

AGENCY FOR INTERNATIONAL DEVELOPMENT WASHINGTON, D. C. 20623 BIBLIOGRAPHIC INPUT SHEET	FOR AID USE ONLY
---	-------------------------

1. SUBJECT CLASSIFICATION	A. PRIMARY Agriculture	AF25-0000-0000
	B. SECONDARY Soil fertility, fertilizers, and plant nutrition	

2. TITLE AND SUBTITLE
TVA's international fertilizer effort

3. AUTHOR(S)
(101) National Fertilizer Development Center, TVA

4. DOCUMENT DATE 1969	5. NUMBER OF PAGES 78p.	6. ARC NUMBER ARC
---------------------------------	-----------------------------------	-----------------------------

7. REFERENCE ORGANIZATION NAME AND ADDRESS
TVA

8. SUPPLEMENTARY NOTES (*Sponsoring Organization, Publisher, Availability*)

9. ABSTRACT

10. CONTROL NUMBER PN-RAA-194	11. PRICE OF DOCUMENT
12. DESCRIPTORS Directories Professional personnel	13. PROJECT NUMBER
	14. CONTRACT NUMBER PASA TA (QA) 6-69 GTS
	15. TYPE OF DOCUMENT

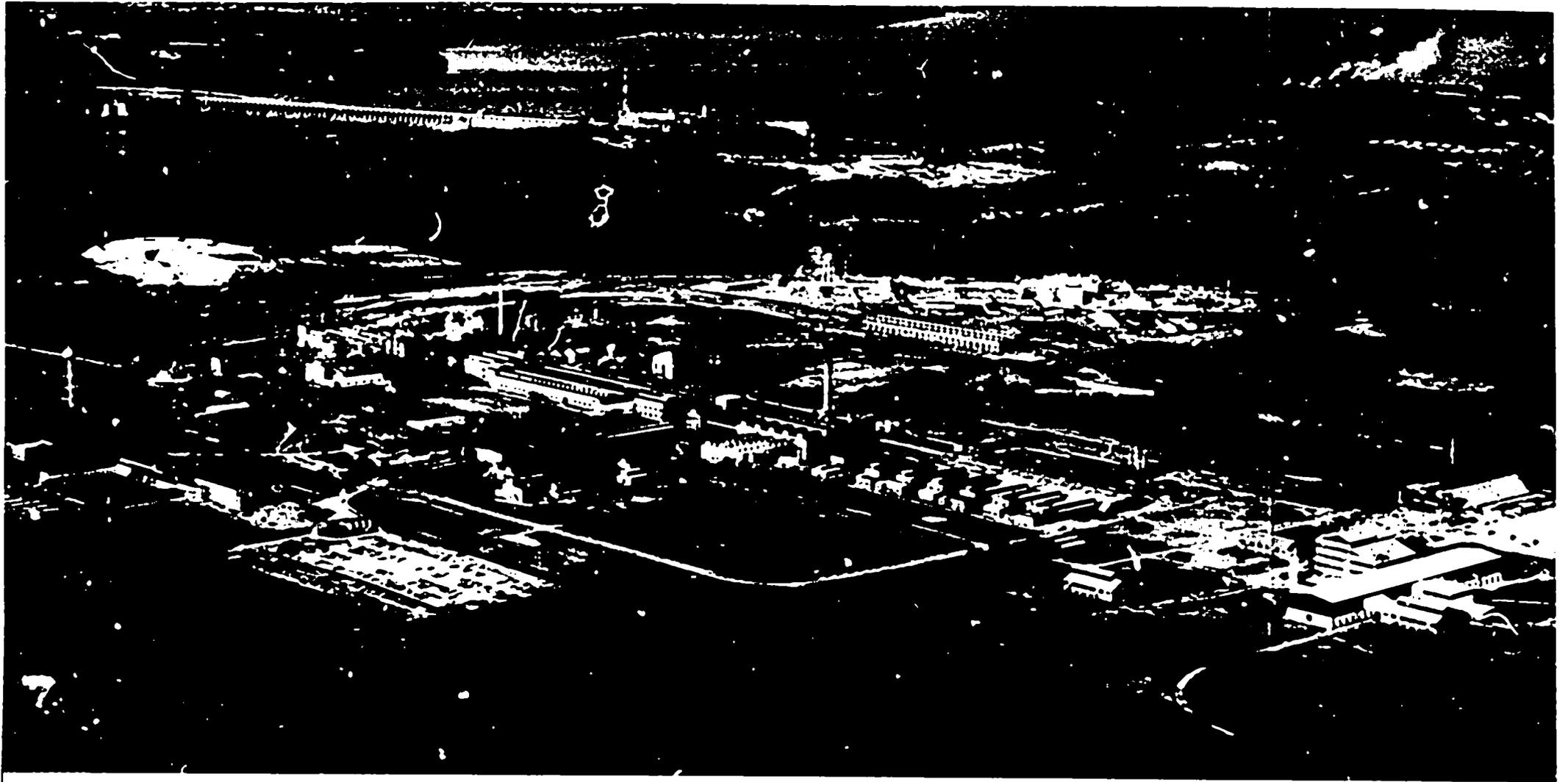
TVA 122



**TVA's International
Fertilizer Effort**

**Muscle Shoals, Alabama
National Fertilizer Development Center**

June 1969



Aerial view of TVA National Fertilizer Development Center

TVA's INTERNATIONAL FERTILIZER EFFORT

INTRODUCTION

By a General Agreement between USAID and the Tennessee Valley Authority (TVA) signed in November 1965, the provisions of the Foreign Assistance Act of 1961 as amended are utilized in an attempt ". . . to enlist as fully and effectively as possible, on a partnership basis, the pertinent resources of TVA in planning, executing, and evaluating those portions of the foreign assistance program in which it has special competence."

The National Fertilizer Development Center of TVA located at Muscle Shoals, Alabama, has special competence in fertilizers. It is the major research and development center for fertilizers in the United States and also in the world. Developments coming out of the National Fertilizer Development Center are used widely by the U. S. and world fertilizer industry.

TVA's staff of over 250 scientists and engineers provide an unequalled storehouse of knowledge and multidisciplinary expertise on fertilizers.

Through Participating Agency Service Agreements (PASA's) AID encourages TVA to staff at a level so that this expertise can be made available to AID missions and the less developed countries as follows:¹

¹AID also encourages TVA to respond to similar requests from other international agencies and organizations.

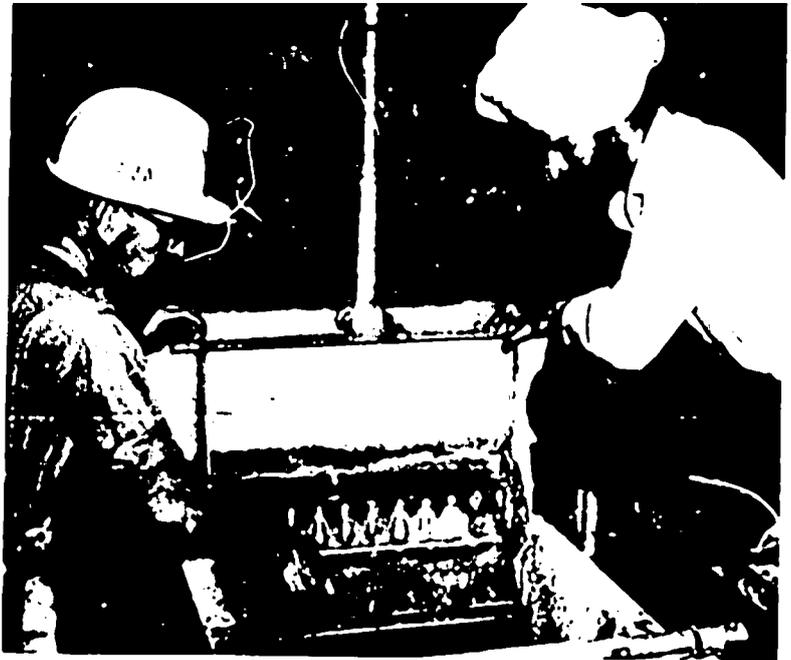
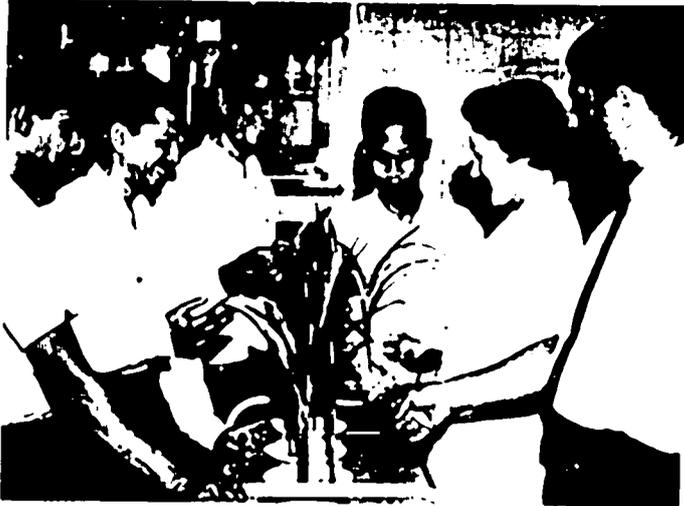


Thirty TVA teams have provided technical assistance in fertilizer production, marketing and use in 20 developing nations since 1963.

Team of TVA specialists visits outdoor fertilizer storage area while conducting study of fertilizer marketing in Peru.



1. Provide experts or teams of experts in various phases of fertilizers for terms of up to six months to evaluate and help solve fertilizer problems as they arise. These teams may address themselves to one or more of the following subjects:
 - a. Estimation of fertilizer needs
 - b. Evaluation of basic raw materials
 - c. Fertilizer marketing and distribution
 - d. Location, conceptual design, and layout of plant facilities, and preparation of Invitations to Bid.
 - e. Plant operation and maintenance
 - f. Planning evaluation
 - g. Management
 - h. Staffing
2. Training--TVA's facilities and staff are utilized annually for at least one course in fertilizer production, marketing, and use. In addition, courses in high-level management, fertilizer control, fertilizer production, maintenance, instrumentation, and in resource development are possible, at Muscle Shoals or in the LDCs. Fertilizer training manuals and aids can also be made available by TVA.
3. Evaluation of Raw Materials--Many materials that appear to contain

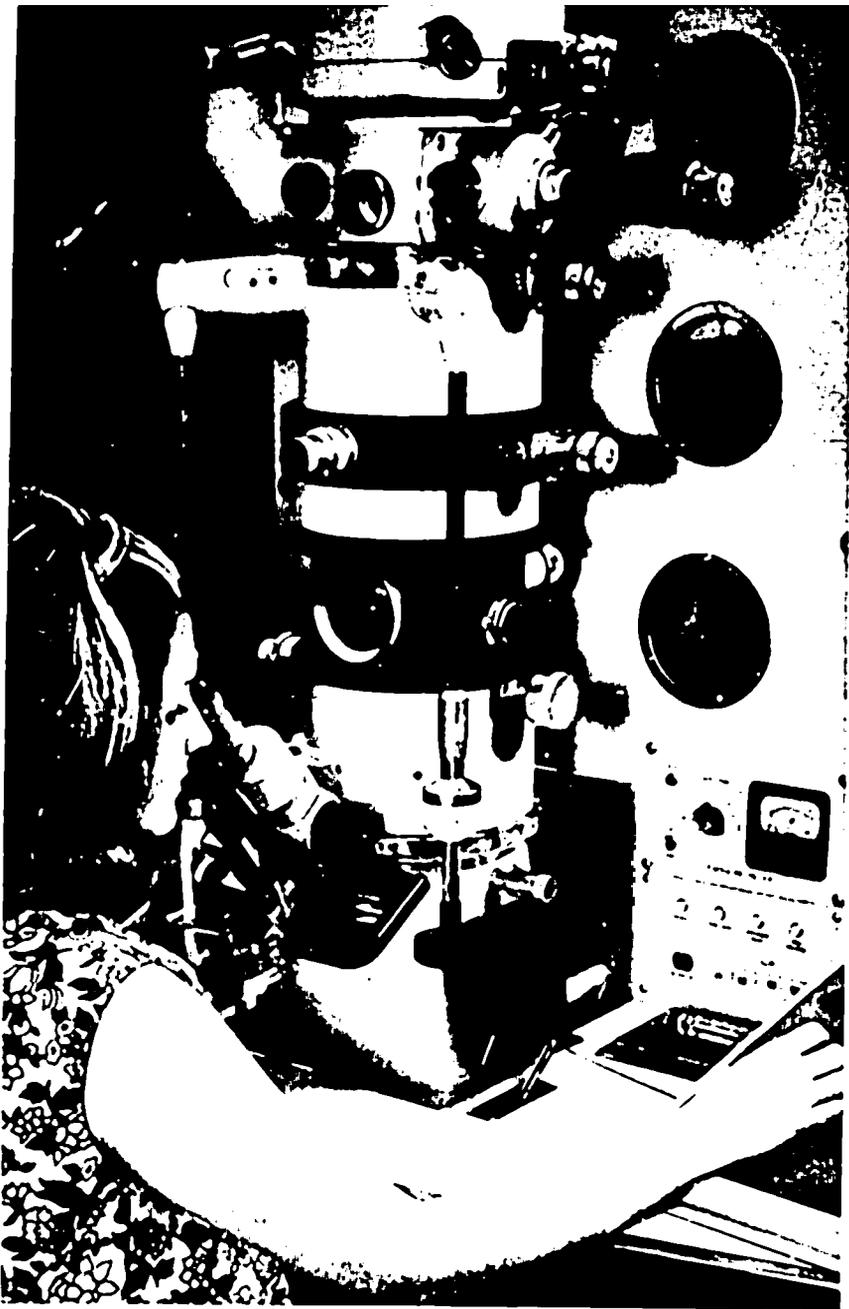


TVA offers broad training in fertilizers to industry, government and education leaders from developing nations. Included are classroom instruction, study of pilot and demonstration-scale facilities, consultation with TVA researchers, and observation of farmer education programs.



exploitable fertilizer elements can be evaluated at the Muscle Shoals facility. Phosphate rock characterization techniques are especially well worked out, and much time and effort--and misuse or waste of raw materials--can be avoided by proper evaluations before exploitation is attempted.

4. Tailoring of Fertilizers--TVA has for the past 35 years been tailoring fertilizers for U. S. soil and crop needs. With this experience and the wide range of facilities--including bench-scale, pilot-plant, and demonstration-scale plants--TVA can prepare or alter most any type of material in at least experimental quantities.
5. Research--TVA's fertilizer research capability ranges from very basic to applied. Its staff and facilities have research capability in practically all fertilizer-related areas.
6. Specialized Expertise--TVA's staff and broad knowledge of the fertilizer industry provide a good source for furnishing or obtaining fertilizer expertise in practically any area.
7. Library--TVA maintains the national fertilizer library and is rapidly developing it into an international facility. Published materials related to fertilizers are solicited for deposit in this modern, automated facility. Requests for information on fertilizer-related subjects also are encouraged,



Laboratories at the National Fertilizer Development Center are equipped for a wide range of research activities. The electron microscope (left), for example, has been used to help determine the fertilizer potential of phosphate rock deposits in several developing countries.

Greenhouses are used for initial screening of new fertilizer products and for study of basic soil-plant-fertilizer relationships.



and hundreds of requests are filled each year. In 1968 the TVA library began publishing Fertilizer Abstracts, a monthly compilation of world information on the technology, marketing, and use of fertilizers. About 200 copies of these abstracts are sent to international subscribers.

The National Fertilizer Development Center has functioned since TVA's creation in 1933.

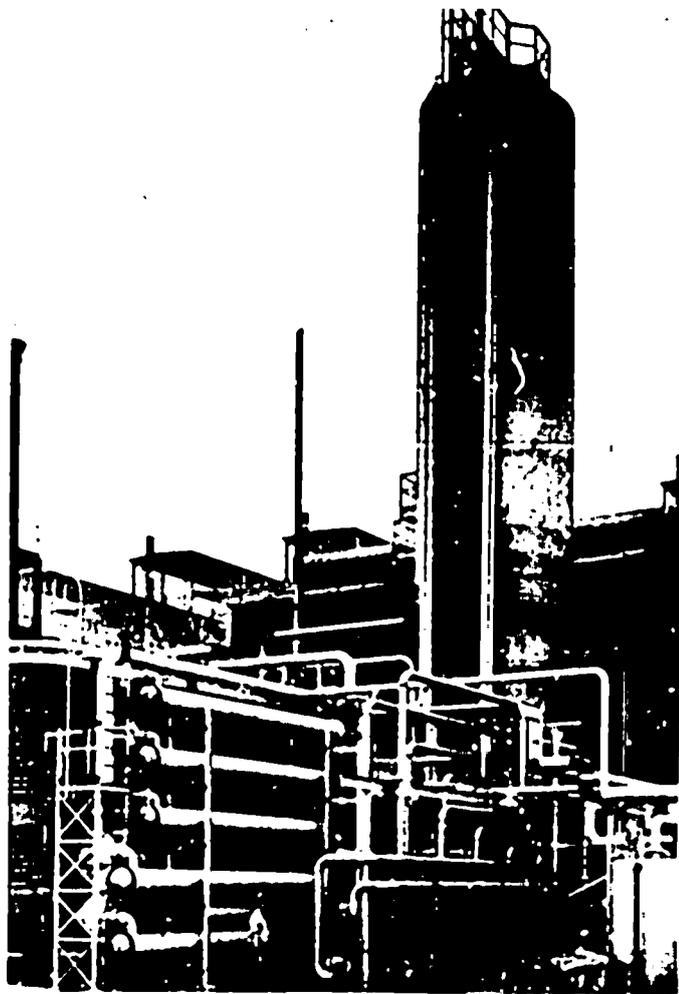
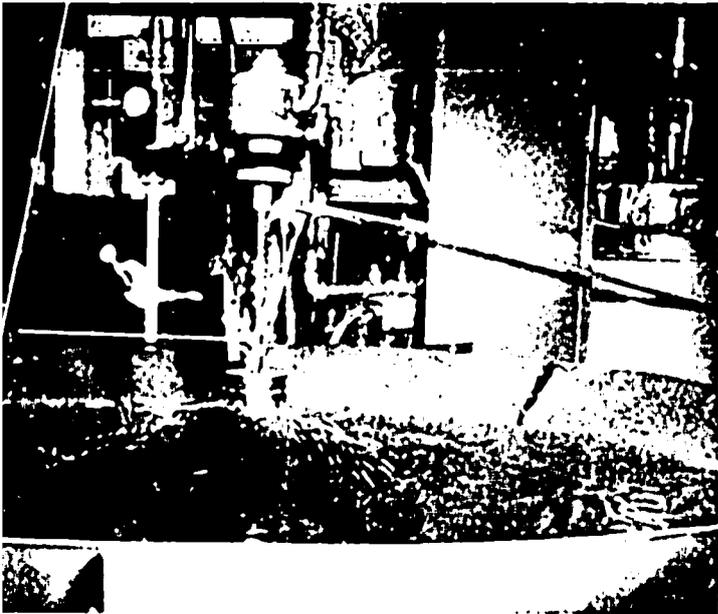
Its experienced multidisciplinary staff and its contacts with universities and other organizations, as well as the fertilizer industry, make it uniquely qualified to furnish technical assistance in fertilizers.

Technical visitors are welcomed to this facility. Each year these visitors number in the thousands; they spend from a few hours to weeks or months studying, observing facilities, and consulting with the staff at the National Fertilizer Development Center. As many as 625 foreign visitors spending over 3,100 visit days have been accommodated within one year. The technical staff answers many letters requesting varied degrees of technical assistance.

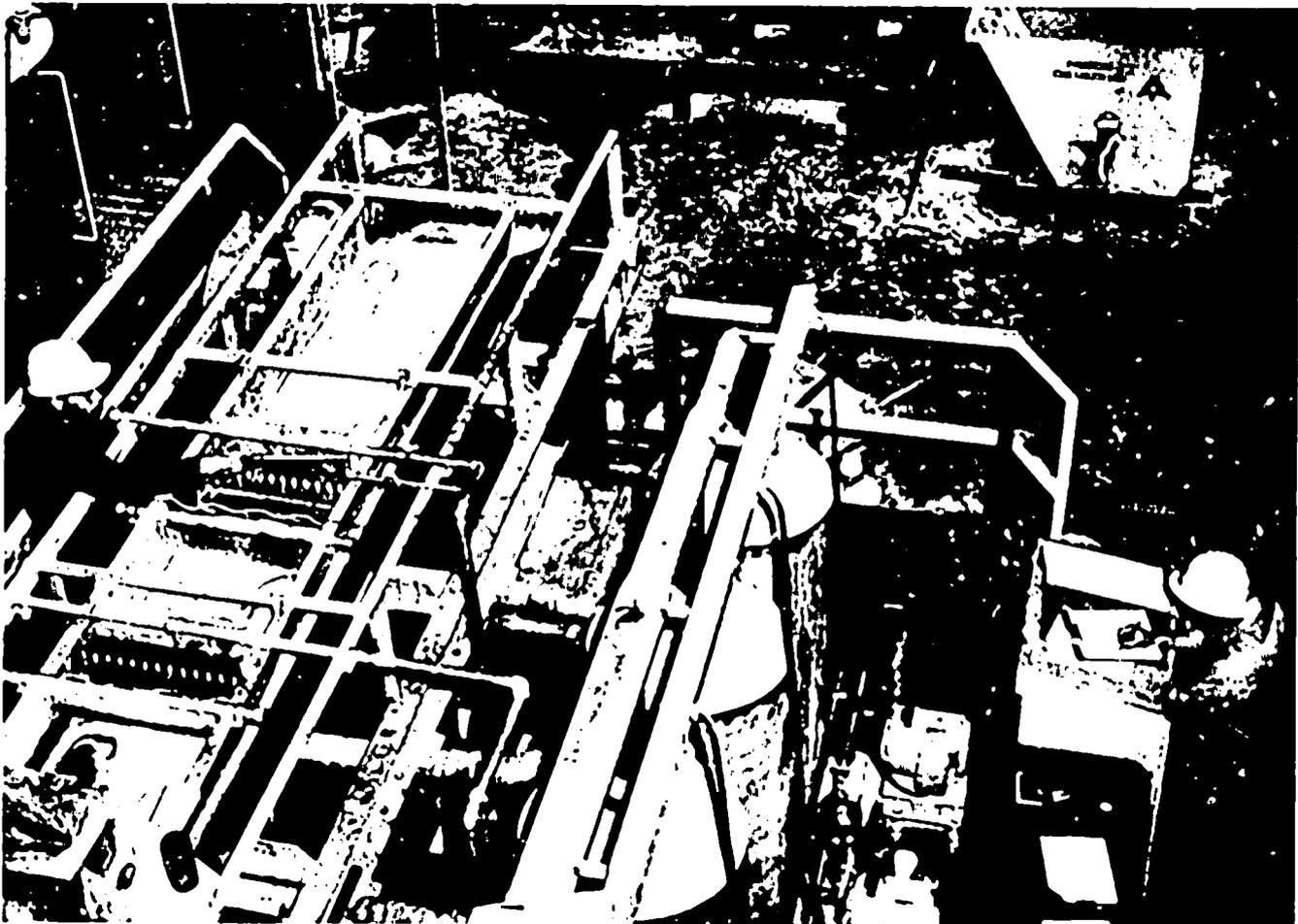
FACILITIES OF THE NATIONAL FERTILIZER DEVELOPMENT CENTER

Modern laboratories, greenhouses, pilot plants, and demonstration-scale plants are maintained at Muscle Shoals. Total effort is directed toward research and demonstration activities. TVA maintains contracts with over 30 land-grant colleges and over 200 fertilizer firms, ranging from the smallest to the giants,

Nitric acid from this modern plant goes into various experimental fertilizers. Other intermediates made at the Center include ammonia, phosphorus, and phosphoric acid.



Pilot plants are key in developing improved fertilizers. Above is small oil-prilling pilot plant in which droplets of fertilizer solution slung from spinning cup form granules as they hit oil bath. Below is a nitric phosphate pilot plant.



through which its products, processes, and know-how are extended for the benefit of American agriculture.

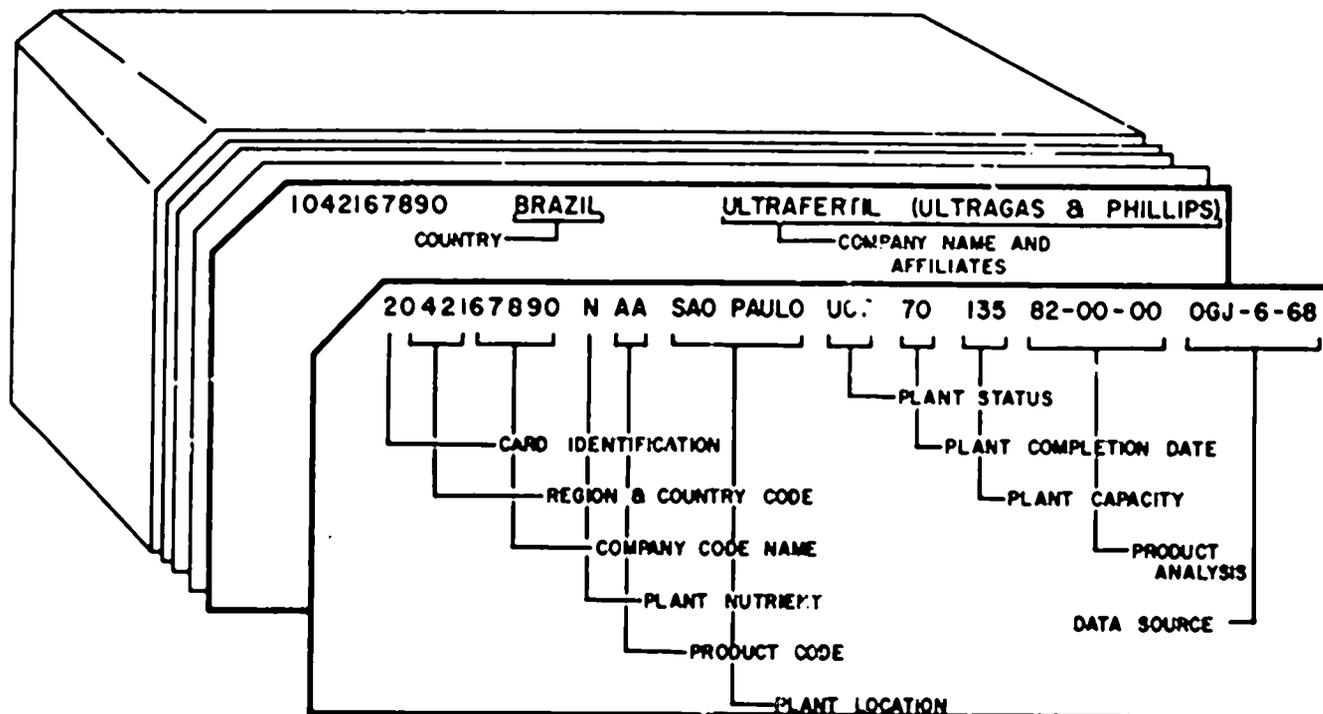
THE INTERNATIONAL FERTILIZER DEVELOPMENT STAFF

TVA's basic strength in fertilizer-agriculture programs lies in its broad experience in working with farmers and industry throughout the United States and in its multidisciplinary capabilities. Its staff has proficiency in most areas of chemistry and chemical engineering as they relate to fertilizers, as well as in agronomy, soil science, and economics, distribution and marketing, and other areas.

TVA has organized an international staff as part of the National Fertilizer Development Center to capitalize on this experience and capability for international efforts. It is composed of a small number of experienced specialists who have a good understanding of food/fertilizer relationships in the LDCs.

This nucleus staff is responsible to the Manager of the National Fertilizer Development Center for all international fertilizer and fertilizer-related activities conducted under formal cooperative and reimbursable agreements with international agencies and organizations. Its functions are to marshal the best technical expertise and capabilities available from the Center's staff for conduct of agreed-upon international projects and activities. It coordinates the projects and activities within TVA and serves as the focal point of contact between TVA and the sponsoring international agency or organization.

Illustration of card layout for data processing system used in continuing study of world fertilizer production capacity.



TVA maintains at Muscle Shoals a national fertilizer library which is being developed into an international center of fertilizer information. *Fertilizer Abstracts*, a subscription publication, is distributed worldwide.

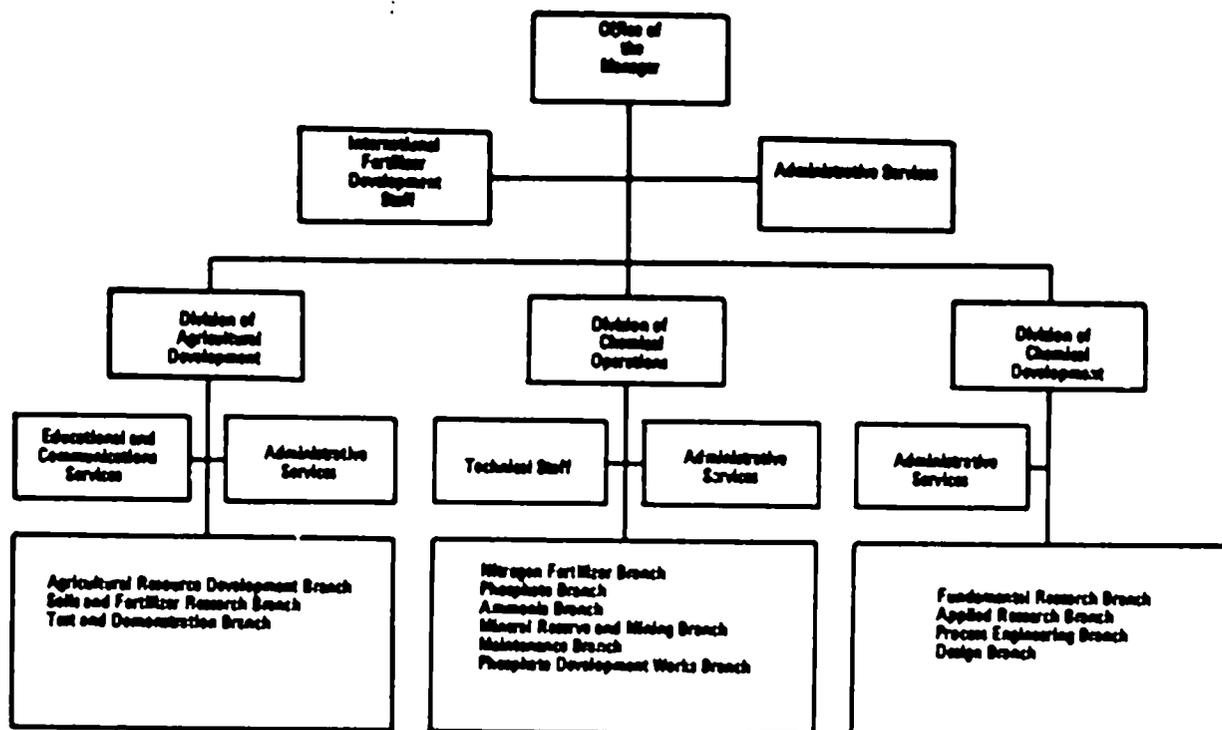


**ORGANIZATION AND STAFFING
OF THE NATIONAL FERTILIZER DEVELOPMENT CENTER**

The National Fertilizer Development Center is staffed with approximately 1,200 employees in three divisions (see organization chart). The totality of this expertise can be called upon by AID or other international agencies or organizations.

To give an indication of the types of expertise that have been available for work in the international effort a partial listing of those that have contributed and their major area of specialty is shown on the following page. A more detailed resumé of educational background, experience, etc., for some 50 staff members is included.

ORGANIZATION OF NATIONAL FERTILIZER DEVELOPMENT CENTER



**PARTIAL LISTING OF NATIONAL FERTILIZER DEVELOPMENT CENTER
AVAILABLE TO CONTRIBUTE TO INTERNATIONAL EFFORT**

Office of Agricultural and Chemical Development

Lewis B. Nelson, Manager
Alvin B. Phillips, Assistant Manager

International Fertilizer Development Staff

Donald L. McCune, Director
Charles H. Davis, Staff Chemical Engineer
Paul J. Stangel, Agriculturist

ENGINEERS

<u>Economic Planning</u>	<u>Research and Development</u>	<u>Process Planning, Plant Start-up, Trouble Shooting</u>
G. M. Blouin	A. W. Frazer	F. P. Achorn
T. P. Hignett	J. G. Gelsinger	J. A. Barnett
F. M. Kennedy	J. D. Hatfield	Homer Graham
V. E. Lyons	G. C. Hicks	T. M. Kelso
A. V. Slack	O. F. Hoffmeister	J. A. McCollum
N. L. Spencer	E. O. Huffman	J. L. Snyder
	F. J. Johnson	P. C. Williamson
	J. R. Lehr	R. D. Young
	J. M. Potts	
	J. D. Ray	
	J. M. Stinson	
	Z. T. Wakefield	
 <u>Design</u>	 <u>Maintenance</u>	 <u>Mining</u>
D. C. Dean	Bruce Edwards	R. B. Burt
Fred Hall	Emmett Lindsey	R. S. Ingle
W. A. Lyndon	Harry Nash	
R. D. Mitchell	Karl Potts	
D. A. Waltzman	T. S. Sloan	

ECONOMISTS

B. J. Bond	R. O. Mueller
J. R. Douglas	J. L. Nevins
R. C. Gray	W. G. Smith
R. D. Grisso	H. O. Walker

EDUCATION AND COMMUNICATION SPECIALISTS

J. E. Culp	W. C. Scott
R. E. McKnight	R. O. Woodward
D. A. Russell	

AGRONOMISTS

R. B. Diamond	V. J. Kilmer
O. P. Engelstad	W. J. Sherratt
R. D. Hauck	W. N. Sutherland

OFFICE OF AGRICULTURAL AND CHEMICAL DEVELOPMENT

LEWIS B. NELSON - (October 18, 1914 - New Plymouth, Idaho)

Educational Background: B. S. , 1936, University of Idaho, (Agr.) Agronomy; M. S. , 1939, University of Wisconsin, Soil Science; Ph. D. , 1940, University of Wisconsin, Soil Science.

Present Position: Manager of Agricultural and Chemical Development, administering an organization of 1,200 people.

Previous Positions: Instructor in Soils, University of Wisconsin, 1940-42; Supervising Chemist, U. S. Rubber Company, 1942-44; Associate Professor, Iowa State College, 1944-49; Supervisory Soil Scientist, U. S. Department of Agriculture, 1949-52; Chief, Eastern Soil and Water Management Research, U. S. Department of Agriculture, 1952-60; Manager of Agricultural and Chemical Development, Tennessee Valley Authority, 1960 to present.

Major Responsibilities and Capabilities: R and D, including fertilizer production plant; and education program management on broad scale. Soil Scientist. Past President, Soil Science Society of America. Member of various task forces, advisor for Atomic Energy Commission.

Overseas Experience: USSR, 1958; Colombia, 1959, 1968; Turkey, 1965; India, 1967.

ALVIN B. PHILLIPS - (July 26, 1920 - Milwaukee, Wisconsin)

Educational Background: B. S. , 1942, University of Missouri, Chemical Engineering.

Present Position: Assistant Manager of Agricultural and Chemical Development.

Previous Positions: Employed by TVA in May 1942. Progressed from beginning level chemical engineer to project leader to Chief of Process Engineering Branch, then to present position in May 1965.

Major Responsibilities and Capabilities: Shares with the Manager of Agricultural and Chemical Development the managing of the research, development, and educational activities of the National Fertilizer Development Center. Past Chairman of the Division of Fertilizer and Soil Chemistry of the American Chemical Society.

Overseas Experience: Special assignment for Army Chemical Corps in Central America during World War II; Morocco, 1963; Pakistan, 1967.

INTERNATIONAL FERTILIZER DEVELOPMENT STAFF

DONALD L. McCUNE - (October 9, 1924 - Gallon, Ohio)

Educational Background: B. S., 1950, Ohio State University, Agronomy; M. S., 1951, Ohio State University, Agronomy; Ph. D., 1957, Purdue University, Plant Physiology and Nutrition.

Present Position: Director, International Fertilizer Development Staff.

Previous Positions: Served in U. S. Army (Philippines) 1945-46; Soil Survey, Ohio State University, 1951-52; Pasture Research Specialist, Purdue University, 1952-54; Soil Scientist (joint appointment Soil & Water Conservation Branch, USDA and Purdue University), 1954-57; Agronomist, The Rockefeller Foundation, Santiago, Chile, 1957-62; Assistant Director, Agricultural Development, TVA, 1962-66; Assistant to Manager of Agricultural and Chemical Development, TVA, 1966-69; Director, International Fertilizer Development Staff, TVA, 1969 to present.

Major Responsibilities and Capabilities: Coordinator of international activities - evaluation and organization.

Overseas Experience: Chile, 1957-62; Europe and Japan, 1965; Morocco, 1966; Afghanistan, 1966; Peru, 1967 and 1968; Indonesia, 1968.

CHARLES H. DAVIS - (March 21, 1935 - Waynesboro, Tennessee)

Educational Background: B. S. , 1958, Auburn University, Chemical Engineering.

Present Position: Chemical Engineer, International Fertilizer Development Staff.

Previous Positions: Co-op Student at TVA, 1953-58; U. S. Army, 1958; Chemical Engineer, Rohm and Haas Co. , 1958-59; Chemical Engineer, TVA, 1959 to present.

Major Responsibilities and Capabilities: Principal chemical engineer, International Fertilizer Development Staff; Pilot plant--design, construction, supervision and evaluation of fertilizer pilot plants. Design and operation of full scale operating plants, especially phosphate granulation facilities.

Overseas Experience: Turkey, 1966; Peru, 1968.

PAUL J. STANGEL - (June 30, 1929 - Kewanee, Wisconsin)

Educational Background: B. S., 1958, University of Wisconsin, Agriculture and Extension Education; M. S., 1960, University of Wisconsin, Soils; Ph. D., 1962, University of Wisconsin, Soils and Plant Physiology.

Present Position: Agriculturist, International Fertilizer Development Staff.

Previous Positions: U. S. Air Force, 1948-53; Agriculturist, Test Demonstration Branch, TVA, 1962-64; Assistant Professor of Soils, University of Wisconsin, 1964-66; Agronomist, International Minerals & Chemical Corporation, 1966-69; Agriculturist, International Fertilizer Development Staff, 1969 to present.

Major Responsibilities and Capabilities: Principal agronomist of International Fertilizer Development Staff. Field agronomist--broad experience in all phases of agronomy and in training and directing staff in fertilizer investigation and demonstration. Well-versed in micronutrients deficiencies and needs.

Overseas Experience: None.

ECONOMIC PLANNING - ENGINEERS

GLENN M. BLOUIN - (November 10, 1919 - Houston, Texas)

Educational Background: B. S., 1942, Rice University, Chemical Engineering.

Present Position: Senior Project Leader, Applied Research Branch.

Previous Positions: Chemical Engineer, TVA, 1942-43, 1946-50, 1952 to present;
U. S. Navy, 1943-46, 1950-52.

Major Responsibilities and Capabilities: Pilot plant design, construction, and operation; Laboratory project design and evaluation; Process and equipment cost estimating; Operating experience with calcium metaphosphate and ammonium nitrate plants; Coauthor of patents covering sulfur-coating process.

Overseas Experience: Japan, 1945 and 1951.

TRAVIS P. HIGNETT - (December 30, 1907 - Maxwell, Iowa)

Educational Background: A. B. , 1929, Drake University, Chemistry.

Present Position: Director of Chemical Development.

Previous Positions: Chemist, USDA, 1929-33; Chemical Engineer, Research Associates, 1933-38; Chemical Engineer, TVA, 1938-42; Project Leader, TVA, 1942-47; Chief, Development Branch, TVA, 1947-59; Chief, Applied Research Branch, 1959-62; Director of Chemical Development, TVA, 1962 to present.

Major Responsibilities and Capabilities: As director of TVA's Division of Chemical Development (260 employees), plans and directs a program of chemical research and development on processes and equipment for production of new or improved fertilizers, and for optimum development and sound utilization of regional resources.

Overseas Experience: Austria, 1967; Belgium, 1959, 1968; England, 1959, 1965, 1967, 1969; Finland, 1963; France, 1959, 1967; Germany, 1959, 1961, 1965; India, 1965; Iran, 1965; Italy, 1965, 1967; Netherlands, 1959, 1961, 1965, 1967, 1968, 1969; Portugal, 1965; Scotland, 1959, 1965; Sweden, 1959; Switzerland, 1967.

FRANK M. KENNEDY - (December 6, 1916 - Ontario, Canada)
U. S. Naturalization, 1953

Educational Background: B. A. , 1941, University of Toronto, Chemistry.

Present Position: Economist. Staff of Director of Chemical Development.

Previous Positions: Chemist, International Nickel Co. of Can. Ltd. , 1941-45;
Assistant Director of Research, Management Engineer, St. Joseph Lead Company,
1946-65; Consultant, 1965-67; Economist, TVA, 1967 to present.

Major Responsibilities and Capabilities: World fertilizer-crop-food estimations
and evaluations.

Overseas Experience: Rome, 1968; Pakistan, 1968.

VERNON E. LYONS - (February 25, 1915 - Cartersville, Georgia)

Educational Background: B. S., 1936, Georgia Institute of Technology, Chemical Engineering.

Present Position: Chemical Engineer, Technical Staff, Division of Chemical Operations.

Previous Positions: Chemical Engineering Aide, TVA, 1936. In intervening years held various grades of Chemical Engineer up to Chief, Plant Chemical Control Branch, 1963-64, Chemical Engineer, Technical Staff, TVA, 1964 to present.

Major Responsibilities and Capabilities: Conducts technical and economic studies relating to proposed new processes or changes in plant operation. Technical aspects of (1) phosphate ore mining and beneficiation, (2) phosphorus production by electrothermal process, (3) production of thermal phosphoric acid and phosphate fertilizers, (4) production of fertilizers by crystallization, (5) production of various nitrogen-phosphate fertilizers by granulation, and (6) atmospheric and aqueous pollution abatement in fertilizer plants.

Overseas Experience: Korea, 1963; Netherlands, 1963; West Germany, 1963; Japan, 1963.

ARCHIE V. SLACK - (April 21, 1912 - Butler, Tennessee)

Educational Background: B. S. , 1939, East Tennessee State University, Chemistry; M. S. , 1942, University of Tennessee, Chemistry; L. L. B. , 1950, Jackson Law School.

Present Position: Chief of Applied Research Branch.

Previous Positions: Various positions in TVA, 1941-62; Chief, Applied Research Branch, TVA, 1962 to present.

Major Responsibilities and Capabilities: Direction of Applied Research Branch program, which includes most of the bench-scale research carried out by the Division of Chemical Development. Evaluation and initiation of new projects. Cost estimation of fertilizer and other processes. Coordination of research and development program on atmospheric pollution by sulfur oxides.

Overseas Experience: Korea, 1963; Europe, 1963, 1966; Japan, 1963, 1965, 1967; India, 1967.

NORMAN L. SPENCER - (January 26, 1932 - Louisville, Kentucky)

Educational Background: B.S. , 1954, University of Louisville, Chemical Engineering.

Present Position: Assistant to the Chief, Design Branch.

Previous Positions: Co-op student, Colgate-Palmolive Company, 1951-52; Co-op student, TVA, 1952-53; Chemical Engineer, TVA, 1954-62; Assistant to the Chief, Design Branch, TVA, 1962 to present.

Major Responsibilities and Capabilities: Administrative assistant to the Chief of the Design Branch working with budgets, schedules, cost estimates and reports for construction of chemical process facilities.

Overseas Experience: None.

RESEARCH AND DEVELOPMENT - ENGINEERS

A. W. FRAZIER - (April 12, 1931 - Johnson City, Tennessee)

Educational Background: B. S., 1953, University of Tennessee, Chemistry.

Present Position: Junior Project Leader, Fundamental Research Branch.

Previous Positions: Analytical Chemist, TVA, 1953-56; Research Chemist, TVA, 1956 to present.

Major Responsibilities and Capabilities: Makes microscopic studies on a wide variety of solid materials; makes chemical studies pertaining to the isolation and purification of new compounds leading to their characterization; makes phase-diagram studies to determine conditions of stability of new compounds.

Overseas Experience: None.

JOHN G. GETSINGER - (March 31, 1919 - Darden, North Carolina)

Educational Background: B.S., 1940, North Carolina State University, Chemical Engineering.

Present Position: Chemical Research Supervisor, Applied Research Branch.

Previous Positions: Chemical Engineer, Hans Rees' Sons, Inc., 1940-42; U.S. Army, 1942-45; Chemical Engineer, TVA, 1946 to present.

Major Responsibilities and Capabilities: Supervises 8 to 10 research projects and 18 people; Supervisor of research projects from idea stage through laboratory and bench-scale development; Supervision of pilot-plant design, construction, and operation; Assist in design and operation of full-scale plants; Cost estimation of production of fertilizers.

Overseas Experience: Peru, 1967; Morocco, 1942-43; Algeria, 1943; Tunisia, 1943; England, 1943-44; France, 1944.

JOHN D. HATFIELD - (August 18, 1919 - Sneedville, Tennessee)

Educational Background: A. B. , 1938, University of Tennessee, Mathematics; M. S. , 1939, University of Tennessee, Chemistry; Ph. D. , 1942, Purdue University, Chemistry.

Present Position: Senior Project Leader, Fundamental Research Branch.

Previous Positions: Teaching fellow, University of Tennessee, 1938-39; Control Chemist, E. I. duPont, 1939; Research fellow, Purdue University, 1940-42; Assistant Chemist, Purdue University, 1942-43; Research Chemist, TVA, 1943 to present (U. S. Navy, 1944-46).

Major Responsibilities and Capabilities: Physical chemistry--kinetics, thermodynamics; Mathematics--statistics, design of experiments, regression analysis, analysis of variance; Air Pollution--limestone calcination and sulfation mechanisms and kinetics.

Overseas Experience: None.

GORDON C. HICKS - (November 16, 1918 - Washington, D.C.)

Educational Background: B.S., 1942, Georgia Institute of Technology, Chemical Engineering.

Present Position: Senior Project Leader, Process Engineering Branch.

Previous Positions: Shift Supervisor, Hercules Powder Company, 1942-45; Top Operator, Union Carbide, 1945; Chemical Engineer, TVA, 1945 to present.

Major Responsibilities and Capabilities: Pilot plant--design, construction, supervision and evaluation of fertilizer pilot plants. Design and operation of full scale operating plants, especially phosphate granulation facilities.

Overseas Experience: None.

GEORGE F. HOFFMEISTER - (December 14, 1920 - Philadelphia, Pennsylvania)

Educational Background: B. S. , 1942, Rice University, Chemical Engineering.

Present Position: Senior Project Leader, Applied Research Branch.

Previous Positions: Chemical Engineer, TVA, 1942 to present.

Major Responsibilities and Capabilities: Pilot plant design and operation; Bench-scale test planning and evaluation; Technical report editing; Bulk blending plant design; Storage handling, conditioning, and bagging of fertilizers; Evaluation of physical properties of fertilizers; Supervises several chemical engineering aides and chemical engineers of lower grades.

Overseas Experience: None.

ERNEST O. HUFFMAN - (August 30, 1911 - Hickory, North Carolina)

Educational Background: B. S. , 1932, Lenoir Rhyne College, Chemistry; M. S. , 1934, University of North Carolina, Chemistry.

Present Position: Chief, Fundamental Research Branch.

Previous Positions: Control Chemist, Tennessee Eastman Corporation, 1935-36; Chemical Aide, TVA, 1936-37; Chemical Engineer, TVA, 1937-39; Research Chemist, TVA, 1939-54; Supervisor, Kinetics Section, TVA, 1954-63; Assistant Chief, Fundamental Research Branch, TVA, 1963-64; Chief, Fundamental Research Branch, TVA, 1964 to present.

Major Responsibilities and Capabilities: Director of fundamental research on chemistry of fertilizers; Research on inorganic chemistry of phosphorus and nitrogen, with emphasis on fertilizer materials.

Overseas Experience: England, 1962; Australia, 1968.

FRANK J. JOHNSON - (August 24, 1930 - Rosendale, Missouri)

Educational Background: B. S., 1952, Northwest Missouri State College, Chemistry;
M. S., 1959, University of Missouri, Agricultural Chemistry.

Present Position: Supervisor Analytical Laboratory, Division of Chemical Development.

Previous Positions: U. S. Army, 1952-54; Graduate student and instructor in Agricultural
Chemistry, 1954-62; Analytical Chemist, TVA, 1962 to present.

Major Responsibilities and Capabilities: Administrative Director of the General
Analytical Laboratory; Directs research on analytical methods development.

Overseas Experience: Eighteen months European tour of duty as member of Armed Forces.

JAMES R. LEHR - (October 31, 1920 - Scranton, Pennsylvania)

Educational Background: B.S., 1942, Pennsylvania State University, Chemistry.

Present Position: Senior Project Leader, Fundamental Research Branch.

Previous Positions: U. S. Naval Reserve Officer, 1943-46; Research Chemist, TVA, Fundamental Research Branch, 1946-58; Junior Project Leader, 1958-62; Senior Project Leader, 1962 to present.

Major Responsibilities and Capabilities: Characterization and identification of solid compounds arising from chemical research, experimental fertilizer processes, and raw material sources. Crystallographic and structural studies of inorganic compounds. Special solid state studies and consulting on corrosion and mineralogy problems for other TVA offices; and contractual research for AEC, PHS, and NASA on solid state problems. The reaction mechanisms and compositions of fertilizer from conventional processes and TVA experimental processes. The reactions of fertilizer compounds with soil minerals. The chemistry of apatite-type compounds, with emphasis on the compositions and variability of commercial phosphate ores, and their adaptation to fertilizer manufacturing.

Overseas Experience: Hawaiian Islands, Guam, Philippines, 1944-46; France, Germany, Sweden, and Finland, Great Britain, 1967.

JOHN M. POTTS - (August 3, 1918 - Waterloo, Alabama)

Educational Background: B. S. , 1947, University of Alabama, Chemical Engineering.

Present Position: Chemical Engineer, Applied Research Branch.

Previous Positions: Mechanical Engineer Aide, TVA, 1937-44; U. S. Navy, 1944-46;
Chemical Engineer, TVA, 1947 to present.

Major Responsibilities and Capabilities: Supervision of applied research on fertilizers.
Design, construction, and operation of fertilizer pilot plants and full-scale operating
plants, especially electric phosphorus furnaces.

Overseas Experience: Philippines, 1945.

JAMES D. RAY - (May 9, 1920 - Santa Clara, California)

Educational Background: B. S. , 1949, Stanford University, Chemical Engineering; M. S. , 1953, Stanford University, Chemistry; Ph. D. , 1955, Stanford University, Chemistry.

Present Position: Senior Project Leader, Fundamental Research Branch.

Previous Positions: Research Associate, Stanford University, 1955-58; Teacher, University of Minnesota, 1958-59; Teacher, Georgia Institute of Technology, 1959-65; Research Chemist, North American Aviation, 1965-67; Research Chemist, TVA, 1967 to present.

Major Responsibilities and Capabilities: Structural studies of fertilizer compounds with nuclear magnetic resonance spectroscopy.

Overseas Experience: England, 1942-45.

JOHN M. STINSON - (August 5, 1922 - Kansas City, Missouri)

Educational Background: B.S., 1947, University of Missouri, Chemical Engineering.

Present Position: Senior Project Leader, Fundamental Research Branch.

Previous Positions: Engineering Officer, U.S. Navy, 1942-46; X-ray Technician, U.S. Public Health Service, 1946; Chemical Engineer, TVA, 1947 to present.

Major Responsibilities and Capabilities: Supervises two groups of chemical engineers and chemical engineering aides; Have supervised research, pilot-plant, and demonstration-scale fertilizer operations with experience in design, cost estimation, construction, operation, and evaluation. Principal fields of activities have been: (1) solid polyphosphates, (2) micronutrients, (3) liquid fertilizers, (4) sulfuric acid from gypsum, (5) fire retardant treatment of construction wood, (6) fluorine recovery, and (7) agglomeration of phosphates for use as furnace charge.

Overseas Experience: Pacific Area (U. S. Navy).

ZACHARY T. WAKEFIELD - (October 29, 1919 - Jarrolds Valley, West Virginia)

Educational Background: B.S., 1942, University of Virginia, Chemistry.

Present Position: Research Chemist Project Leader, Fundamental Research Branch.

Previous Positions: Research Chemist, TVA, 1942 to present.

Major Responsibilities and Capabilities: Plan and supervise research on P-N compounds of possible future application in fertilizer technology; Plan and supervise calorimetry program for development of thermodynamic and thermochemical information relevant to fertilizer technology.

Overseas Experience: None.

**PROCESS PLANNING, PLANT START-UP, AND
TROUBLE SHOOTING - ENGINEERS**

FRANK P. ACHORN - (March 23, 1923 - Biloxi, Mississippi)

Educational Background: Bche. , 1946, Speed Scientific School, University of Louisville.

Present Position: Head, Process and Product Improvement Section.

Previous Positions: Chief Engineer of a destroyer in World War II, 1942-46; Research Worker, Speed Scientific Research Institute, 1946-47; TVA Research and Development, 1947-50; Chief Engineer of destroyer-type vessels, U. S. Navy, 1950-52; Research and Development and Start-Up of Large-Scale Fertilizer Plants at TVA, 1952-57; Assistant Plant Manager, Coastal Chemical Corporation, 1957-59; Head, Process and Product Improvement Section, TVA, 1959 to present.

Major Responsibilities and Capabilities: Supervises five engineers and three non-professional employees. Supervises the technical service work that this section provides to more than 500 fertilizer plants that cooperate with TVA in their field programs. In this work engineers of this section design small-scale plants for the use of TVA materials, and they assist in the design of large-scale plants which use TVA processes. After a plant has been designed, they supervise the initial use of the TVA materials in the plant or the initial operation of the large-scale plant. Consultant to several large engineering companies in the planning of large-scale fertilizer complexes which are being constructed in the United States and overseas. Written more than 40 papers concerning the entire spectrum of the fertilizer industry.

Overseas Experience: Philippine Islands, 1966; Afghanistan, 1967.

JOHN A. BURNETT, JR. - (May 28, 1915 - Rienzi, Mississippi)

Educational Background: B. S., 1938, Union University, Chemistry.

Present Position: Supervisor of Technical Section, Ammonia Branch.

Previous Positions: Chemical Engineer, TVA, 1942-59; Hydrocarbon Research, Inc., 1959-61; Armour Agricultural Chemical Company, 1962-63; Chemical Engineer, TVA, 1964 to present.

Major Responsibilities and Capabilities: Consultant to The Fertilizer Corporation of India, Ltd., in the expansion of their fertilizer manufacturing facilities at Trombay, India; Training of operating personnel for large-scale ammonia, urea, ammonium nitrate, and N-P-K plants; Preparation of plant operating manuals; Preparation of Tender for procurement of ammonia, urea, and N-P-K plants; Assisting in the design, construction, start-up, operation, and performance evaluation of ammonia, urea, ammonium nitrate and N-P-K plants; Performance of plant engineering studies and solving of plant operating problems, with special emphasis on ammonia and urea plants.

Overseas Experience: Korea, 1959-61; Turkey, 1966-67; South Vietnam, 1967; India, 1968.

HOMER G. GRAHAM, JR. - (January 8, 1922 - Miami, Florida)

Educational Background: B. S., 1948, University of Florida, Chemical Engineering.

Present Position: Assistant Chief, Nitrogen Fertilizer Branch.

Previous Positions: U. S. Air Force, 1942-45; TVA, 1948 to present.

Major Responsibilities and Capabilities: Operation of several demonstration-scale fertilizer units. Assists with technical problems, in-plant maintenance and engineering, production planning, quality control, bagging and shipping, and personnel management. Extensive experience in nitric acid production and granulation and crystallization of ammonium nitrate--ammonium phosphate--ammonium sulfate based fertilizers.

Overseas Experience: None

T. M. KELSO - (November 20, 1924 - Clovis, New Mexico)

Educational Background: B. S. , 1947, University of Missouri, Chemical Engineering.

Present Position: Group Supervisor, Process Engineering Branch.

Previous Positions: TVA, 1947 to present.

Major Responsibilities and Capabilities: Pilot plant--Design, construction, and test supervision of fertilizer and other pilot plants. Currently directing design and construction of two pilot plants to study removal of SO₂ from stack gases of fossil-fueled power plants. Responsible for directing operation of two pilot plants for production of granular fertilizers.

Design and operation of full scale operating plants especially granulation facilities such as ammonium polyphosphate. Currently serving as prime PE representative in planning of plant scale urea-ammonium phosphate facilities. Also, directing PE portion of a full scale SO₂ removal unit on an operating 175 mw. boiler.

Overseas Experience: Thailand, 1966; Morocco, 1967.

JAMES A. McCOLLUM - (December 27, 1919 - Carbon Hill, Alabama)

Educational Background: B. S., 1940, University of Alabama, Chemical Engineering.

Present Position: Assistant Chief, Phosphate Branch.

Previous Positions: TVA, 1941-1944; U. S. Navy, 1944-46; TVA, 1946 to present.

Major Responsibilities and Capabilities: Principal administrative and technical assistant to the Chief, Phosphate Branch, in planning, supervising, and coordinating the operation of the Phosphate Branch. The Branch program consists primarily of large-scale production of fertilizers containing phosphorus and nitrogen and also large-scale experimental operations to determine the commercial feasibility of technological improvements in the production of high-grade fertilizers containing phosphorus and nitrogen. This includes management of the following operations: Processing of raw materials; production of elemental phosphorus and disposition of related byproducts; production of phosphoric acid and various solid and liquid fertilizers.

Overseas Experience: None.

JAMES L. SNYDER, JR. - (August 22, 1904 - Jessups, Maryland)

Present Position: Chief, Ammonia Branch.

Previous Positions: B. Ober and Sons, Co., 1926-33; The Oberphos Co., 1933-34; Chemical Plant Foreman, TVA, 1934-40; Chemical Plant Supervisor, TVA, 1940-45; Chief, Ammonia Branch, 1945 to present.

Major Responsibilities and Capabilities: Thirty-five years of experience in the manufacturing of phosphate fertilizer and ammonia production. Experience includes manufacturing of semiwater gas from generator sets and steam reforming of natural gas.

Overseas Experience: Iraq, 1963; India, 1967.

PHEBUS C. WILLIAMSON - (August 17, 1933 - Ridgely, Tennessee)

Educational Background: B.S., 1961, University of Tennessee, Chemical Engineering.

Present Position: Senior Project Leader, Process Engineering Branch.

Previous Positions: Self-employed--farming, 1952-1953; U.S. Air Force, 1954-1957; Student, 1958-1961; Chemical Engineer, TVA, 1962 to present.

Major Responsibilities and Capabilities: Responsibilities presently involve the design, construction, operation, and evaluation of two projects--one pilot-plant scale and one full scale--both concerned with control of SO₂ emission from power plant stack gases.

Overseas Experience: Germany, France, North Africa, 1955-57.

RONALD D. YOUNG - (January 24, 1921 - Waterloo, Alabama)

Educational Background: B. S., 1942, Auburn University, Chemical Engineering.

Present Position: Chief, Process Engineering Branch.

Previous Positions: Engineer, Chemical Warfare Service, 1942-44; U.S. Army, 1944-46; Research Engineer, Reynolds Metals Company, 1946-47; Chemical Engineer, TVA, 1947-63; Assistant Chief, Process Engineering Branch, TVA, 1963-65; Chief, Process Engineering Branch, TVA, 1965 to present.

Major Responsibilities and Capabilities: Planning, supervising, and evaluating research and development program for a large group of professional, subprofessional, and operating personnel in development of fertilizer and munitions processes. Program includes pilot-plant studies and initial operation of demonstration-scale plants. Results of the development work are made available to industry through reports, publications, and discussions.

Overseas Experience: Europe (The Netherlands and West Germany), 1963; Iraq, 1963; India, 1966-67; Iran, 1968.

DESIGN - ENGINEERS

DEXTER C. DEAN - (May 12, 1916 - Belmont; Mississippi)

Educational Background: B. S. , 1937, Mississippi State University, Electrical Engineering.

Present Position: Project Engineer, Design Branch.

Previous Positions: Electrical Engineer, U.S. Steel, 1937-41; Electrical Engineer, TVA, 1941-42; U.S. Air Force, 1942-45; Electrical Engineer, TVA, 1946-55; Chief Electrical Engineer, Southern District, Republic Steel, 1955-61; Project Engineer, TVA, 1961 to present.

Major Responsibilities and Capabilities: Responsible for the planning, estimating, design and material specifications of the electrical portion on all projects for the Design Branch.

Overseas Experience: India, China, Mariana Islands, 1944-45.

FREDERICK G. HALL - (May 15, 1932 - St. Petersburg, Florida)

Educational Background: BSIE - CO-OP, 1959, Georgia Institute of Technology.

Present Position: Mechanical Engineer (Instrumentation), Design Branch.

Previous Positions: U. S. Navy, 1950-54; Co-op student at Georgia Institute of Technology, 1954-59 (1 year for Vitro at Air Force Armament Center, Eglin Air Force Base, Florida, 3 months for Armco Steel's Rolling Mill, Ashland, Kentucky, 1 year for Ford Motor Company's Atlanta Assembly Plant); Application and Sales Engineer, Taylor Instrument Companies, 1959-61; Mechanical Engineer, TVA, 1961 to present.

Major Responsibilities and Capabilities: Responsible for the overall design of instrumentation system for large pilot-plant facilities. Work includes selection, specifications, drawing and installation of instrumentation for the Design Branch.

Overseas Experience: 2 years overseas duty with U. S. Navy - Japan, Korea, Philippines, Mariana Islands.

WILLIAM A. LYNDON - (December 20, 1934 - Knox County, Tennessee)

Educational Background: B.S., 1961, University of Tennessee, Mechanical Engineering.

Present Position: Assistant Project Engineer, Design Branch.

Previous Positions: U.S. Army, 1954-57; Mechanical Engineer, TVA, 1961-66;
Assistant Project Engineer, TVA, 1966 to present.

Major Responsibilities and Capabilities: Design and engineering of chemical plant facilities for production of phosphate and nitrogen fertilizers. Includes full scale operating plants and other major and minor plant replacements.

Overseas Experience: Germany, 1956-57.

Registered Professional Engineer, State of Alabama, No. 6794.

ROBERT D. MITCHELL - (November 28, 1933 - Tuscumbia, Alabama)

Educational Background: B. S. , 1956, University of Alabama, Chemical Engineering.

Present Position: Assistant Project Engineer, Design Branch.

Previous Positions: E. I. DuPont, 1956-57; U. S. Army, 1957; Process Engineer, Reynolds Metals Company, 1958-63; Chemical Engineer, TVA, 1963-65; Assistant Project Engineer, TVA, 1965 to present.

Major Responsibilities and Capabilities: Process engineering--evaluation of pilot-plant data, calculation of full scale plant equipment sizes and stream flows, and direction of preparation of process flow sheets, engineering flow sheets and piping and instrumentation diagrams for full scale plants. Project Engineering--Plant design, equipment selection, equipment procurement, and coordination of detail design work of the several fields on engineering applicable to the construction of full scale chemical plants. Plant Startup--work with startup operations identifying design changes needed to correct minor deficiencies.

Overseas Experience: None.

DONALD A. WAITZMAN - (May 17, 1924 - New Orleans, Louisiana)

Educational Background: B. S. , 1948, Auburn University, Chemical Engineering.

Present Position: Project Engineer, Design Branch.

Previous Positions: U. S. Air Force, 1943-45; Senior Analyst and Technician, Cities Service Refining Corp. and Cit-Con Oil Corporation, 1948-50; Engineer, Stone and Webster Engineering Corporation, 1951-53; Assistant Project Engineer, The Rust Engineering Company, 1953-56; Sales Engineer, D. B. Gooch Associates, Inc. , Ebbert & Kirkman Company, Inc. , and Crandall Engineering Company, 1956-62; Project Engineer, TVA, 1962 to present.

Major Responsibilities and Capabilities: In charge of design and engineering on all phases of projects such as fertilizer plant modifications and new urea plant.

Overseas Experience: Tunisia, 1968; Italy, 1945.

Member American Institute of Chemical Engineers.

Registered Professional Engineer, State of Alabama, No. 2494.

MAINTENANCE - ENGINEERS

BRUCE W. EDWARDS - (July 19, 1920 - Minneapolis, Minnesota)

Educational Background: B. S., 1943, University of Alabama, Mechanical Engineering.

Present Position: Chief, Maintenance Branch.

Previous Positions: Military Service, 1943-46; Design Engineer, 1946-54; Maintenance Engineer, 1954-62; Assistant to the Chief, Maintenance Branch, 1962-64; Assistant Chief, Maintenance Branch, 1964-66; Chief, Maintenance Branch, 1966 to present.

Major Responsibilities and Capabilities: Design and maintenance of Chemical Plant facilities.

Overseas Experience: None.

EMMETT A. LINDSAY - (June 27, 1919 - Lafayette, Louisiana)

Educational Background: B. S., 1942, University of Southwestern Louisiana, Chemical Engineering.

Present Position: Assistant Director of Chemical Operations.

Previous Positions: Jr. Chemical Engineer, TVA, 1942-43; U.S. Navy, 1943-46; Mechanical Engineer, TVA, 1946-51; Assistant Chief, Maintenance Branch, TVA, 1951-1962; Chief, Maintenance Branch, 1962-66; Assistant Director of Chemical Operations, TVA, 1966 to present.

Major Responsibilities and Capabilities: Participates with and assists the Director of Chemical Operations in the formulation, direction, administration, and coordination of the policies, programs, and activities of the division.

Overseas Experience: India, China, 1945.

HARRY NASH, JR. - (August 2, 1918 - Mangham, Louisiana)

Educational Background: B. S. , 1941, Louisiana State University, Industrial Chemistry.

Present Position: Chemical Engineer, Maintenance Branch.

Previous Positions: Tennessee Coal & Iron Division of U. S. Steel Corporation, 1941-44;
U. S. Navy, 1944-46; TVA, 1946 to present.

Major Responsibilities and Capabilities: Maintenance of Ammonia, Phosphate and Nitrogen Fertilizer plants. Planning and scheduling of major maintenance jobs. Protective coating and corrosion of fertilizer plants.

Overseas Experience: India, 1967.

KARL W. POTTS - (March 20, 1926 - Waterloo, Alabama)

Educational Background: BIE, 1948, Georgia Institute of Technology.

Present Position: Mechanical Engineer, Maintenance Branch.

Previous Positions: Military Service, 1943-46; Chemical Engineer, TVA, 1947-53;
Safety Engineer, TVA, 1953-69; Mechanical Engineer, Maintenance Branch, 1969 to present.

Major Responsibilities and Capabilities: Planning and scheduling, and maintenance of
Ammonia, Phosphate, and Nitrogen Fertilizer plants.

Overseas Experience: None.

THOMAS S. SLOAN - (May 27, 1926 - Ocala, Florida)

Educational Background: B. S., 1950, University of Alabama, Industrial Engineering.

Present Position: Assistant to the Director, Division of Chemical Operations.

Previous Positions: U. S. Army, 1944-46; Student, 1946-50; Cost Engineer, TVA, 1950-53; Chemical Engineer, TVA, 1953-62; Assistant Chief, Nitrogen Fertilizer Branch, TVA, 1962-67; Assistant to the Director, Division of Chemical Operations, TVA, 1967 to present.

Major Responsibilities and Capabilities: Cost studies and plant records compilations. Conducting plant scale engineering tests to improve plant operations. Line supervision in a fertilizer manufacturing plant.

Overseas Experience: None.

MINING - ENGINEERS

REYNOLD B. BURT - (January 25, 1910 - Sheffield, Alabama)

Educational Background: B. S. , 1933, Auburn University, Chemical Engineering.

Present Position: Chief, Technical Staff, Division of Chemical Operations.

Previous Positions: Chemical Engineer, TVA, 1934 to present.

Major Responsibilities and Capabilities: Minerals exploration and development as related to phosphate ores including reconnaissance, prospecting, deposit evaluation, development planning, mining, and beneficiation. Chemical and fertilizer process research and production as related to phosphorus, phosphates, and nitrates and combination fertilizers. Operation and plant research on processes for phosphate mining and beneficiation, electric phosphorus furnaces, phosphoric acid, anhydrous ammonia, nitric acid, phosphate, and nitrogen fertilizers. Chemical plant production planning, scheduling, materials procurement, process costing, and budgeting.

Overseas Experience: Saudi Arabia, 1968.

ROY S. INGLE - (November 10, 1918 - Statesville, North Carolina)

Educational Experience: Bche., 1947, North Carolina State University, Geological Engineering.

Present Position: Chief, Mineral Reserve and Mining Branch.

Previous Positions: Field Geologist, North Carolina Geologic Survey, 1941-42; Inspector of Construction on TVA dams, 1942-43; Pilot, U. S. Air Force, 1943-46; Geologic Laboratory Instructor, North Carolina State University, 1946-47; Mining Engineer, Bryan Rock and Sand Company, 1947-48; Phosphate Geologist, TVA, 1948-60; Chief, Mineral Reserve and Mining Branch, TVA, 1960 to present.

Major Responsibilities and Capabilities: Collecting and evaluating geologic and engineering data in the development of phosphate deposits and reserve. Planning, directing, and coordination operations of TVA phosphate and mining branch. Directing the phosphate mining program in TVA's phosphate reserve lands in Tennessee.

Overseas Experience: Turkey, 1966; Venezuela, 1966; Saudi Arabia, 1968.

ECONOMISTS

BILLY JOE BOND - (July 13, 1930 - Deering, Missouri)

Educational Background: B. S., 1953, University of Missouri, Land Economics; M. S., 1957, University of Illinois, Farm Management; Ph. D., 1959, University of Illinois, Production Economics.

Present Position: Chief, Agricultural Resource Development Branch.

Previous Positions: U. S. Navy, 1953-55; Graduate Assistant, University of Illinois, 1955-58; Assistant Professor, Washington State University, 1958-60; Program Evaluation and Analysis, Test-Demonstration Branch, TVA, 1960-64; Assistant Branch Chief, Western Test and Demonstration Branch, TVA, 1964-67; Chief, Agricultural Resource Development Branch, TVA, 1967 to present.

Major Responsibilities and Capabilities: Agricultural development planning and program implementation, economic analysis and economic planning for fertilizer use in developing countries, responsible for planning and conducting the agricultural portion of TVA's overall economic development program in the Tennessee Valley, coordination of fertilizer marketing studies in Division of Agricultural Development conducted for AID.

Overseas Experience: Thailand, 1966.

JOHN R. DOUGLAS - (May 13, 1923 - Maury County, Tennessee)

Educational Background: A. B., 1948, Harvard University, Industrial Economics; Ph. D., 1967, Iowa State University, Agricultural Economics.

Present Position: Staff Economist, Office of Manager.

Previous Positions: U.S. Air Force, 1942-46 and 1950-53; Fertilizer Market Analyst, TVA, 1948-56; Head, Distribution Economics Section, TVA, 1956-66; Staff Economist, Office of Manager, TVA, 1966 to present.

Major Responsibilities and Capabilities: Responsible for long-range planning for nationwide fertilizer R and D programs. Reviews and evaluates current plans and programs pertaining to R and D, production, and distribution. Makes economic evaluations regarding the introduction of new and improved fertilizer materials. Responsible for evaluations of applicable research, cost estimates, production and distribution schedules, and pricing schedules. Evaluates benefits and costs of alternative programs for meeting national fertilizer program goals.

Overseas Experience: Morocco, 1963; Turkey, 1965, 1966, 1967; Vietnam, 1967, 1968; Indonesia, 1968.

ROBERT C. GRAY - (May 26, 1914 - Holley, New York)

Educational Background: B. S. , 1935, Cornell University, Agricultural Extension; M. S. , 1953, Iowa State University, Soil Fertility; Ph.D. , 1963, Virginia Polytechnic Institute, Production Economics.

Present Position: Agriculturist, Test and Demonstration Branch

Previous Positions: Vocational Agriculture Teacher, New York State, 1935-41; U. S. Army, 1942-46; Land Classification Specialist, Bureau of Reclamation, 1947-49; Extension Agronomist, Iowa State University, 1949-57; Agriculturist, TVA, 1957 to present.

Major Responsibilities and Capabilities: Planning, executing, and evaluating agricultural programs, especially those concerned with agronomic-economic aspects of soil fertility and cropping systems. Initiate and develop educational programs in fertilizer distribution and use systems. Responsible for the test-demonstration and distribution demonstration programs in nine states.

Overseas Experience: Afghanistan, 1967; Tunisia, 1968.

ROBERT D. GRISSO - (April 17, 1932 - Roanoke County, Virginia)

Educational Background: B.S., 1957, Virginia Polytechnic Institute, Agricultural Economics; M.S., 1959, Virginia Polytechnic Institute, Agricultural Economics.

Present Position: Agriculturist, Test and Demonstration Branch.

Previous Positions: U.S. Navy, 1950-54; Fertilizer Distribution Analyst, TVA, 1958-63; Market Analyst, Armour Agricultural Chemical Company, 1964; Agriculturist, Test and Demonstration Branch, TVA, 1965 to present.

Major Responsibilities and Capabilities: Planning and field implementation of TVA's educational field programs in his assigned states -- such as introduction of new and improved fertilizers and fertilization practices to the land-grant universities and to fertilizer industry.

Overseas Experience: India, 1967.

R. G. MUELLER - (July 25, 1938 - Chicago, Illinois)

Educational Background: B.S., 1960, University of Colorado; M.S., 1962, Montana State College; Ph.D., 1965, Washington State University, Agricultural Economics.

Present Position: Agriculturist, Test and Demonstration Branch.

Previous Positions: Agricultural Economics Department, University of California, 1960; Agricultural Economics Department, Montana State University, 1960-62; Agricultural Economics Department, Washington State University, 1962; Agriculturist, TVA, 1962 to present.

Major Responsibilities and Capabilities: Plans, initiates, and conducts in his assigned states a unified fertilizer education program including test-demonstration activities, fertilizer distributor and dealer demonstrations and fertilizer education activities.

Overseas Experience: India, 1968.

JON L. NEVINS - (February 24, 1937 - Little Rock, Arkansas)

Educational Background: B. S. , 1960, Case Institute of Technology, Management Science.

Present Position: Agricultural Economist, Distribution Economics Section.

Previous Positions: None.

Major Responsibilities and Capabilities: Economic studies concerning the manufacturing, distribution, and marketing of TVA and other new types of fertilizers.

Overseas Experience: Morocco, 1966; Peru, 1967, 1968.

WESLEY G. SMITH - (July 8, 1930 - Brandon, Manitoba, Canada)

Educational Background: B. S. A., 1951, University of Manitoba, Plant Science; M. S., 1953, University of Manitoba, Agricultural Economics; Ph. D., 1958, Iowa State University, Agricultural Economics.

Present Position: Agricultural Economist, Agricultural Resource Development Branch.

Previous Positions Student Assistant, University of Manitoba, 1950 (Summer); Economics Division, Canada Department of Agriculture, 1951 (Summer); Economist, Canada Department of Agriculture, 1952-55; Graduate Assistant, Iowa State University, 1955-58; Assistant Professor, Department of Agricultural Economics, University of Delaware, 1958-59; Agricultural Economist, Agricultural Resource Development Branch, TVA, 1959 to present.

Major Responsibilities and Capabilities: Conducts and plans highly technical research which identifies and quantifies factors involved in the structure of Valley agriculture; such as forage and livestock potentials, land use and land use adjustments, obstacles impeding agricultural development, and competitive position of Valley agriculture nationally. He has published over 30 major reports or publications on his TVA research which have contributed materially to the orientation and formulation of educational program activities.

Overseas Experience: Korea, 1963, 1965.

HAROLD G. WALKUP - (September 19, 1917 - York, Nebraska)

Educational Background: B. S. , 1942, University of Nebraska, Agronomy; M. A. , 1947, Washington State University, Agricultural Economics.

Present Position: Head, Distribution Economics Section.

Previous Positions: U. S. Army, 1942-46; Graduate Research Assistant, Washington State University, 1946-47; Agricultural Economics Instructor and Researcher, Washington State University, 1947-54; Farm Manager, 1954-55; Agricultural Economist, TVA, 1955 to present.

Major Responsibilities and Capabilities: Supervise five professional people engaged in fertilizer marketing research. Cost and returns analyses with regard to various types of fertilizer marketing systems.

Overseas Experience: Afghanistan, 1966, 1967.

EDUCATION AND COMMUNICATION SPECIALISTS

JOHN E. CULP - (February 27, 1933 - Clanton, Alabama)

Educational Background: B. S., 1957, Auburn University, Agricultural Education.

Present Position: Head, Educational and Communications Services.

Previous Positions: Farm Director, WAVU Radio, 1957-61; Extension News Editor, Auburn University, 1961-62; Editor, *Broiler Business* (a national poultry book), 1962-63; Communications Specialist, TVA, 1963 to present.

Major Responsibilities and Capabilities: General planning and supervision of all audio-visual communications activities of the Division of Agricultural Development and conduct of national fertilizer conferences, international training courses, and regional agricultural resource development activities.

Overseas Experience: Peru, 1967, 1968.

RALPH E. McKNIGHT - (July 20, 1912 - Trenton, Tennessee)

Educational Background: B. S. , 1938, University of Tennessee, Agricultural Engineering;
M. S. , 1939, Virginia Polytechnic Institute, Agricultural Engineering.

Present Position: Chief, Test and Demonstration Branch.

Previous Positions: Assistant County Agent, Tennessee, 1939-41; County Agent, Tennessee, 1942-44; Extension Engineer, Virginia, 1945-46; Agricultural Engineer, TVA, 1946-48; Chief, Agricultural Development Section, TVA, 1948-50; Chief, Test-Demonstration Branch, TVA, 1950-64; Chief, Western Test and Demonstration Branch, 1964-Jan. 1969; Chief, Test and Demonstration Branch, January 1969 to present.

Major Responsibilities and Capabilities: Responsible for planning and administration of TVA's fertilizer field activities in the United States and Puerto Rico except for test-demonstration activities in the seven Tennessee Valley states.

Overseas Experience: Morocco, 1966.

DARRELL A. RUSSEL - (May 26, 1921 - McPherson, Kansas)

Educational Background: B. S. , 1943, Kansas State College, Agriculture; M. S. , 1947, University of Illinois, Soil Fertility and Crop Production; Ph. D. , 1955, University of Illinois, Soil Fertility and Analytical Chemistry.

Present Position: Agriculturist (Staff Agronomist), Office of the Director, Division of Agricultural Development

Previous Positions: Special Research Assistant, University of Illinois, 1946-47; Instructor in Soils, Iowa State College, 1947-49; District Extension Director, Iowa Agricultural Extension Service, 1949-51; Assistant in Soil Fertility, University of Illinois, 1951-55; Assistant Soil Chemist and Assistant Professor of Soil Chemistry, North Louisiana Hill Farm Experiment Station, Louisiana Agricultural Experiment Station, 1955-60; Agriculturist, Fertilizer Distribution and Eastern Test and Demonstration Branches, Division of Agricultural Development, TVA, 1960-64; Agriculturist (Staff Agronomist), Office of the Director, Division of Agricultural Development, TVA, 1964 to present.

Major Responsibilities and Capabilities: Functions as Division Staff Agronomist; Summarizes and communicates orally and in writing, a broad range of fertilizer information; Sets up and conducts training courses; Major contributor to the monthly publication Fertilizer Abstracts.

Overseas Experience: Morocco, 1966; Europe, 1967.

WILLIAM C. SCOTT - (August 26, 1917 - Sibleyville, Alabama)

Educational Background: B. S., 1940, Auburn University, Chemical Engineering.

Present Position: Assistant to the Chief, Process Engineering Branch.

Previous Positions: Byproduct Engineer, DeBardeleben Coal Corporation, 1940-42; TVA, 1942-43; Chemical Engineer, TVA, 1943 to present.

Major Responsibilities and Capabilities: Design, construction, operation, and supervision of pilot plants. Design, construction, and operation of large-scale plants. Emphasis on burden preparation for phosphorus furnaces, utilization of furnace byproducts, phosphoric acid, liquid fertilizers. Administration of engineering research and development including budgeting, expenditures control, personnel, maintenance, scheduling, and training. International Training Committee.

Overseas Experience: Nigeria, 1965.

R. O. WOODWARD - (June 17, 1917 - Farm in Oklahoma)

Educational Background: M.S., 1955, Oklahoma State University, Agronomy and Extension Education.

Present Position: Agriculturist, Agricultural Resource Development Branch.

Previous Positions: Comptroller, USDA, 1939-41; U.S. Air Force, 1941-46; Extension Agronomist, Oklahoma State University, 1946-55; Research Agronomist, Standard Oil Company of California, 1956-63; Agriculturist, TVA, 1963 to present.

Major Responsibilities and Capabilities: Supervisor of agricultural resource development projects in three tributary areas of the Tennessee River. Evaluate agricultural potential of tributary areas. Organize and direct citizen groups on projects to develop local agriculture. Also, coordinate projects according to agreements between TVA and the land-grant universities in Alabama and Mississippi.

Overseas Experience: North Africa, Europe, West Asia (World War II) 1942-46; Thailand, 1965.

AGRONOMISTS

RAY B. DIAMOND - (January 10, 1933 - Louisa, Kentucky)

Educational Background: B.S., 1954, Ohio State University, Agriculture (Agronomy); M.S., 1961, University of Florida, Agriculture (soils); Ph.D., 1963, University of Florida, Agriculture (soils).

Present Position: Agronomist, Test and Demonstration Branch.

Previous Positions: U.S. Navy, 1954-59; Graduate Assistant, University of Florida, 1960-63; Agriculturist, TVA, 1963-64; Agronomist, TVA, 1964 to present.

Major Responsibilities and Capabilities: Agronomy leader and soils and fertilizer use specialist for TVA's fertilizer introduction, education, and evaluation program in 43 states. Gives guidance in planning, developing, evaluating, and reporting of projects for evaluating new fertilizers, determining crop response to macro-, secondary, and micronutrients.

Overseas Experience: Turkey, 1966; Peru, 1967, 1968.

ORVIS P. ENGELSTAD - (February 19, 1928 - Fertile, Minnesota)

Educational Background: B.S., 1952, University of Minnesota, Soils, Economics; M.S., 1954, University of Minnesota, Soils, Crop Production; Ph.D., 1960, Iowa State University, Soil Fertility, Economics.

Present Position: Research Agronomist, Soils and Fertilizer Research Branch.

Previous Positions: Soils Agent, Minnesota Agricultural Extension Service, 1953-55; Research Associate, Iowa State University, 1955-60; Research Agronomist, TVA, 1960 to present.

Major Responsibilities and Capabilities: Agronomic evaluation of experimental fertilizers; Improvement of methodology of fertilizer evaluation; Agronomic, statistical, and economic interpretation of yield response to fertilizer nutrients; Leader of TVA-AID project, "Tailoring of Fertilizers for Rice." This involves cooperation of agronomists and engineers in production and overseas testing of new fertilizer formulations for flooded rice.

Overseas Experience: South Korea, 1965; Pakistan, 1967; India, 1968.

ROLAND D. HAUCK - (September 21, 1926 - Dayton, Ohio)

Educational Background: B. Ph., 1948, University of Chicago, Liberal Arts and Sciences; B.A., 1950, North Central College, Chemistry; M.S., 1952, and Ph.D., 1954, University of Illinois, Agronomy.

Present Position: Research Chemist, Soils and Fertilizer Research Branch.

Previous Positions: U. S. Air Force, 1945-47; Research Assistant, University of Illinois, 1950-55; Research Botanist, Firestone Plantations Co., 1955-60; Research Chemist, TVA, 1960 to present.

Major Responsibilities and Capabilities: Research on new N fertilizers, chemical and biological reactions of soil and fertilizer N, N tracer studies, mass spectrometer, infra-red, gas chromatograph instrument analysis. Instructor in training programs.

Overseas Experience: Philippines, 1946-47; Liberia, West Africa, 1955-60; Germany, 1963; Australia, 1968; Japan, 1968.

VICTOR J. KILMER - (January 24, 1913 - Oconto Falls, Wisconsin)

Educational Background: B. S. , 1940, M. S. , 1943, University of Wisconsin, Agriculture.

Present Position: Chief, Soils and Fertilizer Research Branch, TVA.

Previous Positions: Soil Scientist, USDA, 1941-42; U. S. Army, 1942-46; Soil Scientist, USDA, 1946-61; Assistant to Manager, TVA, 1961-63; Chief, Soils and Fertilizer Research Branch, TVA, 1963 to present.

Major Responsibilities and Capabilities: Soils and fertilizer research. Responsible for TVA's basic agronomic research program involving a staff of 28. The program consists of laboratory, greenhouse, and field research in all phases of soil-fertilizer-plant relationships. A cooperative research program with universities and other organizations augments the "in house" program.

Overseas Experience: Philippine Islands, 1945-46; Venezuela, 1966.

WARREN J. SHARRATT - (December 3, 1931 - Eldorado, Wisconsin)

Educational Background: B. S. , 1953, University of Wisconsin, Soils; M. S. & Ph. D. , 1961, University of Wisconsin, Soil Fertility and Plant Physiology.

Present Position: Agriculturist, Test and Demonstration Branch.

Previous Positions: General Laborer, Green Giant Company, 1951; Construction Company, Fon-du-lac, Wisconsin, 1952; U. S. Army, 1953-56; Extension work at University of Wisconsin, 1956; Agriculturist, TVA, 1961 to present.

Major Responsibilities and Capabilities: Plans, initiates, and conducts in his assigned states a unified fertilizer education program including test-demonstration activities, fertilizer distributor and dealer demonstrations and fertilizer education activities.

Overseas Experience: Pakistan, India, and Turkey, 1968.

WILLIAM N. SUTHERLAND - (August 10, 1927 - Linden, Iowa)

Educational Background: B.S., 1950, Iowa State University, Agriculture; M.S., Ph. D., 1960, Iowa State University, Soil Fertility.

Present Position: Agriculturist, Test and Demonstration Branch.

Previous Positions: U.S. Navy, 1946; Temporary County Youth, Extension Service, 1948; Agent, Extension Service, 1949-54; Assistant County Agent, Extension Service, 1954-56; Soil Conservation Agent, 1956-60; Agriculturist, TVA, 1960 to present.

Major Responsibilities and Capabilities: Plans, initiates, and conducts in his assigned states a unified fertilizer education program including test-demonstration activities, fertilizer distributor and dealer demonstrations and fertilizer education activities.

Overseas Experience: South Vietnam, 1967.

AID STUDIES

1. "Seminar for Latin American Fertilizer Executives" proceedings, 1967.
2. "Estimated World Fertilizer Production Capacity as Related to Future Needs." (published first in 1966 and again in June 1968.)
3. "Importance of Water Solubility of Phosphorus Fertilizers." 1966.
4. "Economic Evaluation of Producing Mixed Fertilizers in India by Ammoniation of Triple Superphosphate vs Ammoniating Phosphoric Acid to Diammonium Phosphate." 1966.
5. "Ocean Shipment of Anhydrous Ammonia vs Urea Ammonia Solutions." 1966.
6. "Economic and Technical Evaluation of Overseas Shipment and Utilization of Elemental Phosphorus for Fertilizer Production." 1968.
7. "Economic Evaluation of Overseas Shipment and Utilization of Phosphoric Acid for Fertilizer Production." 1968.
8. "Tunisia--Nitrogen Fertilizer Needs, Alternatives to Meet Needs." 1968.
9. "Korea--Mixed Fertilizer Plant for Korea: Project Evaluation." 1963. (Not Available)
10. "Projected Fertilizer Needs for Korea, 1967-71." 1965.
11. "A Report on the Thailand Fertilizer Situation and Potential." 1966.
12. "Survey of Fertilizer Use in Nigeria--An Evaluation of Potential Demand and Methods of Supply." 1965. (Not Available)
13. "Report on the Development of the Turkish Fertilizer Industry." 1966.
14. "Morocco--Role of Fertilizer in Agricultural Development." 1967.
15. "The Role of Fertilizer in the Agricultural Development of Afghanistan." 1968.
16. "The Report of the Fertiliser Study Team." 1968. (Not Available)

17. "The Trombay Unit of the Fertiliser Corporation of India, Ltd." 1967. (Not Available)
18. "Uruguay's Fertilizer Supply and Need." 1967.
19. "South Vietnam--An Evaluation of the Fertilizer Industry." 1967.
20. "Peru's Fertilizer Distribution and Marketing System." 1968.
21. "1968--Follow-up Report on South Vietnam's Fertilizer Industry." 1968.
22. "Report of TVA Technical Team's Visit to Instituto Venezolano de Petroquímica, November 29-December 11, 1966." (Not Available)
23. "Indonesia's Fertilizer Requirements." 1968. (Not Available)
24. "Economic Comparison of Overseas Manufacture vs Importation of Anhydrous Ammonia." 1969.
25. "Comparison of Shipments of Intermediates vs Raw Materials for Finished Products " 1969.
26. "Phosphate Deposits in the Sirhan-Turaif Area of Saudi-Arabia Mining-Processing, Transportation-Marketing, Feasibility Study." 1968. (Not Available)
27. "Programming of India Fertilizer Imports, 1974-75." (Evaluation and Recommendations)
28. "Preliminary Technological & Economic Evaluation of Prospects for Utilization of Iranian Phosphate Ore for Fertilizer Production."