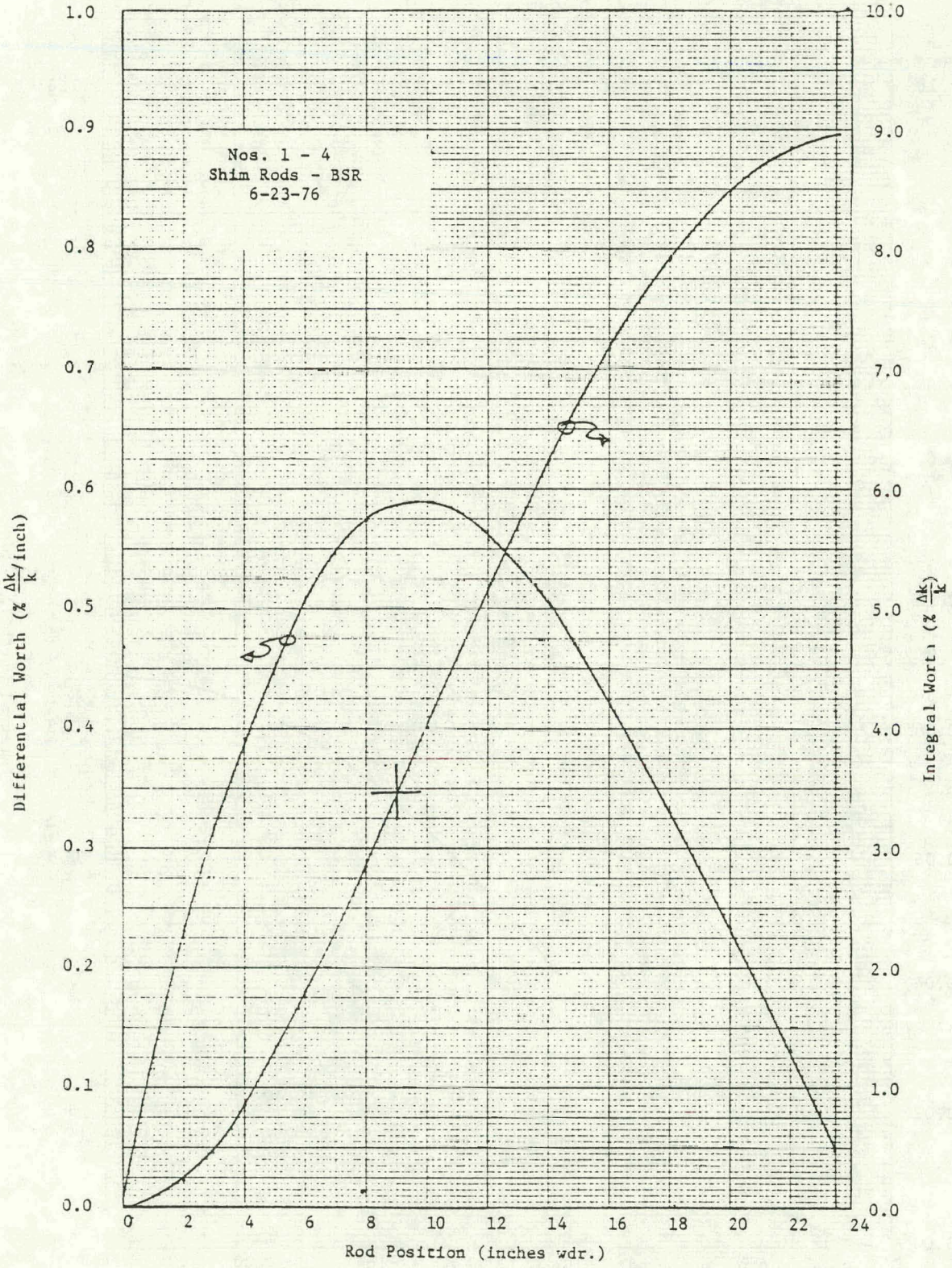


No. 4 Shim Rod - BSR

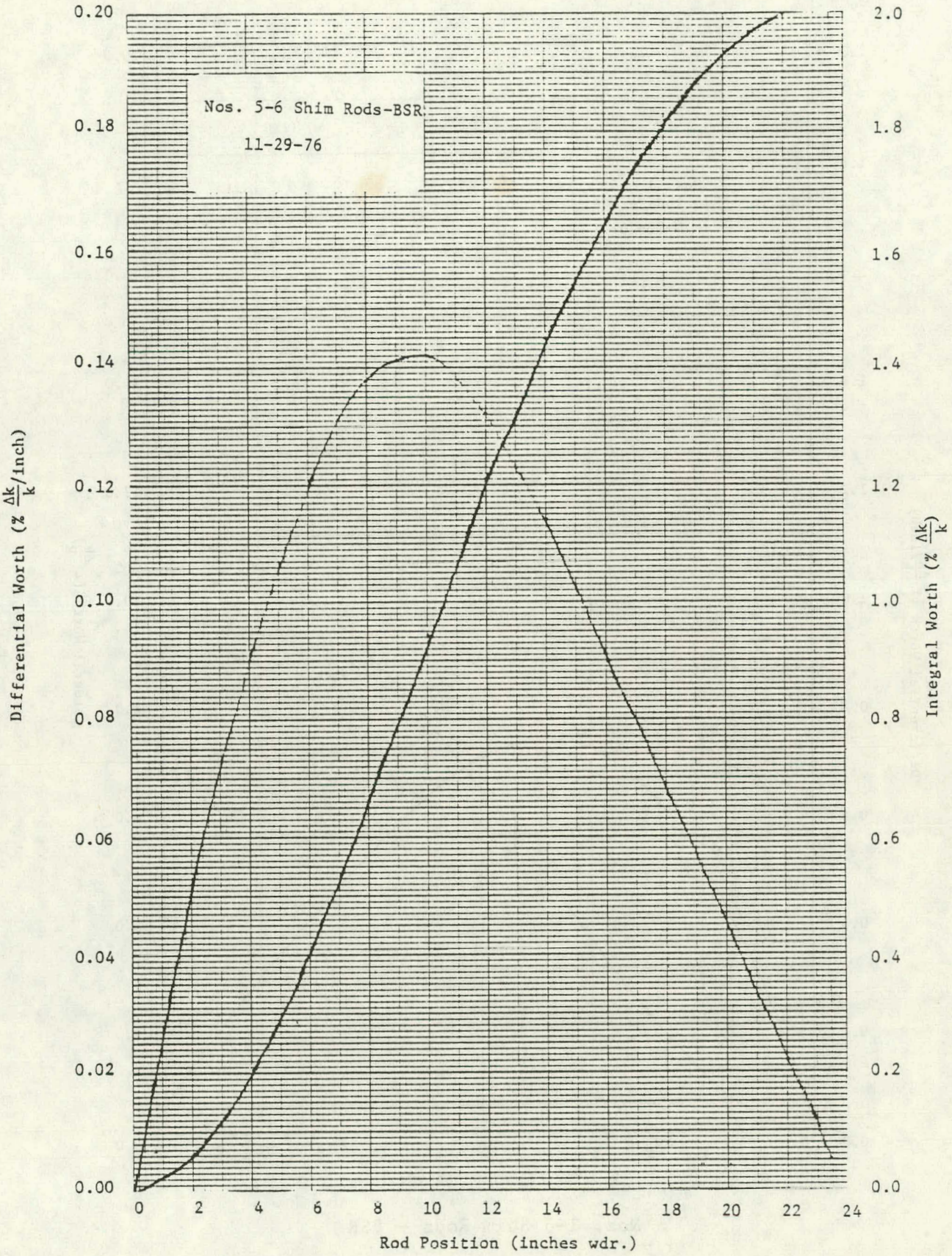

No. 5 Shim Rod - BSR
11-29-76
Differential Worth (% Δk/k/Inch)
Integral Worth (% Δk/k)
Rod Position (inches wdr.)
0.20
0.15
0.10
0.05
0.00
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
22
24

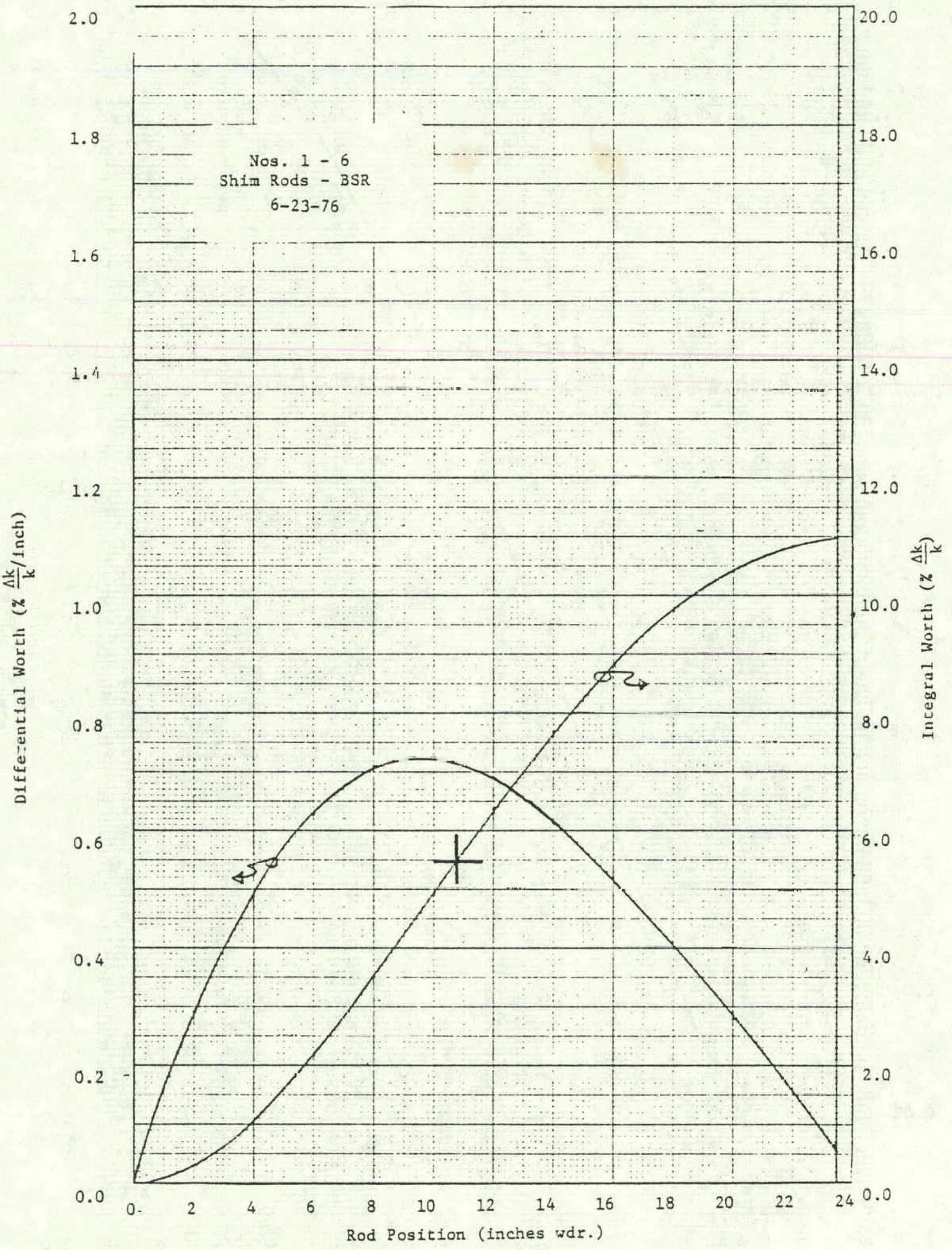


No. 6 Shim Rod - BSR

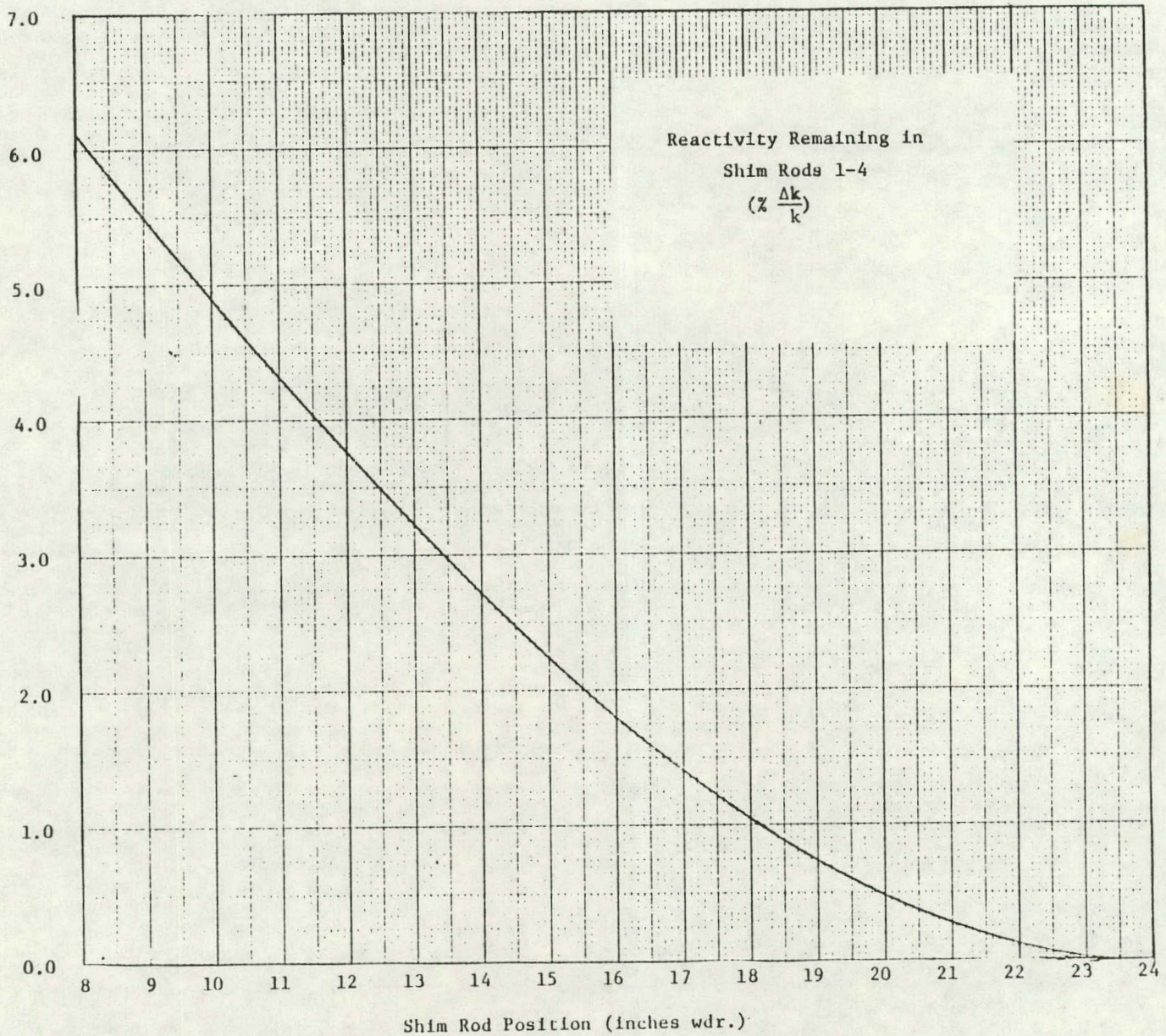


Nos. 1-4 Shim Rods - BSR


Nos. 5-6 Shim Rods-BSR
11-29-76
Differential Worth (% Δk/k/Inch)
Integral Worth (% Δk/k)
Rod Position (inches wdr.)
0.00
0.02
0.04
0.06
0.08
0.10
0.12
0.14
0.16
0.18
0.20
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
0
2
4
6
8
10
12
14
16
18
20
22
24



Nos. 1-6 Shim Rods - BSR


Reactivity Remaining in
Shim Rods 1-4
(% Δk/k)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
Reactivity Remaining in Shim Rods 1-4 (% Δk/k)
Shim Rod Position (inches wdr.)

THIS PAGE

WAS INTENTIONALLY

LEFT BLANK

ORNL/TM-6010

INTERNAL DISTRIBUTION

1. R. G. Berggren
2. G. H. Burger
3. C. D. Cagle
4. W. R. Casto
5. J. W. Cleland
6. G. H. Coleman
7. R. R. Coltman, Jr.
8. J. A. Conlin
9. J. A. Cox
10. W. A. Duggins
11. E. D. Gupton
12. T. P. Hamrick
13. S. S. Hurt, III
14. L. P. Jernigan
15. E. B. Johnson
16. E. D. Lance
17. D. L. Laughlin
18. R. V. McCord
19. F. H. Neill
20. T. B. Nixon
21. L. C. Oakes
22. J. H. Pemberton
23. H. Postma
24. M. E. Ramsey
25. W. H. Sides
26-27. J. R. Thomas
28. K. W. West
29. M. K. Wilkinson
30. F. W. Young
31-32. Laboratory Records Department
33. Laboratory Records, ORNL R. C.
34-35. Central Research Library
36. Research and Technical Support Division
37. ORNL Patent Office

EXTERNAL DISTRIBUTION

38. K. M. Akhtar, Head, Reactor Operations Maintenance Division, Pakistan Institute of Nuclear Science and Technology, Post Office Nilore, Rawalpindi, Pakistan
39. R. D. Martin, Ford Nuclear Reactor, University of Michigan, 2301 Bonisteel Boulevard, Ann Arbor, Michigan
40. J. D. Randall, Director, Nuclear Science Center, Texas A&M University, College Station, Texas 77843.
41. D. Segal, Israel
42-43. E. S. Beckjord, Division of Reactor Development and Demonstration, ERDA, Washington, D. C.
44. Safety and Environmental Control Division, ERDA-ORO
45-71. Technical Information Center, Oak Ridge