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**Mound Laboratory
Annual Report
CY 1974**

R. K. Flitcraft

October 1975

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Monsanto

MOUND LABORATORY

Miamisburg, Ohio

operated by

MONSANTO RESEARCH CORPORATION

a subsidiary of Monsanto Company

for the

UNITED STATES ENERGY RESEARCH

AND DEVELOPMENT ADMINISTRATION

U. S. Government Contract No. E-33-1-GEN-53

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Mound Laboratory Annual Report CY 1974

Issued: October 1975

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Explosives Operations Programs

WEAPONS COMPONENTS PRODUCED

Weapons support production during 1974 consisted of the manufacture of the following major categories of products: detonators for weapon primaries, detonators for timers and fire sets, solid dielectric switches, transducers, fire sets, explosive timers, explosive actuators, pellets, joint test devices, special application explosive devices, and test devices. These categories, excluding pellets, included 49 products. More than 20 types of pellets were also manufactured. There were 219 submittals to the AEC of components produced by Explosives Operations, with an acceptance rate of 93.1%. In addition, 18 lots of B-items, for which Mound Laboratory has engineering and inspection responsibilities, had a 94.4% acceptance rate.

DETONATOR PROGRAM RESUMED

A LASL detonator program was back in production one year earlier than planned following a two-year period of inactivity. Test fire results of the qualification detonators and the first WR detonators compared favorably with detonators produced during the original production run.

PYROTECHNIC EFFORTS INCREASED

In October efforts being placed on pyrotechnics were significantly increased. A Project Manager was appointed to coordinate all activities related to pyrotechnics, including incoming materials, component fabrication, testing for in-house development and production, and procurement of B-item components. Individuals were selected to coordinate activities in four broad areas: materials characterization, component development, component production, and facilities. Three pyrotechnic-containing components are being developed for fabrication at Mound Laboratory, and five B-item programs are under development at outside vendors.

PYROTECHNIC PELLETING DEVICE DEVELOPED

A pyrotechnic pelleting device was developed to form small pyrotechnic tablets for an injection molding operation. The system will be released to production in January 1975.

PRODUCT TESTERS UTILIZED

The Product Tester Group at Mound Laboratory fulfills design agency requirements for product development, in-process and final acceptance test equipment and associated instrumentation. The provision of suitable testers for Mound Laboratory weapons programs is a major commitment. Several ongoing weapons programs were supported in CY 1974, as were several other programs in early phases of development. Eight testers were completed in CY 1974, and nine additional testers were in various stages of completion. Continuing tester support is projected for CY 1975 for units needed for the pyrotechnic and other programs.

JTA SENSOR SIMULATOR DEVELOPED

Because of two new system requirements and critical delivery schedules, Mound Laboratory was requested by Sandia Laboratories Livermore to develop, fabricate, and test four different JTA Sensor Simulators each using the same Mound-designed detonator. The new design was successfully developed and demonstrated.

CORROSION PROTECTION IMPROVED

Improvements in the corrosion protection coating of explosives component parts were made by the application of a very thin, electrically insulating and corrosion resistant oxide coat on metallic surfaces.

EXPLOSIVES POWDERS EVALUATION USING FIBER OPTICS

A computer-interfaced system was developed to evaluate the firing properties and burn rates of explosives powders using fiber optics and a fast response photodetector to monitor the detonation flash. A time-distance profile was produced showing accelerations of the shock front from its inception to maximum detonation velocity. Results also showed a correlation between acceleration and powder sensitivity. Tests are planned in a recently completed facility to aid in the understanding of the reaction kinetics of pyrotechnic compositions.

OPTICAL DEVICE USED FOR COMPONENT VIEWING

An explosion-proof optical device was designed, fabricated and placed in the production area to illuminate a variety of miniature detonator components for viewing under a microscope. By using a high-intensity light source, a fiber-optic bundle and a hollow "omni-light" sphere with a reflective coating on the inside, the objects may be viewed by "cool light" with no shadows and no danger of sparks or heat near the work area.

CERAMIC MOLDING COMPOUND IN DEVELOPMENT

Efforts were directed toward the production of a ceramic molding compound that may be formed using standard techniques with conventional thermoplastic and thermosetting plastic transfer molds. Ceramic parts, mostly high aluminas, were made and fired into a variety of shapes, and may be made of other standard ceramic material.

ADHESIVE SYSTEMS EVALUATED

Evaluation of possible production urethane adhesive systems free of OSHA-restricted chemicals such as 4-4'-methylene-(bis)-2-chloroaniline (MOCA) continued. Emphasis has been placed on urethane systems based on methylene diphenyl diisocyanate (MDI) rather than tolylene diisocyanate (TDI) which, if uncombined in the prepolymer, acts as a strong irritant to the mucous membranes of the nose and throat. The curing agent for a newly employed urethane adhesive, a ferric acetylacetonate catalyzed polyol blend, was found to possess an undesirably short shelf life. However, quick freezing and cold storage of freshly prepared curing agent greatly increased the shelf life.

SOLVENTS REMOVED FROM EXPLOSIVES

A vacuum system was designed to extract occluded solvents from plastics and explosives by heating up to five grams of sample from ambient to 100 °C. The volatiles components are captured in a liquid nitrogen trap from which the solvents are quantified using a gas chromatograph.

CABLE JUNCTION WELDING AUTOMATED

An automatic pulse arc welder was designed and fabricated to position and weld up to eight cable junctions and to test for electrical continuity. The system is controlled by an electrically-wired sequencer and the weld points are positioned under the weld head by means of an open loop, numerical tape control, and two-axis cable.

DISPENSING SYSTEM FOR FINE SOLIDS DEVELOPED

A refined automatic dispensing system for metering finely divided solids was designed and fabricated. The system utilizes a modified Cahn digital top loading balance as the metering mechanism and has the capability of dispensing and metering finely divided solids in quantities of up to 1000 mg with a precision of ± 1 mg in the 1000 mg range and ± 0.05 mg in the 100 mg range.

RESISTANCE MEASURING SYSTEM DEVELOPED

A computer system was designed and fabricated to accept the resistance measurement, room temperature, X and α (temperature coefficient) directly from the measuring instruments and perform the calculation $R_{20} = R_x / (1 + \alpha \Delta)$. The results are then transmitted to a teletype to be printed and to an IBM card punch to be punched.

PRESSURE/VOLUME CALIBRATION SYSTEM AUTOMATED

An automatic pressure/volume calibration system was developed under computer control with operating parameters automatically measured and results calculated and printed. The calibration system shuts down automatically if preset limits are exceeded. This new method reduces calibration time from three working days to a 24-hour period.

FLUIDIC GAGE FABRICATED

A fluidic non-contact gage was fabricated to measure compacted powder heights, pellet heights, and diameters and cylindrical well depths. This method eliminated standard contact methods of gaging which could disturb easily damaged powder surfaces.

ACCUTRON GAGE RESOLUTION INCREASED TENFOLD

The output of a standard Bendix Accutron gage is normally displayed on an analog meter with a visual resolution of approximately 0.001 in. This resolution on a gage in the production area was increased tenfold to 0.0001 in. by tapping the variable analog signal in the gage before it enters the meter circuit. The signal was then run through a conditioning network and displayed on a digital panel meter with the proper range to give 0.0001 in. resolution.

ULTRA-HIGH SPEED EVENTS EVALUATED

The capability of obtaining qualitative data of ultra-high speed events by optical recording techniques was developed for the evaluation of exploding wires and detonation phenomena. The major effort was with Q-switched laser stereophotography.

VACUUM DEPOSITION TECHNIQUES DEVELOPED

Vacuum deposition techniques for metallic and nonmetallic thin films suitable for mechanical, electrical and optical applications were developed. An ion plating system equipped with a planetary motion fixture, a residual gas analyzer and a substrate heating device has been in constant use supporting two programs. Copper and aluminum film of various thicknesses have been deposited on plastic and other substrates with considerable success. An electron beam deposition source which provides a higher application rate has been procured.

HOT OBJECTS ACCURATELY WEIGHED

A high-vacuum weighing system was developed and installed using a modified Mettler one-kilogram analytical balance. The system can be used to determine the true masses of objects 5 to 8 degrees above ambient temperature in a vacuum of 70 μm Hg without a significant decrease in balance performance. Other thermally hot objects may now be weighed without air buoyancy errors.

STATIC ELECTRICITY CONTROLLED

A process was developed for the application of very narrow strips of aluminum to the inside of Lucite barricades to remove any static charge generated during processing. The work is part of establishing a safe pyrotechnic assembly area providing good visibility and static electricity free surfaces.

To prevent buildup of electrostatic charges on packaging for explosives shipping, the polystyrene bead foam trays in current use are coated with a conductive carbon latex paint. An alternative method of formulating the conductive material into the foam is under study.

Nuclear Operations Programs

MHW/LES HEAT SOURCES FABRICATED

One qualification and three flight heat sources (each 2400 thermal watts) for the Multi-Hundred Watt/Lincoln Experimental Satellite (MHW/LES) program were fabricated. The qualification source and one flight source were shipped to General Electric Company, the prime contractor, for evaluation; the other two flight sources were stored at Mound Laboratory pending receipt of shipping instructions. Fabrication of the two remaining flight units for the program will be completed during the first quarter of 1975. The qualification heat source was subsequently returned for disassembly, postmortem operations and recovery of fuel. This work was completed satisfactorily.

MHW TEST ASSEMBLIES FABRICATED

Five heat source assemblies for the MHW program (pressed plutonium oxide fuel spheres, 100 thermal watts each, encapsulated in iridium) were fabricated for vent compatibility and system verification tests at LASL. Twenty-five others (containing fuel simulant) were prepared for impact and system verification tests at General Electric.

MHW/MJS PRODUCTION PLANNING EXPEDITED

Production planning for the Multi-Hundred Watt/Mariner-Jupiter-Saturn (MHW/MJS) program was expedited by implementation of a computer program which produces a tabulation of the decay loss factors of plutonium-238 by days, months, and years, and also develops a sphere fabrication schedule.

MASSIVE IRIDIUM DISSOLVING TECHNIQUE DEVELOPED

A new method of dissolving massive iridium which does not involve halogens or elaborate equipment was developed. Iridium was fused in a potassium hydroxide-potassium nitrate mixture converting the iridium to iridium oxide. The cooled melt was dissolved in water, a few grams of sodium nitrite were added and the solution acidity adjusted to 2-7M nitric acid. Subsequent boiling of the acidified solution containing the iridium oxide expelled the nitrous acid and dissolved the iridium oxide.

MWG HEAT SOURCES FABRICATED

Twenty-eight fueled sources for the Milliwatt Generator (MWG) program, and 130 sources containing a fuel or volume simulant, were fabricated and shipped to Sandia Laboratories, Albuquerque for impact and burst tests, respectively. Nineteen fueled MWG capsules were subjected to a compatibility study at Mound Laboratory to determine fuel purity. Two fueled MWG capsules subjected to vibration tests at Sandia were returned for radiography and fines analyses on the fuel.

MWG HEAT SOURCE NEED SLIPS

Official word was received in May that the need for the first MWG heat source had slipped seven months; in October it was learned that a further slip of 17 months had occurred. Mound Laboratory was advised, however, that planned efforts here should be continued. A further impact occurred in October when Sandia announced a 50% decrease in the FY 1975 reimbursable order to the Laboratory for the MWG heat source.

MWG FACILITY DESIGNED

Design of facilities to provide for fabrication and testing of the Milliwatt Generator (MWG) heat source, including major equipment and instrumentation needs was finalized. All equipment was ordered and facility completion is scheduled for June 30, 1975.

MWG IMPACT GUN TEST FACILITY DESIGNED

An impact gun installation, for first use on the MWG program, was designed, and purchase of equipment was initiated. This installation, expected to be completed late in CY 1975, will provide a new testing capability at Mound Laboratory.

FUEL AND CONTAINER COMPATIBILITY STUDIES MADE

Compatibility between plutonia fuel elements and T-111 alloy (Ta-8 wt % W-2 wt % Hf) used in the Milliwatt Generator program was studied. It was discovered that high temperatures changed the stoichiometry of the fuel, which inhibits oxygen transport across the fuel liner interface.

MHW AND MWG TECHNOLOGY TRANSFERS MADE

The active liaison established previously with the du Pont organization relative to the contemplated transfer of plutonium-238 activities to Savannah River was maintained in 1974. Transfers of pertinent technologies on the MHW and MWG programs were made smoothly and with minimum impact on present Mound Laboratory operations.

HEAT SOURCE DEVELOPED FOR NAVY ANTISUBMARINE WARFARE GROUP

Design and development of techniques for fabrication of a plutonium-238 fueled heat source (18 thermal watts) were carried out in CY 1974. This source is to be used in a 0.5-watt electrical Radioisotope Thermoelectric Generator (RTG) for the Navy's Antisubmarine Warfare Group. Eight prototypes were fabricated in December for the demonstration phase of the program.

VIKING HEAT SOURCE PROGRAM NEED REDUCED

Mound was advised by the AEC that the number of flight heat sources required for the Viking Program had been reduced from six to five. The five units, each of 685 thermal watts output, were fabricated and all were shipped to Teledyne Isotopes, Inc., the prime contractor.

LABORATORY REPRESENTED IN SPACE NUCLEAR SYSTEMS AWARDS PROGRAM

In an award ceremony conducted at AEC Headquarters on October 17, 1974, the Director of AEC/DSNS presented copies of the Pioneer 10 Contractor Team Award to representatives of those contractors and laboratory organizations that contributed to the Pioneer Program. The Director of Nuclear Operations represented Mound Laboratory at this event.

PIONEER 11 PASSES JUPITER

Pioneer 11, which was launched on April 5, 1973, passed the planet Jupiter in December 1974. The Mound Laboratory fabricated heat sources aboard this satellite performed faultlessly during the long voyage.

PIONEER HEAT SOURCES DISASSEMBLED

Two Pioneer heat sources which had been undergoing power tests at Mound Laboratory for a year were disassembled for recovery of fuel and for postmortem analyses of the capsule components. No difficulty was encountered in these operations.

PLUTONIUM-238 PROCESSED

Sufficient plutonium-238 was processed in 1974 to fuel the following heat sources: two MHW/LES (4.2 kg each), nearly one MHW/MJS (4.2 kg), five Viking (1.2 kg each), eight Navy (~32 g each) and 47 MWG (6-10 g each).

During the year 13.2 kg of plutonium-238 were processed through the Mound Laboratory recovery cycle and purified for reuse. The concerted effort initiated in 1973 to maintain the total plutonium-238 inventory associated with recovery at the lowest practical level was continued. As a result, the backlog of plutonium-238 awaiting recovery in the form of residues, scrap and dead inventory holdings was negligible at yearend.

NEW CALORIMETERS FABRICATED FOR SAVANNAH RIVER AND MOUND LABORATORY

A dual calorimeter system, fabricated at Mound Laboratory, was delivered to the Savannah River Plant in March 1974. These calorimeters have a capability for assaying samples up to 11 inches in diameter and 14 inches in length. Two additional calorimeters were ordered by the same customer and are presently undergoing construction.

A new calorimeter capable of handling samples up to 8-1/2 inches in diameter and 12 inches in length was designed and fabricated for general purpose use on low wattage materials at Mound Laboratory. The uncertainty of measurement with this equipment was found to be four times less than obtained with the calorimeter previously used for the purpose.

MATERIAL ASSAY AND CONTROL SYSTEM INITIATED

Fabrication of a computerized calorimeter-gamma scan combination for the RETIMAC (real time material assay and control) systems being developed for the AEC was initiated. Indications are that the first installation will be made at the Hanford Engineering Development Laboratory.

MATHEMATICAL APPROACH TO CHEMICAL EQUILIBRIUM DEVELOPED

A new mathematical approach to the study of chemical equilibrium has been developed so that chemical redox reactions, specifically those of plutonium, may be more easily characterized than traditional methods allow. By this method, many reactions may be studied with a degree of ease and facility not presently known in traditional approaches to chemical equilibria. Problems previously characterized as among the most intricate in chemistry may prove to be readily solvable.

NEW TESTING CAPABILITIES INSTALLED

New testing capabilities were installed in the surveillance (quality testing) area: a new centrifuge installation which enables Mound Laboratory to conduct a functional test under conditions of flight environment; modification of the vibration facility to permit sine and random vibration in combination with a high, low or programmed temperature environment; new Sandia functional testing equipment installed to correct problems of calibration and reliability experienced with the previous system.

COMPUTER USED FOR WR SYSTEM TEST

A PDP-8/E computer was used for the first time at Mound Laboratory to record and reduce engineering data from an actual WR system functional test. This timesaving arrangement is now being used routinely.

AUTOMATED COMPONENT TESTER DESIGNED

An automated tester for weapon components was designed at the request of Sandia Laboratory, Livermore. It is anticipated that the Mound Laboratory proposal for construction of at least one such tester will be accepted and that the work will begin in 1975.

MOUND HOSTS TWO WEAPONS CONFERENCES

Mound was the host for two important weapons-related conferences during 1974. A Gas Analysis Conference was attended by 34 visitors from the AEC and design agencies. Twenty-four attendees (welding and metal-joining specialists) from 12 industrial organizations attended a Joining Subgroup meeting of the Interagency Mechanical Operating Group (IMOG). Mound Laboratory personnel presented technical papers at both meetings.

TRITIUM OPERATIONS REPORTED

An unclassified report issued as WASH-1269, was published summarizing tritium operation practices. Operations involving tritium monitoring, handling and containment, trapping and removal, and packaging, storage and disposal methods were described. The techniques and equipment of laboratories process facilities, light- and heavy-water reactors, fuel reprocessing plants and waste disposal facilities were also described.

TRITIUM RECOVERY GOAL FULFILLED

The tritium recovery goal for FY-1974 was fulfilled in early May by round-the-clock operation with less than 1% downtime.

TRITIUM EFFLUENT CONTROL LABORATORY UNDER CONSTRUCTION

A Tritium Effluent Control Laboratory is presently under construction to provide space for bench and pilot type facilities for research and development on systems for recovering tritium from waste gas streams. The laboratory is expected to be operational in early 1975. A prototype emergency containment system for tritium was installed in the Tritium Effluent Control Laboratory and is currently undergoing evaluation.

PILOT PLANT CONSTRUCTED FOR TRITIUM REMOVAL

A pilot scale helium purifier to remove tritium and air contaminants from a containment atmosphere of helium circulating through a glovebox line was designed and fabricated. Evaluation of this equipment is planned in the Tritium Effluent Control Laboratory during 1975.

DECONTAMINATION OF TRITIUM-CONTAINING LIQUIDS BEING EVALUATED

The possibilities for decontamination of tritium-containing aqueous liquids, using techniques such as electrolysis, catalytic exchange, cryogenic distillation, molecular excitation and extractive distillation - alone or in combination - are being evaluated. Literature and design studies have been made and bench scale work is underway. A feasible solution to this decontamination problem would have wide application in the nuclear industry.

REGENERATION CELL TESTED IN THREE MODES

A General Electric regeneration cell using a solid polymer electrolyte has been procured and tested in three modes (recombination, electrolysis, and alternating) to make a determination of hydrogen isotopic specificity and to develop a tritium decontamination process using electrolysis and/or fuel cell recombination. Separation factors in the H_2 , D_2 - H_2O , D_2O system of approximately 1.7 for the recombination and alternating, and 2.0 for the electrolysis modes have been determined.

HYDROGEN ISOTOPES SEPARATED

Hydrogen isotopes have been selectively separated from oxygen and nitrogen using three different techniques: a nitrogen displacement technique using activated charcoal at $77^\circ K$; a temperature-zoned technique using molecular sieve beds at temperatures decreasing from $142^\circ K$ to $77^\circ K$; and a hydrogen-sorption method using GE's HIP alloy.

HYDROGEN ISOTOPE DISTILLATION COMPUTER SIMULATIONS PERFORMED

Computer simulations of hydrogen isotope distillations were performed to provide a basis for designing future systems. Various systems were simulated: (H_2 , HT) separation; (D_2 , T_2) separation; and an (H_2 , T_2) separation with D_2 present as may be found in the tritiated waste of future fusion reactor systems.

SOLID-STATE BAND THEORY AND STATISTICAL MECHANICS USED FOR HYDRIDE SYSTEMS

A broad-based study employing solid-state band theory and techniques of statistical mechanics has been initiated for the following systems: Pd-H, Ti-H, and FeTiH. Pressure-composition isotherms for the hydrides of Pd, V and U have been determined. Pulsed nuclear magnetic resonance has been utilized to obtain the bulk diffusion coefficients of hydrogen in $TiH_{0.4}$, $TiH_{0.5}$, $TiH_{0.75}$, and $TiH_{1.0}$. The degree of hydrogen mobility in these hydrides is of paramount importance in determining whether these materials can be repeatedly hydrided and rehydrided.

CHANGES IN ISOTOPE DISTRIBUTION IN METAL LATTICES ACHIEVED

An implantation technique has proven successful in uniformly distributing helium-3 throughout a metal lattice. Also, levels of tritium in these lattices were reduced to less than 10 nCi/cm³ by an isotopic swamping technique using hydrogen.

MOUND HOSTS TRITIUM SYMPOSIUM

Mound Laboratory was the host for a two-day symposium on "Tritium Technology Related to Fusion Reactor Systems". The symposium was attended by 44 outside visitors representing all the AEC laboratories and universities that are participating in the DCTR programs and those laboratories possessing expertise in tritium.

CTR FUSION RESEARCH EVALUATED

An outline of tritium flow pathways in the Oak Ridge and Westinghouse/Princeton deuterium-tritium (D-T) fusion demonstration burner designs was prepared for the Tritium Fusion Interaction Project sponsored by AEC/DCTR. Potential tritium interaction problems relevant to these D-T burner pathways were listed and areas of future research on tritium are being determined from this initial evaluation.

COAL CONVERSION STUDIED

A project was initiated to develop a Mound concept for a new hypervelocity (several hundred ft/sec) multistage reactor into a process that can convert soft sulfurous coals into chemical feedstocks, synthesis/fuel gas, and a combustible low sulfur char for use in conventional electric power plants. Activity was begun in late November 1974 with a literature search, development of a program plan, reactor design effort, and consideration of economic factors.

COMPUTER PROGRAM IDENTIFIES MATERIALS UNACCOUNTED FOR

A computer program was developed and implemented which automates the analysis and preparation of control charts to assist in identification of SS materials unaccounted for (MUF). These are required for reporting the accountability of SS material to AEC Albuquerque Nuclear Materials Management. The program provides direct comparison of similar analyses performed at AEC Albuquerque Operations, and a visual control tool for Mound Laboratory management.

NUCLEAR MATERIAL WASTE CONTAINERS IDENTIFIED

A four-phase computerized system for unit identification and control of all nuclear material waste containers at Mound Laboratory was completed. A 20-year traceable system is provided. The unique identification of all waste containers provides the Nuclear Material Accountability group with the control necessary to identify diverted material and provides basic information to the system in its recovery.

COMPUTERIZED PRECIOUS METALS INVENTORY SYSTEM IMPLEMENTED

The system to provide a computerized precious metals inventory system and to maintain accurate and current records of all precious metals held by each custodian at Mound Laboratory was fully implemented and used throughout the year. Records of all transfers between custodians and all material issued to a given custodian are recorded and automatically compared to the ongoing record of transactions.

STABLE ISOTOPE SALES INCREASE

In 1974 sales of stable isotopes from Mound Laboratory were made to 145 domestic and 80 foreign customers. The total value was \$1,038,040, compared with \$853,000 in 1973. Major uses by these customers comprised nuclear physics research, biological tracing, cryogenic applications, nuclear fuel element gas tagging, geochemistry, gas laser studies, neutron radiography, heart scanning, and cancer research. The three major contributors to 1974 income were, in decreasing level of sales, helium-3, krypton-82, and carbon-13. Revised prices for all stable isotopes produced at Mound were announced in December.

HELIUM-3 PRICE REDUCED - SALES RISE

A price reduction and quantity discount for helium-3 were established in January 1974. Production and sale of helium-3 showed a marked increase in 1974 with shipments totaling 3420 liters, compared with 1900 liters in 1973.

LARGEST XENON-136 ORDER RECEIVED

The largest order received to date for xenon-136 (5 liters, 80% concentration) was obtained from the Lawrence Berkeley Laboratory.

ENRICHED ARGON-37 SHIPMENTS MADE

Argon-37, enriched by a factor of at least 70 over natural abundance, was shipped to the National Bureau of Standards and to the University of Bern, Switzerland. The enriched material is being used in a program to determine the concentration of argon-37 in the atmosphere caused by cosmic rays.

MORE STABLE ISOTOPES MADE AVAILABLE

Several isotopes are now being produced and sold that were not available previously. These include 45% sulfur-34, 20% oxygen-17, 95% oxygen-18, and compounds of nitrogen-15.

ISOTOPES OF NOBLE GASES PRODUCED

Preparation of enriched stable isotopes of all the noble gases continued: 90% neon-21 from natural abundance neon feed with 99.95% neon-20 and 99.9% neon-22 recovered as by-products; 50%, 90% and 99% krypton-78, 70% krypton-80, 70% krypton-82, and 75% krypton-83; 20% and 40% xenon-124 and 99% xenon-136; and 97% and 99% carbon-13 in methane.

HIGHER XENON-124 CONCENTRATION ACHIEVED

Production of 40% xenon-124 was initiated in a 19-column thermal diffusion system. This is the highest xenon-124 concentration achieved anywhere on a continuous production basis. A number of shipments of xenon-124 at various concentrations were made to the Hanford Engineering Development Laboratory for use in gas tagging of cores in the Liquid Metal Fast Breeder Reactor.

KRYPTON ISOTOPES SEPARATED BY GAS THERMAL DIFFUSION

Technological advances in the separation of krypton isotopes by gas thermal diffusion were made in 1974. Krypton-78 in greater than 90% concentration and krypton-80 in greater than 70% concentration - the highest concentrations ever attained - were achieved in a 19-column system. Krypton-82 of at least 70% concentration was produced continuously from the same system; 20 liters of this isotope - low in krypton-83 content - were shipped to Medi-Physics, Inc., Emeryville, California, in 1974 for preparation of special materials used in heart scanning applications.

ENRICHED METHANE PRODUCED IN RECORD QUANTITY

Methane having a carbon-13 concentration of about 99.5% was produced in record quantity (97 liters). Applications for this material for synthesizing compounds multiply-labelled with carbon-13 are being explored.

SULFUR-34 PRODUCED TO 51% CONCENTRATION

Using an 8-column liquid thermal diffusion cascade, gram quantities of sulfur-34 in the form of carbon disulfide were produced at a concentration of 51% (the natural abundance of sulfur-34 is 4.2%). Higher concentrations are anticipated following addition to the system of a flow reactor for effecting exchange equilibration of the sulfur isotopes in the carbon disulfide molecule.

LIQUID THERMAL DIFFUSION COLUMN EFFICIENCY INCREASED

The efficiencies of prototype liquid thermal diffusion columns were greatly increased by redesign of the cooling water jackets. An 8-column isotope separation cascade was assembled from two types of successful prototype columns.

SPECIAL RADIOISOTOPES SHIPPED

Four shipments of thorium-220, totaling 19.0 mg of the radioisotope, were made to Brookhaven National Laboratory. This radioisotope, a decay product of uranium-233, was separated and purified by solvent extraction.

Four shipments of other radioisotopes were made to the Heavy Elements Pool at Oak Ridge National Laboratory. One comprised 9.5 g of uranium-234, a decay product of plutonium-238 which is separated and purified at Mound. Two others were made up of a thorium dioxide product, containing 21.37 g of thorium-230, obtained by processing uranium concentrate supplied by the Cotter Corporation. The fourth shipment comprised 0.13 g of protactinium-231 extracted from the same Cotter concentrate.

AUTOMATED REPORT YIELDS SAVINGS

The preparation of the Stable Isotope Shipping Containers Summary Report was automated achieving a savings of 45 workhours of clerical effort each quarter.

METAL CARBIDES PREPARED

Many metal ions form insoluble tricyanomethide salts. Chromium carbide, Cr_3C_2 , was formed from water-insoluble $\text{Cr}[\text{C}(\text{CN})_3]_2$ which, after ignition to 1200°C in vacuum, yielded a mixture of the carbide and elemental carbon. Other metal carbides, such as iron carbide, may also be prepared by this simple and inexpensive technique.

AUDITS AND SURVEYS OF VARIOUS ACTIVITIES CONDUCTED

An audit of the Viking capsule assembly, conducted by the Dayton Area Office of the AEC, resulted in an Excellent rating.

Three audits of different aspects of the BOSK IV program, conducted by the Dayton Area Office of the AEC, resulted in Satisfactory ratings.

Two audits of MHW program activities were made by the Dayton Area Office of the AEC. One, conducted on hydroforming and hardware production for the first MHW heat source, resulted in a Conditional rating; the other, on assembly operations, resulted in a Satisfactory rating.

Two surveys by AEC/ALO teams - one an annual audit of the Mound Nuclear Safeguards programs and the other an appraisal of Nuclear Materials Management activities - were conducted in September-October 1974 and resulted in Satisfactory ratings.

The annual appraisal of Weapons Production Operations of Mound Laboratory was conducted by AEC/ALO in January 1974. While no formal rating was given, the Nuclear Operations fabrication and material recovery activities included in this appraisal were cited by the survey team as "areas of progress".

A program management audit conducted during the latter half of 1974 by an AEC team from the Dayton Area Office relative to heat source fabrication activities at Mound Laboratory resulted in no findings.

A quality management survey, conducted by a team from AEC/ALO in midyear and covering both Nuclear and Explosives Operations, was completed. No official close-out on this survey was made by the end of the year.

Analytical Developments

PLUTONIUM-CONTAINING AUDIT-VERIFICATION SAMPLES ANALYZED

Thirty-nine plutonium-containing audit verification samples from Los Alamos Scientific Laboratory were analyzed. The data for samples of pure oxides, impure oxides and plutonium fluoride slags - showed good agreement among the various analytical techniques used. These same materials were also subjected to calorimetric and gamma scan evaluations.

MOUND CONTINUES PARTICIPATION IN SALE PROGRAM

Participation in the SALE (Safeguard Analytical Laboratory Exchange), Metal and Isotopic Sample Exchange analytical programs was continued. As a result Mound is better able to control the quality of existing determinations as well as to develop more accurate and precise methods.

PLUTONIUM ASSAY SYSTEM UPGRADED

The in-line gamma scan system employed for assaying plutonium-containing residues was updated to use a Ge(Li) detector instead of the NaI(Tl) detector previously employed. The new system, characterized by high resolution, provides better reproducibility and a lower level of detectability for plutonium-238.

AUTOMATIC SAMPLE TRANSFER AND ASSAY SYSTEMS DEVELOPED

An automatic positioning system was designed for transporting plutonium samples to and from operating stations inside a series of stainless steel cells. The system runs the length of the process line on overhead rails (X axis), the width is spanned by a sliding carriage (Y axis), and the vertical (Z axis) sample pickup is a reel-type system with automatic pickup and release mechanism. Computer entries control the desired location, eliminating manual operations. Process line completion is scheduled for Mid-1975.

The conceptual design for development of a Safeguards, or accountability system, which utilizes an automated plutonium assay system involving calorimetry for heat measurements and high-resolution gamma-ray spectroscopy for the measurement of plutonium isotopic and americium concentrations was accepted by the AEC for Safeguards applications. All design work was completed, equipment purchased, and calorimeter construction

initiated. The system will be assembled by July 1975 with testing scheduled for completion by December 1975.

AMERICIUM-241 AND PLUTONIUM-238 DETERMINED IN MIXTURES

An alternate method of analysis, based on liquid scintillation and sodium iodide well crystal spectrometry, was developed for determining americium-241 and plutonium-238 in plutonium isotopic mixtures. The method provides improved accuracy when analyzing samples of low specific activity such as slags, ashes and ground porcelain crucibles.

AMERICIUM SEPARATED FROM PLUTONIUM

Americium was separated from plutonium for the first time by residue adsorption. The new technique now enables independent determination of plutonium-238 and americium-241.

CARBON DETERMINATOR INSTALLED

A Leco carbon determinator was installed in a glovebox in a plutonium processing area, replacing a gas chromatograph which was subject to frequent maintenance and was more time-consuming to operate.

IMPURITIES IN IRIDIUM MATRIX DETERMINED

A spark source mass spectrographic (SSMS) technique was developed which quantitatively determines cation impurities in an iridium matrix after the hemishell hydroforming process. This material is used in encapsulating radioactive fuel for the multihundred watt power generator.

TUNGSTEN IN IRIDIUM DETERMINED

Wet chemical methods were developed for determining tungsten in concentrations as low as 10 ppm in iridium by a spectrophotometric method.

SCANNING ELECTRON MICROSCOPE INSTALLED

Two new ETEC scanning electron microscopes were installed, providing Mound with new capabilities for the analysis of tritium- and plutonium-contaminated samples.

HYDROGEN ISOTOPE MIXTURES ANALYZED

A du Pont 21-491 double-focusing mass spectrometer was extensively modified to permit quantitative analyses of the isotopic composition of hydrogen mixtures with increased precision and accuracy.

INFRARED SPECTROPHOTOMETER INSTALLED

A new Beckman infrared spectrophotometer was installed, thereby providing a capability for infrared analysis of tritiated samples.

PARTICLE SIZE ANALYZER INSTALLED IN SW

A new Micromeritics particle size analyzer installed in a glovebox line in SW Building now permits routine analyses for particle size of materials used in weapon development programs.

CUMULATIVE TRITIUM COLLECTION MONITOR DESIGNED AND FABRICATED

A cumulative tritium collection monitor was designed and fabricated for the automated collection of tritium as water which can be distilled weekly for liquid scintillation counting using existing environmental monitoring distillation equipment. Alarms are activated on both the monitor and in a control office if deviations are detected in the sampling rate or catalyst temperature which are monitored continuously. Tritium can be measured in both elemental and oxide forms. Detection levels of 10^{-5} $\mu\text{Ci}/\text{m}^3$ are possible.

IMPROVED ROOM MONITORS FABRICATED

Improved realtime room monitors designed and tested by Mound Laboratory have been fabricated. These monitors, specifically developed for tritium handling facilities, have sensitivities of $1 \mu\text{Ci}/\text{m}^3$, digital displays which are readable at 25 feet, a continuous response range to $20,000 \mu\text{Ci}/\text{m}^3$ (10 times the maximum permissible occupational exposure), and a number of other capabilities including stability under varying environmental conditions.

COMMERCIAL INSTRUMENT MODIFIED AS ROOM MONITOR FOR TRITIUM

A design and development testing program led to modifications of a commercially-available instrument for use as a room

monitor having improved sensitivity, stability, alarming capabilities, response time and display features for tritium handling areas. Performance checking of this new equipment is continuing.

GAS CHROMATOGRAPHIC PROCEDURES ASSESSED

Experimental and statistical procedures defined the accuracy and precision of gas chromatographic determinations of low concentrations of hydrogen isotopes, helium-3, argon, nitrogen, and methane. Estimates of system error were calculated and defined over the instrument range for quantitative measurements of 50 ppm to within 1%.

METHANE (CARBON-13) STREAM ANALYZED BY GAS CHROMATOGRAPHY

A gas chromatographic method for determining carbon dioxide, carbon monoxide and ethane in the methane (carbon-13) product of a thermal diffusion separation process was developed and implemented.

X-RAY SAFETY INCREASED - PROCESS TIME REDUCED

To reduce operating time and possible safety hazards involved with x-ray fluorescence source-tube changes, an externally mounted x-ray tube identification system was devised. As a result opening of the x-ray equipment is avoided, thereby minimizing the potential for occurrence of an accidental x-ray exposure.

X-RAY EXPOSURE TIME GREATLY REDUCED

A Rigaku-Denki RV-200PL rotating anode x-ray generator equipped with a graphite monochromator was put into operation. Studies with selected mixtures of oxides revealed that the greatly enhanced x-ray flux obtainable with this machine afforded a 60- to 90-fold reduction in exposure time to produce diffraction photographs comparable to those produced by widely-used fixed anode x-ray sources. The x-ray analysis of routine powder diffraction samples has now been semiautomated through improvements in the capability of film reading and data interpretation.

EDDY CURRENT MEASURING TECHNIQUES DEVELOPED

An eddy current test was developed and implemented for measuring the thickness of fiberglass sprayed over plywood - to

assure a minimum thickness of 0.125 inches for the fiberglass coating on plywood boxes used to store TRU waste for 20 years. An eddy current test was also developed and put into use for determining the nail spacing in such boxes.

FIRE RETARDANT MATERIAL ANALYZED

An emission spectrographic procedure to determine the antimony trioxide content in fire-retardant material was developed in support of a Final Safety Analysis Review of PP Building.

ACETONE IN PETN DETERMINED BY GAS CHROMATOGRAPHY

A gas chromatograph with programmable column heating and a flame ionization detector was used in developing a method to determine acetone content in PETN on a routine basis. Maximum sensitivity was 1.25×10^{-14} grams acetone.

Environmental Control and Waste Management—●

MOUND PLUTONIUM STUDY MADE

As a result of routine environmental analysis, traces of plutonium-238 were found in silt in the abandoned Miami-Erie Canal and overflow ponds just offsite. A special project task force was formed to evaluate the inventory of plutonium-238 in the environment at Mound Laboratory, determine the source of the plutonium-238, and alleviate any potential health hazard to the general public.

A comprehensive study showed there is no hazard or safety concern for the public. About 1500 analyses were made in this study, and 250 offsite core samples were taken; plutonium concentrations of sediments and core samples ranged from 0.0001 to 4.6 nanocuries/gram. Plutonium concentrations in the air and water in the affected areas were found to be well within established radiation and concentration guidelines. It was also determined that the contamination was a result of a leak in a waste line on the Laboratory site in 1969.

A news conference was held on October 2 to announce to the Dayton area news media and the Middletown and Cincinnati newspapers results of the Mound Plutonium Study and plans for future action. A briefing was also held for representatives of the Ohio Department of Health, Ohio and Federal Environmental Protection Agencies, the Montgomery County Combined Health District, the Miami Conservancy District, and Miamisburg city officials.

NEW WASTE SOLIDIFICATION FACILITY OPERATIONAL

A new Waste Solidification Facility for plutonium-containing liquid wastes became operational in September 1974. This installation eliminates the need for further use of an underground pipeline to transport such waste to a processing area.

RADIOACTIVE WASTE REMOVED

Radioactive waste material removal for burial and recovery changed drastically during the year. New containers were designed and acquired, revised methods of storage developed and transporting criteria were provided to remove the transuranium (TRU) materials from the laboratory.

TRANSURANIC WASTE CONTAINMENT SYSTEMS TESTED

To satisfy the requirement of 20-year retrievability from burial, efforts were established to improve the Mound position relative to procurement of acceptable containment systems for transuranic (TRU) wastes. A comprehensive testing system to assure integrity of TRU polyethylene liners was developed and implemented, a material review board was established to make disposition decisions; on nonconforming TRU liners, vendor surveys were made, and close liaison was maintained with the burial site.

LOW SPECIFIC ACTIVITY WASTE REDUCED

The volume of low specific activity (LSA) waste was reduced by 50% through administrative controls. Compactors for such waste were installed by the end of 1974 and a compaction ratio of about 3/1 was achieved in demonstration runs.

PROCEDURES WRITTEN FOR WASTE MATERIALS HANDLING

Procedures required in the collection, containment, staging and shipment of radioactive waste materials were written and consolidated into a formal manual for use by Nuclear Operations personnel.

SURVEY OF RADIOACTIVE NUCLIDE ADSORPTION ON BONE CHAR COMPLETED

A literature survey was completed and equipment assembled for a study of the mechanism of adsorption of various radioactive nuclides on bone char (a naturally-occurring calcium phosphate compound). The objective of this program is to study the mechanisms of reduction of radioactive nuclides in waste streams to ultra-low levels. Bone char was found to be effective in reducing radioactivity levels in aqueous waste stream solutions containing plutonium-238. The activity level in such a solution was reduced from about 10 disintegrations per minute per milliliter (dis/min/ml) to about 1 dis/min/ml after passing through a bed of bone char.

NON-RADIOACTIVE WASTE

White paper segregation and sale continued throughout the year. Due to market conditions, mixed papers and trash became an obstacle. Arrangements were made which significantly reduced transportation costs through compaction and the subsequent hauling of larger loads to the reclamation center for salvage of glass, metal, wood and plastic materials.

Computer Programming and Data Processing

SACNET INSTALLED

A computerized system to improve the flow of telecommunications traffic to and from the Laboratory was installed. Known as SACNET (Secure Automatic Communications Network), the system is capable of processing a variety of traffic such as magnetic tape, paper tape, and cards. The system is fully encrypted and approved through the SECRET level for classified messages. SACNET replaces the Secure Automatic Data and Information Exchange (SADIE) network created in the early '60's to meet the AEC's telecommunications requirements. An example of the improved transmission speed available within the SACNET system is the Financial Reporting data (MIS-FIS) at end of each month. The time required to transmit this data has been reduced from about 8 hours to less than 15 minutes. A SACNET Emergency Backup facility providing for narrative traffic only with full cryptographic abilities was also made operational.

A SACNET transmission of computer-generated analytical weapon attributes was successfully accomplished between Mound Laboratory and LLL. The elimination of manual transcription, teletyping or mailing of data enables Mound to respond quickly to inquiries during product development.

LARGE CORE STORAGE UNIT OBTAINED

An IBM 2361 Large Core Storage (LCS) unit - capable of storing one million data characters - was obtained from the Bendix Kansas City Plant and attached to one of Mound Laboratory's IBM 360 Model 50 systems. The LCS unit stores the teleprocessing software and related data for the Laboratory's real time interactive environment. The unit is of significant value in permitting applications programs that exceed normal core storage boundaries to run in a conventional manner.

DUAL 360/50 COMPUTER SYSTEMS ACHIEVED

Mound Laboratory achieved dual IBM 360/50 computer system by the installation of a two-channel switch on an IBM 2314 disk unit, enabling that device to be shared by the two model 50's, and by the implementation of OS/MVT software on the second system. Both systems can now utilize the same program libraries and data bases during normal processing. If one unit breaks down, the remaining system can operate independently.

INFOREX KEV-DISK SYSTEM EXPANDED

The INFOREX Kev-Disk System was expanded by the addition of two additional input stations - bringing the total number to eight - and by the tripling of the capacity of the disk storage unit.

UTILITY OF PDP-12 SYSTEMS INCREASED

Nuclear Operations, Engineering, and Explosives Operations personnel collaborated to make the hardware changes and the software accommodations to enable the translation of data and program files from one format (DEC-TAPE) to another format (LINCTAPE) on a PDP-12A minicomputer. The new capability, achieved at virtually zero out-of-pocket cost, gives a transfer medium capability that will greatly increase the utility of the two PDP-12 systems at Mound Laboratory by creating a convenient link between them and the large Digital Equipment Corporation Users System (DECUS) library.

REMOTE JOB ENTRY TERMINAL INSTALLED

A Data-100 Remote Job Entry Terminal - acquired from Monsanto Research Corporation - was installed on the first floor of the OS Building. The terminal consists of a card reader, line printer, and video tube. The Data-100 terminal is connected to the IBM 360 Model 50 and is available to open shop users during normal working hours.

NEW DISPLAY CAPABILITY SAVES \$39,000 ANNUALLY

An NCR Computer Output Microfilm (COM) System and a Scotts Micrographics Duplicator were installed in the central computer facility. This installation provides a new capability in information display which will save \$14,000 annually on external services and an estimated additional annual savings of \$25,000 in paper costs.

\$7000 SAVED BY ACQUISITION OF EXCESS DISK PACKS

Over \$7000 was saved in the acquisition of needed disk packs for Mound Laboratory's computer facility by obtaining excess units from Sandia, Albuquerque.

ACCESS OBTAINED TO COMPUTER HARDWARE MONITORING DEVICE

Mound Laboratory obtained access - on a circulating basis with three other AEC contractors - to a computer hardware monitoring device purchased by the AEC-MIS facility at Albuquerque.

The device, known as DYNAPROBE, is able to capture various measurements, pulses and conditions on virtually all ADP equipment.

SHIELDED AREA CERTIFIED

A totally shielded area for Data Processing and Crypto was successfully certified and placed in operation. A complete report of the enclosure (the first of its kind), its construction, problem areas, etc., was submitted to the AEC.

DATA BASE FACILITIES EXPANDED

Mound Laboratory's data base facilities have been expanded by the integration of 15 additional physical data bases with the centralized data base. These additional bases relate to Employee Information, SS Accountability, Product Index, Shop Order, Production and Operating Systems Management facilities. The ability to interrogate the centralized data base in different ways - a technique known as logical data base views - was also increased by the addition of 25 logical views. The total logical data base capability level is now at 60.

PROGRAMMING LANGUAGE CONVERTED FROM COBOL II TO COBOL IV

A conversion from COBOL II programming language to COBOL IV was accomplished to take advantage of the advanced features in the higher level language package. The newer software package contains several programming aids which improve programmer productivity. By immediately incorporating this new technique into the Laboratory Budget Model, a significant reduction in testing and production run time was obtained.

SOFTWARE UPGRADED TO PROVIDE TELEPROCESSING CAPABILITY

The software comprising Mound Laboratory's Operating System - an organized collection of techniques and procedures for operating a computer - was upgraded to provide teleprocessing capability. This capability allows instantaneous response as inquiries are made of the centralized data base. Pilot testing of this capability proved successful: inquiry terminals were interfaced to the host computer, and inquiry programs were established with the centralized base.

COMPUTER EFFICIENCY IMPROVED WITH STRUCTURED PROGRAMMING

Mound Laboratory introduced the use of structured programming and top-down design concepts - coupled with program walk-throughs -

into its computer programming function. Limited usage to date has provided a 50% reduction from conventional programming in the number of passes on the computer required to obtain an executable program.

DATA EDIT ROUTINE PROVIDED

A data edit routine providing a more efficient technique for detection of input data errors prior to submittal to the IBM-360 for processing was developed for the Explosives Development Component Section. This technique eliminates the need for manual verification and results in a more efficient operation.

CYCLOID MASS SPECTROMETER DATA PACKAGE IMPLEMENTED

A Texas Instrument Simulation Software Package was implemented on the IBM-360 Model 50 Computer System. This software simulates the operations of a Texas Instrument 960 A System used to perform process control and data reduction functions on a Cycloid Mass Spectrometer. Test shots and complete debugging can now be accomplished on the IBM-360 without disturbing the TI-960A. Program development time has been reduced significantly.

COMPUTERIZED SELECTION PROGRAM IMPLEMENTED

A computer program was implemented in detonator testing to guarantee that no single number will be selected more than once in each number sequence. This technique which replaces a slower manual method has been used to determine the order for detonator test samples and to randomize inventory samples.

PHASE-I CONTAMINATED WASTE INVENTORY SYSTEM OPERATIONAL

The first phase of a Contaminated Waste Inventory System became operational with the inauguration of Mound Laboratory's capability to automatically generate the shipping reports required for burial of contaminated waste at National Reactor Testing Station in Idaho.

NEW PRODUCT INDEX SYSTEM IMPLEMENTED

A new Product Index System was implemented. This is a data base system which provides a list of drawing issues, specifications, and manuals by which product is built and delivered to the AEC. The system, currently containing records on over 50 Sandia and LLL products, will be expanded to accommodate additional products.

BUDGET DATA BY WEAPONS SYSTEM PRODUCED

A system to produce budget data by weapons system was implemented and successfully used in the FY-1975 mid-year budget call.

EXPLOSIVES LABOR REPORTED DAILY

The daily reporting of Explosives labor was initiated through a system which records start and stop times by electromechanical recording stations and utilizes the computer to verify the accuracy of the data.

PERSONNEL RADIATION EXPOSURE DATA COMPUTERIZED

A computerized system to control and store historical data on personnel radiation exposure from 1947 to date was implemented.

STORES INVENTORY COMPUTERIZED

A manual system of controlling stores inventory was converted to a fully computerized system with automatic daily review with order writing for 7,021 items; computer reviews of inactive items which reduced levels from 8,339 to 7,021; balance on-hand levels reduced from 90 days supply to 7 days; and faster physical inventories and reconciliations. This action resulted in \$279,000 savings per year.

RANDOM SELECTION REDUCES INVENTORY EFFORT

A statistical inventory method was developed and implemented which eliminated the need for a 100% physical inventory of stores items. Random selection of items instead of a wall-to-wall inventory was introduced into the annual reconciliation of stores and supplies inventories. This computerized system, based on the selection of 420 items from a total of 10,000 items, provided a 97% accuracy level against a desired goal of 95%. A reduction in the inventory effort from 2400 workhours in CY 1973 to 230 workhours in CY 1974 was obtained. This resulted in a \$10,000 savings.

PRECIOUS METAL INVENTORY TIME REDUCED

Modifications to computer programs and the implementation of a new method of taking the physical inventory reduced the time required to administer the Precious Metal Inventory Control System by 40 workhours per quarter.

COMPUTER SYSTEM DEVELOPED FOR EQUIPMENT INVENTORIES

A computer system was implemented to provide for quarterly and semiannual property verification and cyclical inventories of capital and sensitive equipment.

AUTOMATION SAVES WORKHOURS

Automation of the certification reporting process for HH test pressure gages provided an estimated savings of 200 work-hours per year.

CONTRACTORS CAPABILITY REPORT AUTOMATED

The Quarterly Contractor's Capability Report section of the Product Labor Analysis System was automated increasing the accuracy of the data as well as providing a substantial reduction in the manual effort previously required of Industrial Engineering to prepare the reports.

MATHEMATICAL SERVICES ENHANCED

Services of the Mathematical Analysis Section were enhanced with the completion of a basic X and R chart computer program replacing the manual calculations and hand-drawing of control charts.

GRAPHIC SERVICES PRODUCTION DATA AUTOMATED

An automated system to collect Graphic Services production data for Joint Committee on Printing reports, as well as for internal control, was implemented. This implementation eliminated 15 hours of manual effort previously required each month to collect this data.

OSHA AND FIRE INSURANCE EVALUATION DATA COMPUTERIZED

Computerized systems to transmit OSHA and Fire Insurance Reporting and Evaluation System Compliance data to ALO/AEC were implemented in conformance to AEC standards.

COMPANY VEHICLE REPORTS AUTOMATED

The maintenance and reporting of utilization and cost data relative to company vehicles was automated resulting in a saving of 10 workhours per month previously required to operate the system manually.

MOUND LABORATORY DIRECTORY AUTOMATED

Computer programs were developed to produce the Mound Laboratory directory from data contained in the Laboratory payroll file. This action provided significant savings over the previous manual method of generating the directory.

UNITED WAY PROGRAM COMPUTERIZED

A computerized system for the processing of United Way pledges was implemented for the 1974 campaign. This system not only greatly simplified the current year's campaign effort but also provides a better approach to future campaigns.

MAGNETIC CARDS DEGAUSSED

A technique which meets the requirements of Security was developed for the degaussing of the magnetic cards used in word processing equipment around the Laboratory. Minor cost saving resulted from the reuse of the cards and the reduction of storage space requirements.

LEASES ELIMINATED - COSTS REDUCED

A reduction in monthly operating expenses for the Data Processing and Telecommunications Center of over \$3,100 was achieved through the elimination of leases of TELEX and TRACOR equipment. These actions were made possible by an improvement in Western Union capabilities and the acquisition of government-owned equipments.

MRC/UNIVERSITY OF DAYTON CO-OP PROGRAM BEGUN

A Data Processing Co-op Program was initiated with the University of Dayton for the 1974-75 school year. This program emphasizes the recruiting of female and minority students and is intended to complement the educational growth of these participants with actual on-the-job experience.

MIS PROJECT TEAM PRESENTS DATA BASE CONCEPTS

Members of an MIS project team made a presentation to the GUIDE International Conference at Anaheim, California on Mound Laboratory's experiences in installing a manufacturing data base. The response from this world-wide association of IBM equipment and software users - organized to consolidate the customers' views - was very good.

EXCELLENT AUDIT RATING RECEIVED

Mound Laboratory received an excellent rating on an ALO-Security Division technical security audit which extensively examined Telecommunications and Data Processing.

Supporting Activities

SAFETY AND SECURITY

Mound employes completed the year without a disabling injury and thereby accumulated at the end of December 32,331,501 safe hours since the last disabling injury in August 1966.

The twelfth and thirteenth Monsanto Board of Directors awards were received on April 5 and October 2.

Mound Laboratory received special recognition from the Industrial Commission of Ohio and the Dayton Area Chamber of Commerce Industrial Safety Committee. The awards, for Group Recognition and Special Achievement, were presented at the 22nd Annual Miami Valley Business and Industry Safety Conference. The display depicting "Safety at Mound Laboratory" was on exhibit at the conference.

There were seven security infractions in 1974, three more than in 1973, but less than the goal of no more than ten for the year.

PERSONNEL

A one-year contract extension to September 15, 1977, with a wage reopener on September 15, 1976, was negotiated with the Oil, Chemical and Atomic Workers Union (OCAW). At the same time, a similar proposal was presented to the United Plant Guard Workers of America (UPGWA) but no affirmative response had been received by the end of the year.

A 5% adjustment was given to all salaried personnel effective May 16, 1974. On December 23 a competitive adjustment was announced for all salaried personnel to be effective March 16, 1975.

Monsanto's Savings and Investment Plan was introduced in July to be effective October 1. Forty-four percent of Mound employes joined the plan.

The Mound/Monsanto Interchange Program resulted in nine interchanges during the year.

A permanent labor standards library was established by Industrial Engineering in which all products are filed by code number with easy and rapid identification of standard operations. This file is available for review by all production and quality control managers, engineers, and foremen requiring labor information on specific products.

TRAINING

A formalized program to train employes to qualify for the Solderer classification was developed and implemented using Mound resources exclusively.

Agreement in principle was established with the University of Dayton to develop and provide a specialized segment of study to retrain technically trained employes to appropriate engineering disciplines.

A series of lectures and film showings was initiated by Industrial Engineering to make production workers more aware of the necessity for - and techniques of - cleanroom operations as one method of assuring the quality of our products.

SAVINGS, SALES, AND ENERGY CONSERVATION

To encourage the saving of fuel, reserved parking spaces were offered employes who formed carpools. Over 270 pools, comprising approximately 900 employes; were registered.

A 15% mileage reduction and an average of 12% fuel reduction for Mound's transportation function was realized in the Energy Conservation Program.

Monthly telephone costs were reduced by more than \$800 per month. An average of \$500 savings was obtained through elimination of various equipment features and an additional \$300 was saved by the alteration of operating techniques.

Because of inadequacies of the Mound firing range for pistol use and in order to avoid the significant expense of building a new range, an agreement was signed by the AEC and the City of Miamisburg granting us use of the new Miamisburg indoor pistol range. In exchange, Miamisburg Police will use our range for smoke grenade practice. This will permit Mound Laboratory to realize a savings of \$160,000 by foregoing the construction of a firing range on site.

A new safety shoe program was implemented, which reduced administrative cost in procuring shoes and expanded the availability to employes for safety at home and work.

The GSA storage activity was relocated to an adjacent GSA warehouse, due to the Federal Records Center taking over allocated space. A space reduction, due to removal of future program holdings, was accomplished and resulted in a savings of \$7,400.

Improved disposal methods and a new monthly HFFP rejustification program resulted in \$502,000 reduction of these inventory holdings during the year.

Approximately 23,000 pounds of excess bismuth material was sold by the Property Management function, after developing criteria for the sale with the AEC when other government agencies did not express interest for transfer. The sale netted revenues of \$119,300.

Disposal of excess thorium materials by sale and removal by the purchaser versus removal as waste was initiated during the year. This action will result in revenue of \$340,000.

Excess weapons float inventory, consisting of nonnuclear weapons components valued at \$1,751,805, was circulated throughout available government agencies. A total of \$590,644 of the inventory was transferred to other agencies as a result of this action.

NEW FACILITY

Occupation of the new Operational Support Building was completed during the first part of the year.

EMPLOYEE AND PUBLIC COMMUNICATIONS

An automatic answering telephone - NEWSLINE - was installed for the purpose of issuing news bulletins, Laboratory messages and items of interest concerning employees.

Mound-Vue, the company employee publication, was put on a quarterly schedule and altered to a feature format.

The Metric Style Guide, establishing standards for the use of metric system symbols, was published for the guidance of Mound Laboratory personnel.

Mound's Speaker's Bureau made 24 presentations during 1974 to groups totalling 600 people. Four new speakers were added to the Bureau, and the subjects were broadened from solely environmental control to include atomic energy, radiation and health measures, and mathematics.

Though the Mound Plutonium Study attracted the main news media attention during 1974, overall coverage of Mound activities maintained good visibility during the year. In all, clippings reveal that over 250 items were carried by 38 newspapers and

Supporting Activities

magazines, while 13 major radio and television appearances were made by Mound spokesman on the subjects of waste management, energy conservation, carpool program, nuclear energy applications, Pioneer 10 and 11, and community services.

Two major feature stories were carried by local newspapers during 1974. Both dealt with different aspects of Mound operations:

Dayton Daily News, July 14, 1974 - "Mound Workers Don't Fear Pollution, Just Respect it."

Miamisburg News, December 18, 1974 - "Back Home Again -- Right Here in Mound City."

Monsanto Research Corporation displays were on exhibit at the following locations during 1974:

Dayton Museum of Natural History
McDonnell Planetarium, St. Louis, Missouri
Monsanto, Springfield, Massachusetts
Neil Armstrong Air & Space Museum, Wapakoneta, Ohio
Chicago Museum of Science & Industry.

Total traffic at these sites during the exhibit periods totalled approximately 950,000 persons.

In March of this year, our new Communications Center was placed in operation. This resulted in more effective security communications and greater protection of the system since the center is now isolated from other operations.

A radio system was installed for the Radiological Assistance Team (RAT) to supplement reliance on the telephone as the sole method of communications. This installation is the fourth radio system in use at Mound Laboratory.

PUBLIC RELATIONS

As part of the MRC Affirmative Action Plan, Minority Business Enterprises received purchase orders for \$148,000 covering materials, supplies and services required by the Laboratory. In addition, managerial and technical assistance was provided to a number of MBE to assist in their development and capability. Several Small Business Administration contracts were also awarded during the year. Despite these efforts we failed to achieve our goal of \$200,000 because of material shortages and the severe lack of minority business capable of participating in the program.

Also as part of our Management Development, Affirmative Action and Community Relations programs, an Awareness Seminar was conducted for upper management personnel and selected Miamisburg officials.

During 1974, Monsanto Research Corporation was represented in numerous civic activities as indicated below.

Miamisburg Community Development Council Industrial Task Force	R. K. Flitcraft
Board of Directors, Dayton Chamber of Commerce	R. K. Flitcraft
Chairman, Dayton Area Safety Council	R. K. Flitcraft
Engineering and Science Institute of Dayton, Advisory Committee	A. L. Richey
Board of Directors, Public Opinion Center	D. R. Storey
Civil Service Board, City of Miamisburg	D. R. Storey
Business Advisory Council Opportunities Industrial Center	D. R. Storey

During 1974 Mound Laboratory hosted a number of visitors including the distinguished visitors listed below.

Major General Ernest Graves, U. S. Army, Assistant General Manager, Military Application, USAEC, and Lieutenant General H. C. Donnelly, USAF (Retired), Manager Albuquerque Operations Office, USAEC.	June 12
Mr. W. J. McCool, Deputy Director, Operational Safety, USAEC.	June 25
Mr. C. H. Sommer, Chairman, Board of Directors, Monsanto Company	Sept. 10
Mr. W. R. Cooper, Assistant Manager, Plans & Budget, Albuquerque Operations Office, USAEC, accompanied by Mr. V. C. Vince of his organization.	Oct. 11
Mr. S. Pickard, Regional Vice President, Monsanto Company, accompanied by L. E. Stone, Monsanto, St. Louis.	Oct. 24
Dr. M. Dmytryszyn, Director, Technology Design and Construction, Monsanto, CED, accompanied by V. H. Coffee, J. R. Fair, J. R. Middleton, R. B. Puyzar, R. L. Sandstedt, and L. H. Todd of CED and J. Maguiro of Personnel	Dec. 10

PUBLICATIONS

Mound Laboratory personnel maintained their pace in publicizing their activities in books, journals, reports, oral presentations, patents, proposals, and catalogs. Their 245 publications included:

- 16 Books and Journal Articles
- 130 Oral Presentations and Proceedings Publications
- 58 Topical Reports
- 30 Progress Reports
- 5 Translations
- 6 Patents, Proposals, and Catalogs