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9 One Mighty Force

Caricature of Du Pont's Field Project Manager, Robert K. Mason, in charge of the construction of the Savannah River Plant. The caricature shows Mr. Mason with the Savannah River Project buildings, for which he was responsible, in his hands. Numerous images showing highlights from the construction era form the background. Site artist and cartoonist J. Cauthen was responsible for this finely drawn caricature. Courtesy of SRS Archives, negative M-3962-6.

In Augusta, Ga this week, an invading army of engineers, builders and technicians jammed the city's hotels and spare rooms to the rafters. Across the Savannah River in South Carolina, the aluminum glint of hundreds of trailers winked among the pecan groves. Giant bulldozers ripped through slash pine and red clay, pushing a four-lane, 20-mile express highway from North Augusta to Ellenton (pop. 700), a town soon destined to disappear before the bulldozers' onrush.

The target of this invading army is just beyond Ellenton; a 200,000-acre site spotted with hundreds of hustling trucks, steam shovels and cement mixers. There the steel skeleton of a headquarters building is already rising- the focus for sightseers who come from miles around to see what the DuPonts are doing. What E. I. du Pont de Nemours is doing is worth considerable attention. It is building the Government's $600 million plant to make the components for the hydrogen bomb.[1]

Du Pont's invading army of engineers, managers, and construction workers was responsible for the "development, design, construction, installation, and operation of facilities for the production of heavy water, fissionable and fusionable materials, and related products" as the prime contractor with the AEC.[2] Center stage for this chapter belongs to Du Pont and its workforce, headed by the able and inventive Bob Mason, Du Pont's Field Project Manager. The magnitude of the Savannah River Project was monumental, calling for the construction of nine integrated industrial plants at the South Carolina site as well as the Dana Plant, in Dana, Indiana. The schedule was urgent and the design processes involved were constantly evolving. All involved applied their knowledge to the tasks at hand, bringing the processes on line. Du Pont's Chief Engineer Granville Read would later commend those involved from the bottom to the top. "The part construction men played in it [the project] will never be glamorized or make the headlines, but for my part, I want to thank management, designers, construction engineers, consultants, craft supervisors, technicians, and all other persons who combined their talents and skills into one mighty force to build the Savannah River Plant."[3]

PROJECT SCOPE OF WORK

The scope of work for Project 8980, Du Pont's internal project number for Savannah River Plant, was continually refined through the first three years to meet production requirements set by the AEC who, in turn, formulated their production projections based on national policy and defense, budgetary concerns, and design imperatives. The expansion program under which the Savannah River Plant was first envisioned was and could be further expanded. Du Pont played a primary role in defining the scope as their engineers began to tackle the project needs. As they responded to modifications to the scope, other changes resulted. All design was conducted within this fluid environment, changing as new variables, new research, and new policy developed.

As discussed earlier, two reactors were contemplated for Savannah River in July 1950. This number was increased to five by August 1 in response to North Korea's drive into the Republic of Korea, Soviet espionage, and the Soviet bomb.[4] The AEC provided Du Pont with a general scope of work, requesting the construction of five full-scale heavy-water-moderated production reactors on normal (natural) uranium, a facility for Purex (solvent extraction) separation, a fabrication facility for plutonium shapes, a tritium separation plant, and facilities where bismuth could be irradiated if needed. This scope was changed in December 1950 to include a second separation area and plans to expand into a third. The increase in reactors compelled the AEC to authorize the construction of a second heavy-water production plant so that an adequate supply of heavy water was available when the reactors were constructed. This generated another major change in the project's scope.

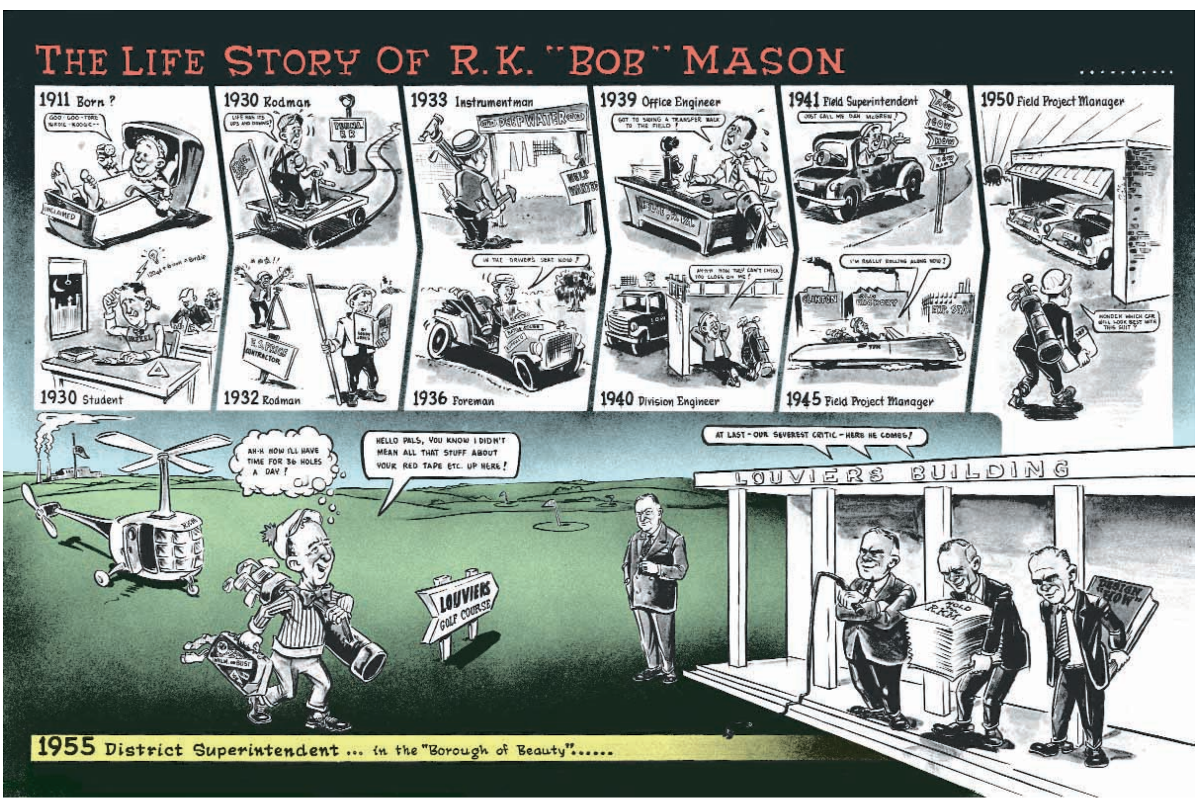
Packed dinner meeting of AEC and Du Pont's "invading army of engineers" possibly in December 1950. Field Manager Robert Mason (second from left) and AEC Manager Curtis Nelson (third from left) are standing in back of room that is decorated for the holidays. Courtesy of SRS History Project.

Robert K. Mason, Field Project Manager, Savannah River Project (1950–1955)

As Field Project Manager for the Savannah River Project, Robert (Bob) K. Mason was responsible for building the Savannah River Plant, the AEC's largest undertaking up to that time. Like AEC SROO Manager Curtis Nelson, he was posted to the project in mid 1950 while the AEC and Du Pont entered into the decision-making process involved in the plant's formation. Mason led a survey to the proposed site in November 1950 and participated in the site-selection process. After site selection, he had the monumental task of translating these decisions into reality.

Mason, a Wilmington, Delaware native, took on the position of Du Pont Field Project Manager for SRP at the age of 39. Son of a pipe fitter, he grew up with his father's extended family in Wilmington as his mother had passed away when he was a child. At age 19, he began working for the Pennsylvania Railroad, studying engineering at Drexel Institute Evening School in Philadelphia at night. This experience led to his employment three years later as a rodman at Du Pont's Deepwater, New Jersey, plant. From there, Mason worked up through Du Pont's ranks, serving as foreman at company plants in Baton Rouge, LA, and Buffalo, NY. He also served as office engineer for the expansion program at Belle, West Virginia; division engineer and assistant field engineer at Indiana Ordnance; and field superintendent at the Alabama Ordnance plant; and later at the St. Paul, Minnesota, Ordnance Works. His construction career continued with a stint at Hanford as supervisor of the company town of Richland; work at Rocket Powder Plant in Charlestown, Indiana, and as field project manager overseeing an addition to Du Pont's Old Hickory, Tennessee, cellophane plant. Prior to Savannah River, Mr. Mason was responsible for the construction of Du Pont's Experimental Station in Wilmington. All of this experience would be needed at Savannah River.

Source: Oral history interview, Mrs. Letitia Mason, July 1999.



After study, Du Pont recommended that the plant's power be produced onsite in dispersed units for economy, self-sufficiency, and defense. During the site selection process, power was to be purchased from offsite sources. In response to the Du Pont recommendation, the AEC again modified the scope, allowing the construction of powerhouses at the heavy-water production plant area and at the first four reactor areas.[5] South Carolina Electric & Gas was to furnish the remaining power needed. Other changes included the elimination of funds for U-233 separation and a possible sixth reactor—a heavy-water model of advanced design that was scratched in November 1952.[6]

The general scope of work for the Savannah River Plant required constructing research and development laboratories and process and service buildings for producing heavy water, deuterium, plutonium, tritium, and special products. Reactors, separations canyons, power plants, cooling basins, waste tanks, and a wide variety of administration and ancillary buildings would be needed. As construction proceeded, manufacturing and service or ancillary facilities would be added, deleted, and modified.

Du Pont designers accomplished their goals using a "flexible design" approach. This approach operated at two levels: the first entailed postponing design decisions until the best design could be determined by research or through consultation, and the second was to build in the potential for future design options should AEC policy change. In the first scenario, Du Pont designers based some design decisions on their experience from previous construction projects for atomic energy plants and from scientific research completed at AEC's national laboratories. This allowed them to move forward with production in some areas while researching alternative design choices for others. In the second scenario, design was necessarily postponed as part of the current and future client-contractor relationship. AEC directives, based on Department of Defense guidance on what product or product mix was needed for its weapons program, directly translated into design decisions. Du Pont recognized this as an integral feature of their contract and responded with aplomb to an evolving scope of work. Their ability to do so was characteristic of the firm's management.[7]

Despite this fluidity in the design context and Du Pont's flexible approach, the end goal—providing plutonium and tritium for the nation's defense—was still to be accomplished on schedule. "The Korean Conflict, the possible imminence of World War III, and a national consensus that sacrifices were needed to stop the Soviets, all created, at the national level of the Atomic Energy Commission, an atmosphere of urgency and commitment."[8] Thus, R Reactor went from conceptual design in December 1950 to an operating reactor in December 1953, an incredible feat of engineering completed with breakneck speed. All contributed to create this success story; however, Du Pont's organization and system of departmental checks and balances and procurement strategies figured prominently in this success.

PLANNING IN SECRECY

Du Pont's invading army was well organized. Planning began in June with intensive planning starting after August 1, 1950, the date that Du Pont accepted the job formally. On October 11, the AEC issued a letter contract that was accepted on the 17th by Du Pont. The letter contract was effective retroactively on August 1.

(Opposite Page) This cartoon, rendered by Site artist and cartoonist J. Cauthen, shows stages in Bob Mason's life. It playfully shows his rise in the Du Pont firm from a rodman to Field Project Manager of the largest construction job undertaken by the AEC in 1950. The cartoon was created as a memento to Mason on his departure from Savannah River and his return to Wilmington as a District Superintendent up until 1955. Source: Oral history interview, Mrs Letitia Mason, July 1999. SRS History Project. Cartoon courtesy of SRS Archives, negative M-3962-1.

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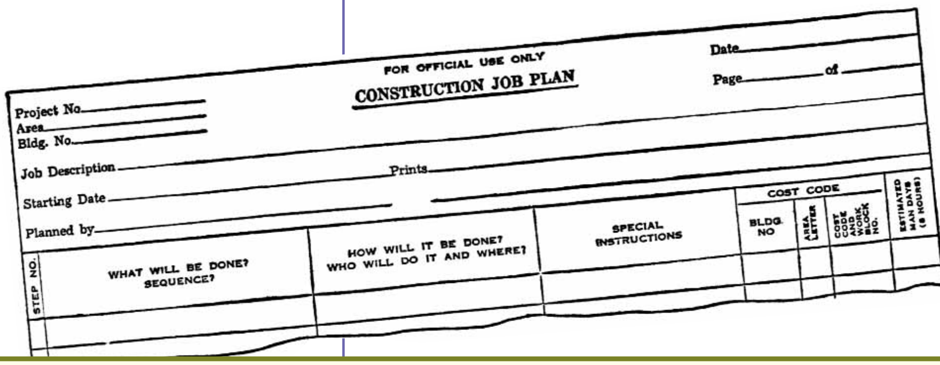

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CONSTRUCTION JOB PLAN

Date

Page ___ of ___

Project No.

Area

Bldg. No.

Job Description

Prints

Starting Date

Planned by

STEP NO.	WHAT WILL BE DONE? SEQUENCE?	HOW WILL IT BE DONE? WHO WILL DO IT AND WHERE?	SPECIAL INSTRUCTIONS	COST CODE: BLDG. NO	AREA LETTER	COST CODE AND WORK BLOCK NO.	ESTIMATED MAN DAYS (8 HOURS)

Construction Job Plan used in Project 8980. A written plan was created for work units with cost code data and estimated man-days. The work plan was later compared with the performance record to assess productivity. Source (text and image): *Engineering News Record*, "How H-Bomb Construction is Controlled," June 26, 1952.

Through the summer, the Du Pont team took shape. Those selected, the majority of whom had played roles in Hanford's construction and design, were assigned to the newly established Atomic Energy Division (AED) within Du Pont's Explosives Department. The Explosives Department was given prime responsibility for the Savannah River Project, beginning with developing the scope of work and the specific process requirements needed to complete it. The AED's management team consisted of an Assistant General Manager and three managers responsible for the AED's three subdivisions: Technical, Control, and Manufacturing.[9] R. Montgomery Evans was chosen as Assistant General Manager. Evans, who had acted as an informal point of contact between the AEC's Carleton Shugg and the Du Pont firm on the developing expansion program prior to Du Pont's re-entry into atomic energy development, was a logical choice.[10]

The Technical Division was charged with acquiring technical and scientific data and with developing and evaluating process requirements. Once known, these requirements

"Plan Your Work. Work Your Plan."

Bob Mason's job as construction manager for the plant was awesome in its scope. *Engineering News-Record* wrote a feature series on "How H-Bomb Construction Is Controlled" in June 1952, and Bob Mason with his hardhat graced the magazine's cover. While the article is written from a construction worker's perspective, it conveys a sense of how Mason and his cohort of managers did their jobs. Planning, scheduling, reporting, and analysis were the steps followed. Two hours or less was spent in the project's "chart room" where the labor of 15 men and women who gathered data on the project's progress, costs, and schedule, was assembled into vast and detailed charts that allowed the top managers to see at a glance project trends. Much of the overall project analysis was completed in Wilmington. Typically there were 150 charts and graphs for review at a time. From this information and project analysis, data was shown for the overall project, the progress within each building area, and finally progress on individual buildings or facilities within areas. The area concept structured the construction, with each area having what amounted to an individual work plan. Forecasts were made on a weekly basis that provided the area engineers with a sense of what was immediately ahead. The weekly schedule was established from the forecast at conferences that were added to the regular Friday afternoon safety meetings of area craft superintendents and their foremen.

Concrete scheduling was critical and was handled separately from other scheduling. An average of 20,000 cubic yards of concrete went from the batch plants to building areas. A scheduling meeting was held daily in addition to the weekly forecast to determine the mix needed, the number of trucks, the plant the concrete was to come from, and the time and rate of delivery. A weather-forecasting service established on site helped the construction force with their schedule, particularly the concrete workers.

From the use of stiff-legged derricks to two-way radios, Mason and his managers used a variety of techniques to get the job done and, in Du Pont style, to learn how to do it better. Performance analysis and field ratings were completed to see whether the construction plan worked and whether estimates of time, manpower, materials, and money were actually met. Mason was also credited with innovative construction solutions that included learning about safety-net techniques from the Ringling Brothers to prepare SRP's "high-wire" riggers for their work on the 400 Area towers.

were relayed through the Production Division to Du Pont's Engineering Department's Design Division. The Technical Division was also responsible for SRP's research laboratories, once they were in operation.

The Manufacturing Division (also known as Production) was responsible for maintaining good communication with Du Pont's Engineering Department and for final approval of basic plant design. This division's responsibilities increased immeasurably after construction; its staff would supervise the overall operation of the plant. Finally, all administrative, cost control, accounting, and office management fell to the Control Division.[11] Two members of Du Pont's Treasury Department were assigned to the AEC project on October 16; five days later $4 million were transferred to Du Pont's account to fund the project start.[12]

AED Management Team, 1950

Assistant General Manager	R. M. Evans
Administrative Assistant	D. F. O'Connor
Atomic Energy Division Manager	B. H. Mackey
Manufacturing Division, Director of Manufacture	W. C. Kay
Control Division Manager	F. M. Burns Jr.
Technical Division Manager	Lombard Squires
Assistant Manager	J. E. Cole
Assistant Manager	Hood Worthington

The management team was expanded quickly to include V. R. Thayer, J. C. Woodhouse, Dale F. Babcock, and C. W. J. Wende as members of the Technical Division's Research staff. W. H. Holstein and J. B. Tinker became members of the Manufacturing Division's Production staff.[13]

The construction men came from Du Pont's Engineering Department, a group that typically built Du Pont's commercial operations, but were assigned to design and construct the new plant. Headed by Chief Engineer Granville M. Read, the overall department embraced several divisions: Design, Construction, Development Engineering, Engineering Service, and Control.

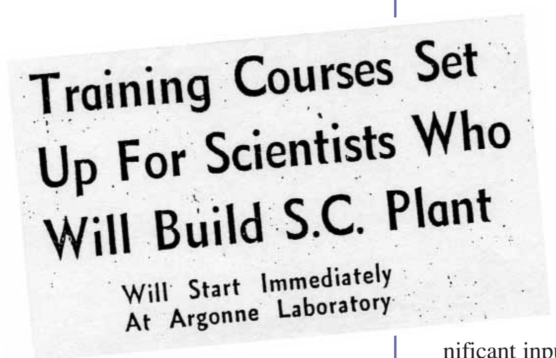
Cognizant of the complexity that lay ahead, Du Pont created a new office on August 9 within the Engineering Department. The new office, Atomic Engineering, was responsible for coordinating all the engineering tasks conducted by Du Pont and coordinating with the federal agencies and all other Du Pont departments. This group would be enlarged as the project developed. The complexity of the design work ahead also made for further internal change. A manager, aided by two assistants—one to manage Du Pont industrial work and the second to manage the AEC project—headed the Design Division. The magnitude of the proposed work necessitated the use of five subcontractors for a major part of the design effort. This added a number of voices to the design environment and, as the home offices of the selected subcontractors were distant from Wilmington, communication would also pose problems. In response to these challenges, Du Pont stationed design and procurement personnel at each of the subcontractor's home offices. These men acted as liaisons for the design team, funneling design data and drawings between the offices. The design information-exchange pool widened in August 1951 when a field design group was established. The Design Division field group, composed of engineers and draftsmen, was sent to South Carolina to handle engineering and design needs that required field-review prior to construction.

Under the eyes of the Resident Design Engineer, the Du Pont field personnel and a member of each subcontractor's staff were given significant authority for field decisions. Effectively, they were point guards for the overall design process, keeping the Design Project Manager informed on field progress, obtaining AED and AEC decisions and approvals at the field level, handling special design services, attending construction meetings to provide information on design, providing the necessary approval for construction to move ahead, and approving field work requests. The importance of the field design group only heightened as construction progressed. Their presence allowed for last-minute changes and test programs that were needed to make scheduled startup dates.[14]

Du Pont's system for design and construction worked. Authors Carlisle and Zenzen point out:

> Reflecting its experience in private-sector chemical engineering, the corporation was quite capable of sorting through difficult design decisions. Du Pont efficiently solved design decisions internally by a system of checks and balances between its own divisions and departments. Du Pont handled liaisons with other parts of the growing nuclear establishment with a minimum of bureaucratic delay, arguing successfully with AEC procurement officials that emergency conditions should allow for non-competitive purchasing of key components. Good scheduling, spurred by a sense of urgency, allowed planning and design work to be done even during construction of already-settled components, probably the greatest single contributor to rapidity and efficiency.[15]

Dr. Walter H. Zinn, Argonne's National Laboratory director, carefully announced to the Chicago press corps that Du Pont had entered into a new agreement with the laboratory that was, in essence, a renewal of an old partnership forged during World War II. The article noted that although the AEC's plans were not made public, the new plant would be based on designs perfected at Argonne for making tritium, hence the need for an Argonne based training program. Source: Roy Gibbons, "Training Courses Set Up for Scientists Who Will Build S.C. Plant," *The Record*, December 4, 1950.


Training Courses Set Up For Scientists Who Will Build S.C. Plant

Will Start Immediately At Argonne Laboratory

DESIGN SOURCES

Hanford, Argonne National Laboratory (ANL), Oak Ridge National Laboratory (ORNL), and Knolls Atomic Power Laboratory (KAPL) had significant input into the proposed plant and its processes and the initial training of designers and, later, operations staff. The national laboratory system was a design source from which Du Pont initially drew upon to accomplish their objectives.

To some extent, Hanford was a model for the Savannah River Plant because the plants shared broad objectives and a common builder. The Du Pont construction history observed that the Hanford construction historical narratives were intensely reviewed by Du Pont staff members over the summer of 1950 to refresh the memories of those returning to the field of atomic energy and to cull any lessons learned from the earlier Du Pont effort. Limited data from Hanford's reactors was useful to the Du Pont engineers, who were to design and construct heavy-water-moderated reactors. However, some of the modified Hanford facilities that corresponded to proposed SRP facilities provided direct valuable design information, mainly in the processes needed for canning of fuels, separations, waste disposal, and service facilities.[16] Hanford also was valuable as a training ground for SRP employees. As early as August 1950, Du Pont approached General Electric (GE) to see if new Du Pont employees could receive short- and long-term training at Hanford.[17]

Reactor studies, particularly on heavy-water-moderated reactors, were centered at Argonne National Laboratory. The conceptual design for the SRP reactors was a product of Walter Zinn's research that had been ongoing through 1950 at Argonne. Du Pont's engineers would take this design and fabricate a multi-purpose reactor that met the AEC's production needs. The AEC had determined that approximately 1800 megawatts of total reactor capability was needed to produce sufficient tritium for the program. The Savannah River reactors, of which there were six originally planned, were each scaled at 300 megawatts.

Argonne's Stuart McLain coordinated the SRP laboratory R&D program at ANL and acted as liaison with Du Pont on technical details. The research effort was focused primarily on metallurgical studies and tests for fuel elements, working on fuel fabrication and investigating how various alloys behave under irradiation. The decision to clad SRP's fuel elements in aluminum would stem from such tests. Although necessary, these reactor tests called for about 25 tons of heavy water that Zinn pulled from various sources. An adequate supply of heavy water would not be available until the Dana Plant went into operation in January 1952.[18]

Sixty-six Du Pont employees were in residence at Argonne by August 1951 to receive training in physics, physical chemistry, chemical engineering, and inorganic chemistry. Milton H. Wahl, who later became the Savannah River Laboratory's first director, led Du Pont's Argonne group. The trainees grew in number over the next year into the hundreds; 75 were in attendance in just the last quarter of 1952, and, in 1953, 317 trainees were expected. The projection for the number of ANL trainees in 1954 decreased to 18, reflecting the new presence of operating and training facilities in South Carolina.[19]

Another source of reactor design data within the early planning period came from Eugene Wigner and John Wheeler. "In one 1950 throwback to the earlier (MED) use of the wisdom of renowned physicists, the AEC consulted with Eugene Wigner and John Wheeler, veterans of the MED effort."[20] Historians Carlisle and Zenzen describe the physicists' input as enthusiastic, but note that the inclusion of non-industrial individuals within the design context was unusual this time around.

Milton H. Wahl led Du Pont's Argonne training group. Dr. Wahl, shown here with an uncharacteristic smile, later became the Savannah River Laboratory's first director, building the foundation for the research and development program the laboratory would pursue. Courtesy of J. Walter Joseph.

Girdler's Dana Plant would contribute significant design information. When Du Pont accepted the plant project, the Girdler Corporation was already under contract to build a pilot plant and a large-scale plant on the old site of the Wabash River Ordnance Works near Dana, Indiana. Girdler, as a Du Pont subcontractor, completed the construction of the Dana Plant which, as Du Pont historian Bebbington points out, became SRP's first operating area, despite its distance from South Carolina. The Dana Plant had its own area office that reported to Curtis Nelson. "Dana gave SRP a running start that significantly advanced the date of the first SRP plutonium production."[21] The "GS" or Girdler Sulfide process used at Dana was used at SRP's heavy-water production area that was added to Du Pont's project scope in January of 1951. The problems met in bringing the GS process on line were handled at Dana, providing the design team for the SRP heavy-water area with solutions to potential operating problems. Also, the core group of SRP's heavy-water operations staff was trained at Dana, greatly shortening their learning curve.[22]

Separations design was based on data provided by KAPL, ORNL, and Hanford. At Hanford, plutonium was separated from uranium by the bismuth–phosphate co-precipitation process, which was dependable and expedient. While the process worked well in recovering plutonium, large quantities of uranium were squandered when the uranium and highly radioactive wastes went into the waste tanks. To correct this, Hanford's engineers worked on the Redox solvent extraction process but information from the Hanford plant, which went into operation in August 1951, was too late for the SRP design.[23]

KAPL and ORNL had developed the alternate solvent extraction process, Purex, that used a less flammable solvent and produced a substantially smaller volume of liquid wastes. Although the Purex process had only been tested in the laboratory, Du Pont chose it for SRP. Accordingly, Du Pont sent a contingent of engineers to ORNL and KAPL to establish research and development programs. The number of Du Pont's ORNL trainees under instruction by Luther Peery and Bob Martens reached into the hundreds in 1951 and 1952. In 1953, 213 Du Pont trainees were sent to ORNL and the next year, only 18 were sent. The decreasing numbers shows the learning curve of the Du Pont engineers. A similar pattern occurred at KAPL with 84 trainees in 1953 and just 7 a year later.[24]

Du Pont wrote a letter of intent to the American Machine and Foundry Company on November 1, 1950, for special equipment design, development and testing services for Savannah River. This firm was responsible for the reactor's complex charging and discharging machines shown here. Discharge Machine, 105-R, 1953. Courtesy of SRS Archives, negative DPESF-1000-15.

The design input from the above resources as well as from private sources and consultants was unquestionably important to SRP's development. In addition to the training program, Argonne operated six programs in support of Savannah River on a $2.7 million budget for FY 1953. Knolls ran two programs for SRP support, one for Purex development at a projected cost of $1.8 million in 1953 and a second for a tritium program at $208,000. ORNL's work on separation studies was forecasted at $400,000 for 1953. While the total cost for these support programs appears substantial, when compared to hundreds of millions of dollars spent by Du Pont just to construct SRP's five reactors, the contributions from outside sources appear less significant. After learning the conceptual designs chosen by the AEC and developed at the national laboratories, "thousands of engineering details, from the concept to the final device, were left to Du Pont."[25]

SUBCONTRACTING DESIGN

After World War II, Du Pont experienced a company-wide expansion and modernization program. The Engineering Department expanded to handle the expansion. In order to meet the construction demands, the department after judicious investigation would use outside engineering firms to supplement their project needs. Du Pont reserved all planning, evaluation, and basic engineering on these projects for their own personnel.

This course of action was selected for the AEC contract, as all involved admitted that no single firm could supply all the different services needed. Du Pont established five criteria for selecting subcontractors: proven record for successful teamwork, the ability to perform unusual engineering tasks on process engineering projects, a large and well-trained staff, prior experience with Du Pont, and home offices in proximity to Du Pont's Wilmington's office. Using these criteria, Du Pont investigated over forty firms prior to the November 28 announcement. The following were selected.

American Machine and Foundry (AM&F)—On November 1, 1950, Du Pont wrote a letter of intent to American Machine and Foundry for special equipment design, development, and testing services for SRP. While their services were used at all areas, AM&F's contribution in fabricating each reactor's charge and discharge machines was notable. The firm described themselves as manufacturers of machines for industry. In 1950 they were considered the world's largest manufacturer of cigarette- and cigar-making equipment. However, they had begun a program in 1948 to capture military contracts for equipment manufacturing. Their acceptance by Du Pont as a subcontractor indicates they were successful.[26]

The Lummus Company—This firm was requested to design and partially procure six "GS" units (towers 116 feet high) including the defense waste and finishing plants for the heavy-water production facilities. Du Pont's letter of intent was dated January 13, 1951. This firm brought strong petroleum, petrochemical, and chemical experience to the project. Self-described as a network of men, minds, and machines that were dedicated to transforming ideas and capital into profit-earning processes and equipment, the Lummus Company was expert in the design of distillation processes. International in scope, the firm was headquartered in New York in 1950. Savannah River's heavy-water production area design benefited from an agreement between the Girdler Corporation, which had designed the Dana Plant, and the Lummus Company. Girdler provided technological information gained from the Dana Plant to the heavy-water plant built at SRP.[27]

Blaw-Knox Company—This firm was responsible for architectural engineering services needed in the design of SRP's separation facilities. Blaw-Knox was issued a letter of intent on November 16, 1950.

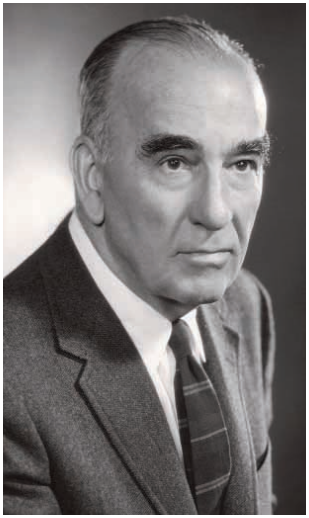
Gibbs & Hill, Inc.—This firm was responsible for design of steam, water, and electrical facilities for process areas and overall plant. The New York-based engineering firm was subsumed by Dravo Corp of Pittsburgh in 1965, then later sold to Hill International, a New Jersey-based firm. Du Pont issued their letter of intent on December 12, 1950.

Voorhees, Walker, Foley & Smith (VWF&S)—This firm, headquartered at 101 Park Ave., NY, was responsible for the design for all "service" buildings and for site layout. This included roads, walks, fences, and parking areas; the manufacturing buildings in the 300 area; laboratories; some design work for 200 areas; and overall site clearance at SRP. VWF&S had a strong track record with the MED. The firm's architects redesigned Columbia University's laboratories for early atomic-energy research in the early 1940s. Strong adherents of the flexible-modular concept for industrial architecture, their 1937 design for Bell Telephone's laboratory at Murray Hill, NJ, was hailed as the country's first modern research structure.[28]

VWF&S was also responsible for Du Pont's Experimental Station in Wilmington where it had worked cooperatively with the chemical firm's organization in designing the modern laboratory complex.[29] For Du Pont's rural headquarters project, VWF&S, under the guidance of senior partner, Perry Coke Smith, designed immense H-shaped buildings that featured a "space unit" design. This design hinged on a unit of space—a floor or a wing—that could be subdivided in whatever manner the client needed. This functional modular approach and their past corporate experience with Du Pont made VWF&S an easy choice for architecture and engineering. VWF&S received a letter of intent from Du Pont for general architectural-engineering services on December 4, 1950.

New York Shipbuilding—This firm was responsible for fabricating SRP's reactor vessels under the NYX Program. This effort produced the top flow distributor chamber of the reactor vessels (the plenum), the reactor vessels, and the primary piping. Organized in

Perry Coke Smith, project manager and senior partner for Voorhees, Walker, Foley & Smith of New York in 1950. The New York based firm, now under the moniker HDL International, was responsible for the design of the site's non-process buildings and its layout. A graduate of Newberry College, SC, Smith went on to study chemical engineering at the University of Wisconsin. After serving in WWI he received his degree in architecture from Columbia University. Smith was so "sold" on Transite™, used uniformly as the chief external wall sheathing material at the site, that he later went on and designed a residence clad in Transite™. Courtesy of HDL International.



Source: Engineering Department, E. I. du Pont de Nemours & Co. *Savannah River Plant Construction History*, Volume I, Report No. DPE (1957).

1899, New York Shipbuilding was located on the banks of the Delaware River in South Camden, New Jersey. The firm brought its experience in the fabrication of heavy industrial equipment and machinery to the task. A company brochure notes that the firm had taken on such projects to stabilize their work load and as "a public service where the facilities of the Yard provided the only available means for constructing unusual items. Its location on tide water, with weight-handling equipment up to 300 tons, makes it possible to load assemblies which may be beyond the size or weight limitations for shipment by rail." These qualities were probably well known to Du Pont who also had a plant in the Camden, New Jersey area.[30] The SRP reactors were transported by barge to the South Carolina site.

Construction Consultants

Academy of Natural Sciences - Performed biological survey of the Savannah River to assess the general health of the river in the plant area and to establish the nature of the aquatic environment.

Amman & Whitney - Responsible for the evaluation of structural design in respect to static loading for reactors.

Dr. George S. Benton - Responsible for meteorological study to determine stack gas dispersion patterns.

Franklin Institute - Performed research on expansion joint fillers and caulking compounds.

General Electric Company - This firm was to provide technical advice in the construction and design of SRP's tritium-extraction facilities.

The Girdler Corporation - Girdler's expertise gained from their construction of the Dana Plant was to be shared with the Lummus Company for their work at SRP's heavy-water facility.

S. Logan Kerr - Mr. Kerr provided his services as a hydraulic turbine engineer. He examined an early proposal for the use of hydraulic turbine drives for the heavy-water pumps in the reactor buildings. He also advised Du Pont on design and test procedures for the river-water supply and distribution system and the reactor cooling-water systems.

Elson T. Killam - This firm provided hydraulic and sanitary engineering for the buildings designed by VWF&S.

Paul F. Kruse - Mr. Kruse aided Gibbs & Hill in their design of a water-distribution system that was protected against water-hammer surge.

Dr. Charles E. Lapple - An Ohio State University professor who had worked with Du Pont at Hanford, Lapple brought his experience with gas filtration to the separations areas, helping to design the sand filter beds.

Dr. George S. Monk - Dr. Monk was a specialist in optics who had studied the effects of radiation on optical materials at Argonne National Laboratory. Monk would help Du Pont select optical viewers for the process areas that could withstand high levels of radiation and the development of non-browning glasses.

Moran, Proctor, Mueser & Rutledge - This firm provided advice on the soil-boring study carried out by the Army Corps of Engineers, helping Du Pont with foundation studies for the process buildings. In addition to other contributions, they also developed the cell-type foundations for the GS towers used by the Lummus Company in the heavy-water area at SRP.

Sheppard T. Powell - Mr. Powell's expertise was needed for design options for the facilities that treated plant effluent and sewage.

Phillip Sporn - Mr. Sporn, president of American Gas & Electric Company, reviewed the overall electrical supply system that was under development for the plant.

U.S. Army Corps of Engineers - The COE completed a soil-boring study to inform Du Pont on the nature and character of the subsurface areas in proposed building areas so they could better design and construct foundations. The COE also gathered considerable hydrological data on flow, water temperature, river stages, and sediment analysis that helped decision-making on the river water supply system.

Eldridge A. Whitehurst - Mr. Whitehurst, Director of the Engineering Station, University of Tennessee, and Director of the Tennessee Highway Research Program, was retained by Du Pont to provide guidance on the sonic method of concrete inspection to detect voids in poured concrete. This method was not successful at SRP, and Du Pont's engineers chose to pour concrete under the most favorable circumstances so that the possibility of voids would be minimal.

Other specialty firms figured prominently in the plant's construction. B. F. Shaw Company was responsible for piping, Miller Dunn for electrical work, the Arma Corporation for reactor machinery, Johns Manville for thermal insulation, the Green Construction Company for excavation and earth moving, the Kolinski Company for concrete mixing and placement, and the Pittsburgh Testing Laboratories for x-ray examination of welds.

Consultants also supplemented the experience of Du Pont's engineers and their subcontractors in areas that ranged from meteorology to engineering studies of static loading. The participation of these individuals and their organizations show the holistic approach adopted by Du Pont and its adherence to good design.

OVERSIGHT—SAVANNAH RIVER OPERATIONS OFFICE

Overall guidance for the plant's construction and later its operation rested with the new AEC operations office established at the plant, the Savannah River Operations Office (SROO). This office consisted of the Office of the Manager, Public Information, and the Assistant General Counsel. There were two adjunct offices, one at Dana and a second at Wilmington. Curtis Nelson was manager through the construction period; Bob Blair, his deputy manager, became Nelson's successor. Their job was to ensure the success of contracted operations and to advise the Director of the Production Division in Washington concerning SROO programs.

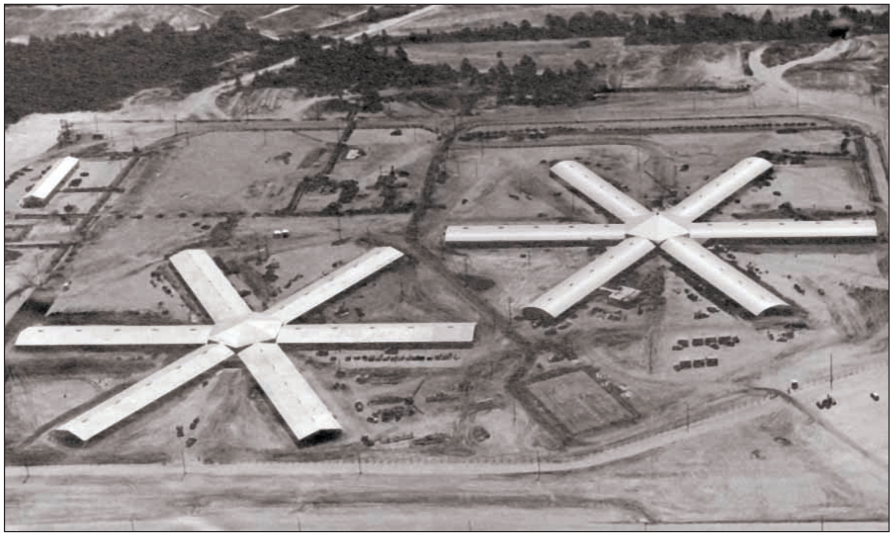
Once construction started, the AEC managers divided their time between recruiting office personnel, monitoring the acquisition program, handling public affairs and the housing problem, and overseeing Du Pont's workforce as they transforming the chosen site into an industrial complex. Six divisions helped the Manager with these goals: Organization & Personnel, Security, Budget and Finance, Administrative, Engineering and Construction, and Technical and Production.[31] The number of AEC personnel would grow from 170 to 352 at the height of construction in 1953. The number of AEC employees decreased to 260 in 1954 and by 1960 leveled out at 228 workers.[32]

ON THE GROUND AND RUNNING

The day after the announcement, basic equipment arrived. Three hundred and fifty typewriters, ordered in September, arrived on December 1; millions of dollars worth of automotive equipment quickly followed. The General Services Administration in Atlanta cooperated in the effort, providing furniture for the first temporary offices. Excess construction equipment at Hanford was identified, slated for reconditioning, and shipped to South Carolina.

Secrecy had required that no offices or warehouses be obtained prior to the announcement. Despite the problems this would make for the construction force, this policy was followed to prevent rumors and land speculation. The staff was located at the Richmond Hotel until temporary space was obtained at Bell Auditorium in Augusta. The Augusta City Council also made space at the "Old Filter Plant" at Augusta's waterworks at 2822 Central Avenue. Both Du Pont and the AEC rented space there on a monthly basis. By

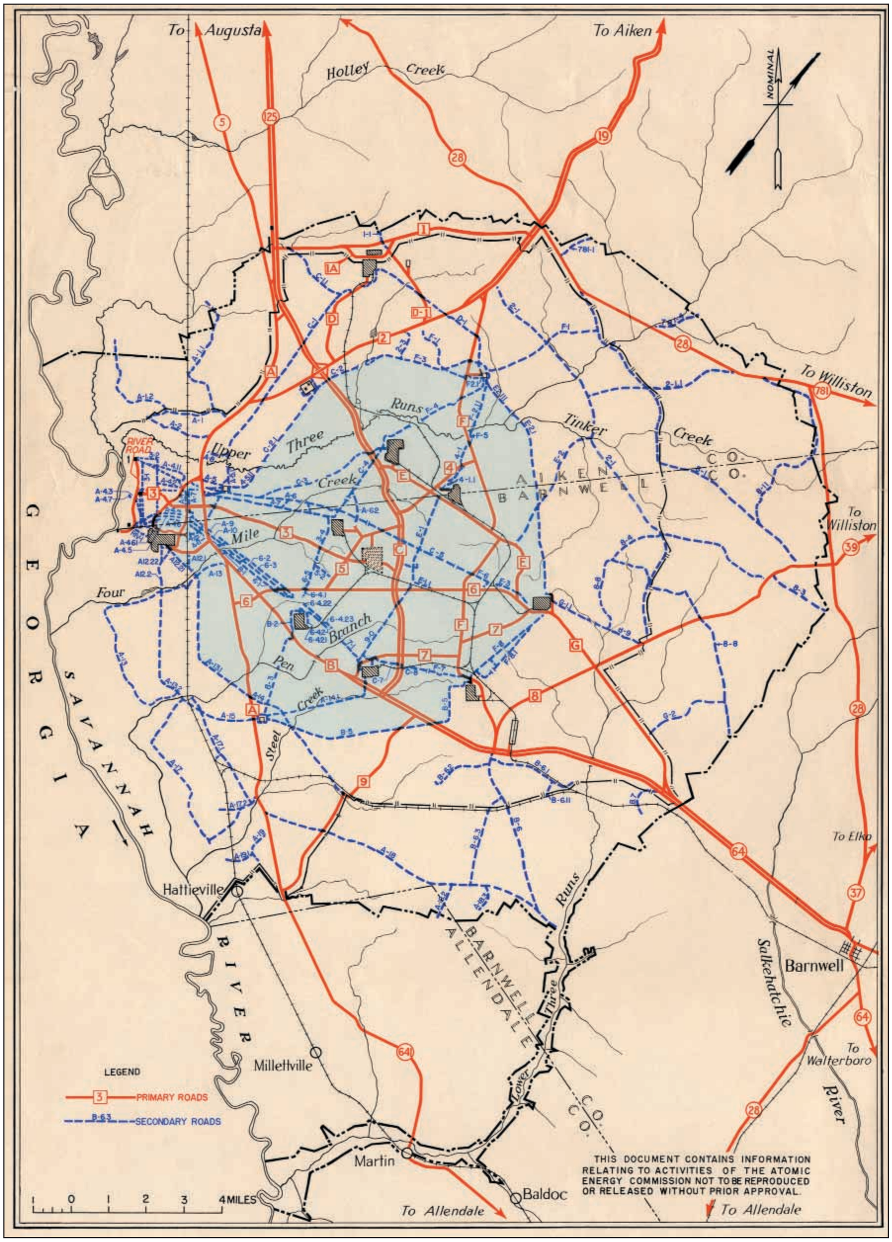
December 19, the employment, medical, investigation, and housing offices were housed at the auditorium. Purchasing, receiving, accounting, transportation, time, and payroll were situated at Daniel Field. An employment office was set up in Aiken's already established federal employment office. The Augusta offices remained open until May 28, 1951, after which the Du Pont construction personnel reported to two temporary construction buildings, designated TC-1 and TC-2, on the site. AEC personnel remained at the waterworks until June 11, after which they reported to Wings D and E of TC-1.[33]



Aerial view of Temporary Construction buildings, TC-1 and TC-2, during construction era. These unique buildings were laid out in "TC" Area now known as B Area. The cart-wheel-shaped steel frame buildings were each constructed of six prefabricated buildings joined to a central rotunda. The TC Area was designed and laid out by an Augusta architectural and engineering firm, Patchen and Zimmerman. Their interesting design, particularly from the air, invited conjecture on their function with many believing that the various wings housed "bomb making" equipment. The buildings were actually used for administrative purposes until the permanent buildings were placed into operation. Courtesy of SRS History Project.

Field supervision occupied buildings rented or purchased from former residents in the plant area. The Bush House temporarily served as the Field Construction Office and a tenant farmer's dwelling was adapted for use as the Field Cost Office. The Grace Fields home, the Cato home, Ellenton's Agricultural Building, the Buckingham property, Cassels Electrical Warehouse, and H. W. Risher Warehouse were also rented for construction field personnel use, as were Dr. Brinkley's warehouse, drugstore (second floor), and six metal buildings. By January 15, the first major construction equipment began to arrive in Ellenton, signaling a new reality to the townspeople there.

With machinery arriving and employment offices opening their doors, the contingent responsible for the overall plant layout were hard at work. A work diary written by Du Pont's A. J. McCullin between November 30, 1950, and August 1954 indicates that general layouts were drawn using three scenarios. The first scenario used the manufacturing boundaries initially published in the newspapers, the second moved the boundaries of the manufacturing area closer to the river, and the third was focused on a "canal scheme." The need for alternatives stemmed from the disagreement between the AEC and Du Pont on appropriate reactor spacing, land necessary for an exclusion area, and the necessity for moving so many towns. By December 19, the Du Pont team in the field got their answer. The manufacturing area was to be moved slightly west, and the towns of Jackson and Snelling were to be excluded. T. J. Conroy reported from Washington that the area between reactors was to be 2.5 miles and that they should be situated in a circular fashion. The distance between any reactor and the property line should be six miles. The area between separations buildings should follow the same interval as reactors but they could be situated within five miles of the property line. The test pile should be located two miles distant from the property line. With these parameters finally specified, Du Pont's Monte Evans, J. B. Tinker, A. J. McCullin, and G. W. Dutcher, along with James Brooks of VWF&S, created a tentative layout.[34]



Savannah River Plant, 1956. This map show the basic layout of the new plant. The manufacturing or process area (blue) was at the center of the plant area surrounded by a six-mile safety envelope. The building areas are shown hatched. Courtesy of the SRS History Project.

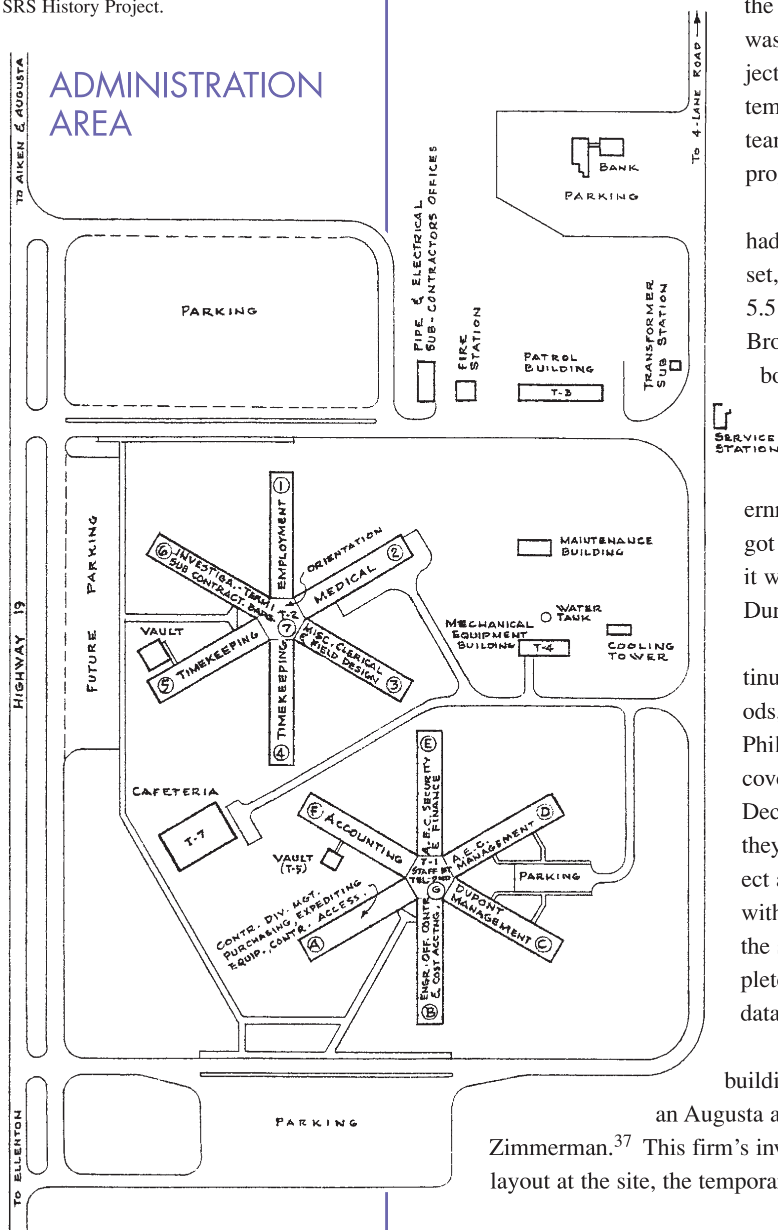
These men had few cartographic sources available to them, and those that were available were out of date. A War Department topographic series from 1921 had no record of the road improvements or growth that had occurred since the 1920s. A 1950 South Carolina State Highway Department map did not provide sufficient topographic data for either the real estate acquisition program or for overall plant maps, but at least had the current roads and communities. Accordingly, the civil engineers responsible for laying out the plant used the highway map for their first attempts and would try to use the earlier topographic series until new information was available. Map 3303, the General Plant Layout, was generated and given to the site surveyors.

The sparse cartographic record changed rapidly as Aero Service, a Philadelphia firm, was brought on board to photograph and map the plant area with two- and five-foot contour intervals, establishing a permanent grid system. The plant area survey was under way in late December 1950. Five Aero Service teams conducted field surveys to establish the reference points needed to anchor their aerial photography. The McCullin diary notes that the COE advised Du Pont that the state of South Carolina was covered by the U.S. Geological Survey Lambert projection system, and asked that the survey's coordinate system be consistent with this known system. The survey team also prepared a separate map set for the COE land program using that system.[35]

Within 7 days of starting to work, Aero reported they had 49 miles of bench levels completed, 128 benchmarks set, 38,000 linear feet of permanent baseline in place, and 5.5 miles of traverse complete. Even State Senator Edgar Brown got into the act, helping the surveyors locate old boundary monuments in Barnwell County. "He was told a geodetic marker buried by the U.S. Corps of Engineers about 100 years or so ago was important to the development of the facility. 'What the government wanted the marker for I never knew for sure but I got hold of the county engineer and we found it.' He said it was found in the old Greendale district above Dunbarton."[36]

The aerial photography began on January 4 and continued through January 10. Using photogrammetric methods, Don McKay, C. Hodell, and others from the Philadelphia firm created a series of topographic maps that covered the project area and produced a relief map. By December 3, less than a year after the start of their work, they had completed the survey and mapped the entire project area. Like the acquisition team, the surveyors worked within priority areas first. As their work came together, the site was like a jigsaw puzzle with some pieces completely finished while others were still incomplete until data came in.

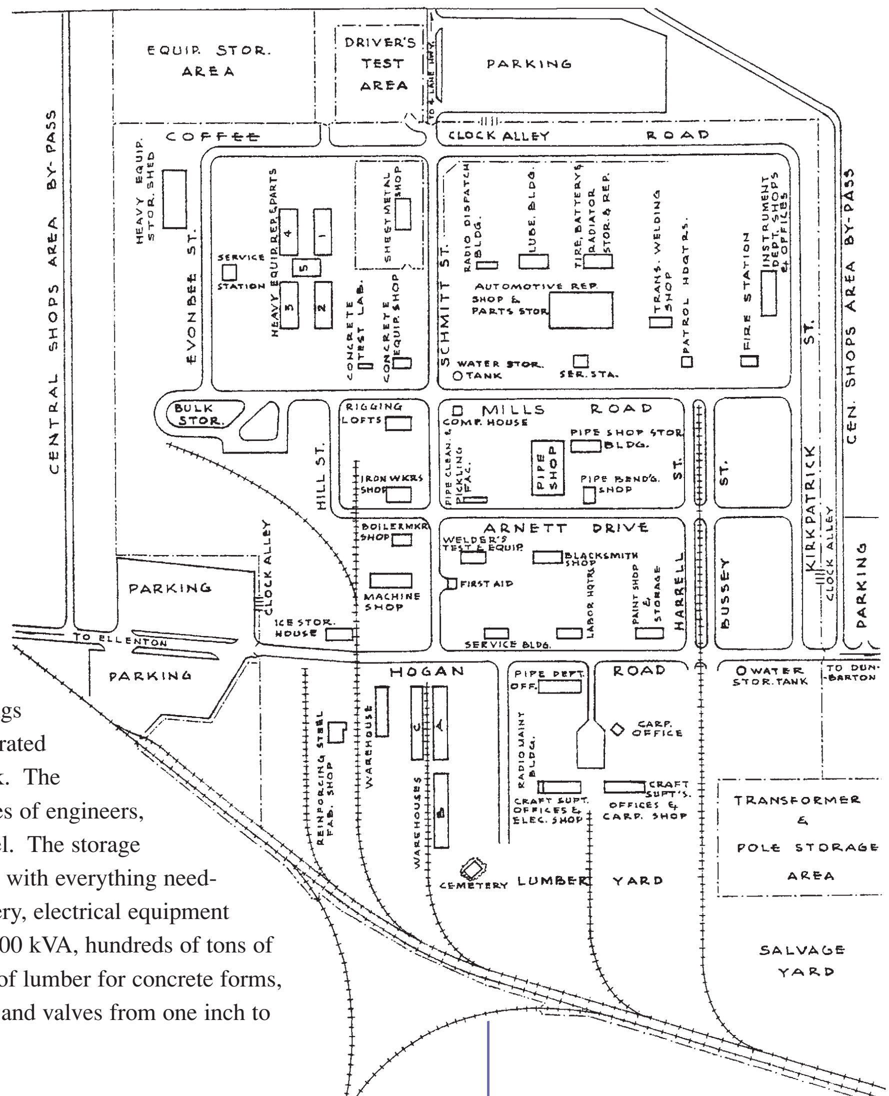
The need for an immediate construction area and buildings while Du Pont was organizing led to the hiring of an Augusta architectural and engineering firm, Patchen and Zimmerman.[37] This firm's inventive design work created the most recognizable area layout at the site, the temporary construction or TC Area, which would later be



The TC buildings were extremely functional, housing each administrative department in a separate wing. The area also included a number of ancillary buildings including a fire station, bank, cafeteria, and patrol building. Source: Pamphlet titled "Savannah River Plant Temporary Construction Area Layout," hand drawn and undated. Courtesy of the SRS History Project.

known as B Area. The TC Area was placed at the juncture of existing highways and in proximity to the new cloverleaf intersection, which was also designed by the Augusta firm. The focus of the new area was two massive cartwheel-shaped steel buildings, each constructed of multiple prefabricated Butler and Braden buildings joined to a central rotunda building. Due to their unusual design and their easy identification from the air, these buildings became symbolic of the site. VWF&S laid out Central Shops on a 100-acre tract strategically located in the heart of the plant area. Every brand of metal, rectangular, gable-roofed prefabricated buildings and structures could be found in Central Shops, where massive buildings housed men of all crafts, warehouses were filled with supplies, and streets arranged in a grid teeming with cars, trucks, and heavy machinery.

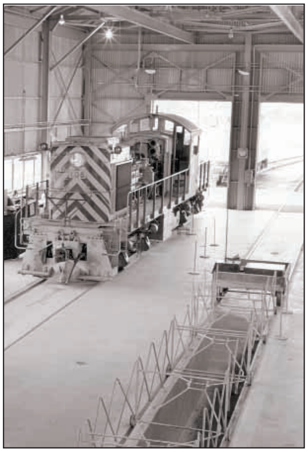
Components of plant equipment were fabricated in several large shops, some enclosing as much as two acres. These buildings were essentially factories and operated 24 hours a day, seven days a week. The buildings also contained the offices of engineers, foremen, and supporting personnel. The storage yards were enormous and stocked with everything needed—thousands of tons of machinery, electrical equipment with transformers as large as 10,000 kVA, hundreds of tons of reinforcing steel, great quantities of lumber for concrete forms, pipe of many materials and sizes, and valves from one inch to several feet.[38]



CENTRAL SHOPS AREA

Central Shops teemed with activity during construction. The multitude of shops needed to construct the plant and warehouses filled with the requisite building materials and tools were encompassed within its grid of named streets. Prefabricated steel frame buildings of every size housed the shops and craftsperson's offices. Lumber, storage, and salvage yards surrounded the building area and the site railroad and its spurs linked the Central Shops' warehouses to the building sites. Source: Pamphlet titled "Savannah River Plant Temporary Construction Area Layout," hand drawn and undated. Courtesy of the SRS History Project.

The plant's infrastructure—roads, railroads, and communication system—was also targeted for immediate change. Access roads to the site were improved with federal funding. A four-lane highway from U.S. 1 outside Augusta to the site, with a feeder route to North Augusta, was completed in six months. Highway 19 was four-laned from Aiken to the new plant site. Highway 64 was widened from Barnwell to the plant, and Perimeter Highway in both Aiken and Barnwell counties, a two-lane thoroughfare, was completed. Inside the plant area, 410 miles of county and state roads were in place before the plant, and most remained unchanged in their course. Temporary roads were built to three areas and other existing roads were widened and surfaced. A by-pass road was created around Ellenton to diffuse some of the early construction traffic and Hogan Road, which led to Central Shops, was widened. The Du Pont construction force maintained all roads within the plant's boundaries. Bridges were an initial concern because only the Sand Bar Ferry Bridge (S.C. 28) and the Fifth Street Bridge (U.S. 1) connected the plant traffic to the Augusta area. Although these bridges were beyond their capacity in 1950, no replacement or additional



(Above) The Locomotive Shop was equipped to accommodate four engines, and all maintenance work. Courtesy of SRS Archives, negative 1785-3. (Right) Aerial view of Railroad Classification Yard. Courtesy of SRS Archives, negative 1746-2.

bridges were added.[39] Talk of a new bridge did occur, but Governor Jimmy Byrnes opposed its construction, calling it an extravagance. This decision helped to keep development on the South Carolina side of the river.[40] When the plant was closed to the public on December 14, 1952, all the road names rich in local history assumed an alphabetical anonymity at the plant boundaries. Only the streets in Central Shops, the milieu of the construction men, would have place names, and in some cases building names, that carried meaning.

First Days on the Job - Julius W. Horvath

After waiting 10 months for the United States Security people to investigate me, I received a letter to report to the Employment Office of the Savannah River Plant in December 1952. The letter came just in time, as we had finished the tool and die work for the Strata-Jet Bomber at the city airport, Macon, Georgia, and the Tumpane Company was going to send me to Atlanta to work with them.

I packed my tools and took off for Aiken. I reported on Monday and was told not to bring my tools on the plant site. I was told to report to 717-A machine shop as a supervisor. I was also told I would be there until the shops in the 773-A Lab would be ready to install the machinery. I would then report to Ray Hale as he would orient me with the different shops and the building. After the introduction with the employment office, I was walking on cloud nine on my way to the 717-A machine shop, where I introduced myself to Floyd Almon. After he talked to me, and pointed out what was expected of me, I came off of the cloud in a hurry. The first thing I was oriented on was "SAFETY COMES FIRST AND ALWAYS, and please see to it the machines are kept clean of chips and absolutely no chips on the floor." When Floyd finished his Safety and Cleanliness lecture I knew right then that Du Pont's motto was Safety First. Now as I look back to all of my days with Du Pont, I will remember that every time a mechanic needed a new job, we would sit together and talk over items of safety pertaining to the job.

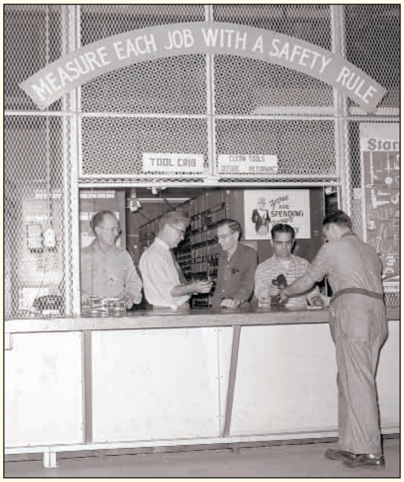
One Monday morning when I arrived at work I was asked to report to Ray Hale at 773-A Laboratory. As I started through the 773-A gate house I was stopped by a security guard who was looking at my badge. He asked who I was going to see and I said Ray Hale. He asked me to wait. While he was making a phone call I was trying to figure out what I had done wrong or was I sure this was the right place. I felt better when the guard came back and said Ray's secretary Eleanor, would meet me at the front door and take me to his office. While we were walk-

Both railroad companies within the area were expanding their services at the time of the announcement. After early briefings, they revised their expansion programs to complement the construction program. The C&WC expanded their track at Ellenton and built a spur to accommodate a concrete batch plant set up in Ellenton. While 6.5 miles of the ACL main line had to be rerouted, this firm rebounded by expanding its services at Dunbarton, transferring 400 hopper cars for use by Du Pont to bring aggregate into the plant area, and supplying 1,000 covered cars for concrete. The William A. Smith

Source (Oral Account): SRS History Project. (Photo Inset) Interior view of window in Stores showing safety signage, circa 1955. Courtesy of SRS Archives, negative DPSPF 2035-1.

Continued ing to the office I asked Eleanor if we were always watched by security people because I was still shaking over my encounter at the gate. I had never worked before under such close security. She said everyone working here inside of the fence has a job to do and I would find after I had been here a day or two that I would have so much to do that I would not have time for anything but my job.

Eleanor explained to me that there would be exotic materials plus classified nuclear materials that the machinists would be machining for Lab samples. She explained that I would go to her with a signed form and she would unlock the cage door for me. With some materials we would record the weight before it was taken to the shop and then after it was returned. The finished product, plus all the chips, would be weighed, for a final weight to be recorded. This was to be standard procedure to the machine shop only.



Ray Hale introduced me to the Technical Instrument Development machine shop and to the shop where we would be machining nuclear materials. There was also a carpenter's shop where special rubber glove boxes would be developed and built. Most of the time we would be working from pencil sketches and prints, so we would need to confer from time to time with the engineer in order to understand what his thoughts were so we could help him with his project, since he would be developing remote control equipment for inside the hot caves. Also during this period we would be supervisors of Technical Maintenance in this building until we could put more supervision in the building.

Ray then showed me the Health Physics office where, after lunch, I would be oriented on the proper clothes and shoes that would be furnished clean each day, and what color coveralls each shop would wear. They would also show me how each mechanic would monitor himself before entering and leaving the shop. On my way over to the cafeteria I turned around and looked back at the building and I said to myself "You surely will have to say a lot of prayer to help you and the men, because you just heard only the beginning and it will not end until you hear the fat lady sing".

After lunch, Health Physics began to explain their daily routine of checking the shops each day with paper smears, and also checking the halls to the change room to make sure we controlled our machining of nuclear materials and what type of film badge were needed for certain types of material and how much radiation each mechanic was allowed per week. I asked them if each morning I could have a list placed on my desk which would include the type and amount of radiation each machinist received the day before and also for each mechanic who did maintenance work in the building. They promised to do this and remarked that we were starting off on the right foot together, and we would be like one big family in that building, and I assured them that we would grow together and win together.

The next day I spent looking over the drawings of each shop, as they were placing equipment and the electricians were wiring them up. In going over the prints for one of the shops, I noticed the machines and a large floor space between them. I began to ask questions about it and found certain procedures would have to be written ahead of time in the hot shop on how to handle and machine certain types of material the shop would be handling and also the proper clothing to be worn in the shop. After the procedure was written it would be checked over by Health Physics and okayed to proceed to machine. It was evident that a schedule would have to be set up a week ahead of time, so that each machinist would be properly oriented in safety procedures before starting a new job.

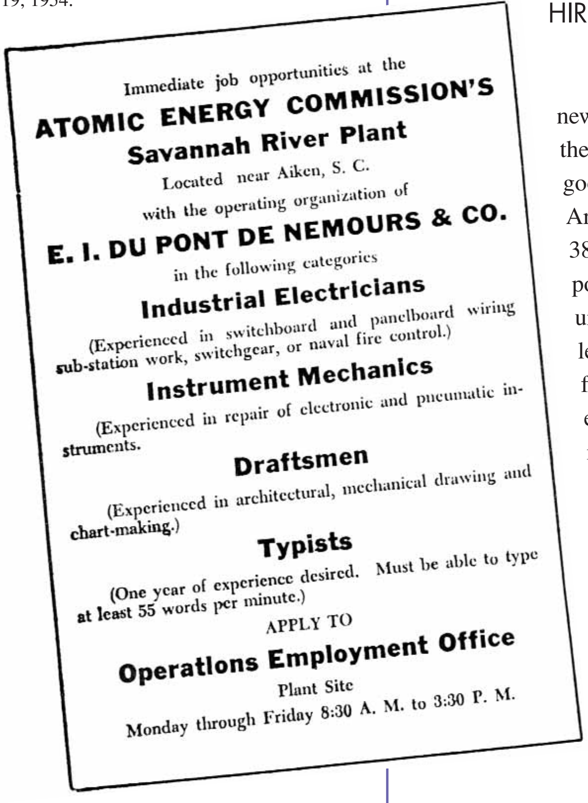
It wasn't too long before the machine shops were ready and mechanics and machinists began to move in from 717-A. Floyd Almon was supervisor of all shops in 773-A. I was assigned the job of Craft Foreman of the Technical Instrument Development Machine Shop and the Carpenters shop, where special glove boxes were developed and built. We worked from pencil sketches and some prints to help Technical develop remote control equipment for inside hot caves during this period. I was also supervisor of Maintenance Equipment in the building. During this time the shop personnel needed extra training in machining, which I personally provided.

Construction Company built sixty miles of railroad track at SRP at a cost of $80,000 per mile, and a classification yard with a 350 car capacity was also constructed.[41]

Another important step toward plant self-sufficiency was the installation of telephone and teletype systems. Cassels Telephone Company did the preliminary hookups for telephones but was supplanted by Southern Bell, who recommended that Du Pont place a cable from Augusta to the site for their permanent phone system. In 1950, Augusta was a terminal point of the New York-Miami coaxial cable. The teletype provided a direct link to Du Pont's Engineering Department in Wilmington and a second to Western Union in Augusta. The plant's telex capability was in place by the end of May 1951.[42]

(Opposite Page) Training the sizable workforce was a challenge. Du Pont's engineers fabricated a mobile training program complete with changeable graphics and loudspeakers so that training could occur in all the building areas and that the whole construction population could be reached. Courtesy of SRS Archives, negatives 1209-1,9,8,10.

(Right) Hundreds of potential workers queued up at the entrance to the plant's Operations Employment Office in TC-2 for job interviews, August 1951. Three supervisors and 120 employees were responsible for the hiring of employees. By August 1952, they would conduct a record 73,000 interviews. Courtesy of SRS Archives, negative M-245-8.



Immediate job opportunities at the

ATOMIC ENERGY COMMISSION'S

Savannah River Plant

Located near Aiken, S. C.

with the operating organization of

E. I. DU PONT DE NEMOURS & CO.

in the following categories

Industrial Electricians

(Experienced in switchboard and panelboard wiring sub-station work, switchgear, or naval fire control.)

Instrument Mechanics

(Experienced in repair of electronic and pneumatic instruments.

Draftsmen

(Experienced in architectural, mechanical drawing and chart-making.)

Typists

(One year of experience desired. Must be able to type at least 55 words per minute.)

APPLY TO

Operations Employment Office

Plant Site

Monday through Friday 8:30 A. M. to 3:30 P. M.

(Below) Active recruitment for employees was carried out through newspapers, college placement programs, and trade journals. Source: *Aiken Standard and Review*, February 19, 1954.

HIRING AND RECRUITING THE WORKFORCE

Early employees came from nearly every state in the nation to work at the new plant. In 1953, "every state in the Union, except Utah, is represented in the list of immediate former addresses of plant personnel. And added in for good measure are Washington, DC, Alaska, Panama, Cuba, Okinawa and Argentina."[43] Peak employment at the Savannah River Project would reach 38,582 during the construction period as laborers, both skilled and unskilled, poured into the Southeast to work on the project. Craftsmen alerted by their unions about job opportunities, engineers recruited out of school and college-placement services, and Du Pont personnel blended into the first workforce. In 1955 when the project was essentially complete, 87,265 employees had been hired and the monthly quit rate, or job turnovers, never reached ten percent of the total force.[44]

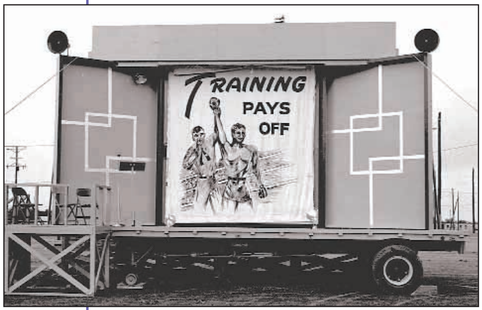
The first hires were non-manual employees: typists, stenographers, clerks, buyers, custodians, and patrolmen. Clerical workers were scarce; Camp Gordon had drained the available labor pool so clerical help had to be recruited.

Even more serious was the lack of engineers. An active recruitment program for engineers was launched in June 1951. Recruiters from the Wilmington office developed applications for professional agencies and engineering societies located throughout the eastern United States, college placement offices, and state employment agencies. Blind ads for positions and advertising in *Engineering News Record* was used to lure young engineers to the plant. A booklet was produced that showed amenities in the Aiken-Augusta area, to introduce the new plant area to the engineer and his or her family. The recruiting office staff grew to 15 as the need for qualified engineers mounted. The recruiters first worked "Region Five," which included South Carolina, Georgia, Florida, Alabama, Mississippi, and Tennessee. The region was later expanded in January 1952 and the expansion paid off. In the month of February 1952, 59 engineers were recruited, and March brought 77 more to the plant. The recruitment effort was most successful in June 1952 when 149 engineers were hired.

In February there were 260 AEC and Du Pont personnel assigned to Savannah River. Hiring began for manual laborers once the Department of Labor formulated wage determinations on February 9, 1951. The range of hourly pay went from a high of $2.60 for plumbers and steamfitters to the lowest rates of $0.90 or $1 for laborers and truck drivers. Approximately a thousand workers were added to the rolls each month through September, when there was a slowdown in hiring because construction got ahead of design. By November 1951, nearly three-fourths of Du Pont's total construction force were manual workers (11,441) and gang foremen (1,198). The trades represented were carpenters and laborers (over 3,000 each); ironworkers, teamsters, and operating engineers (over 1,000 of each); plumbers and steamfitters and electricians (over 600 each); and bricklayers and cement finishers, boilermakers, sheet-metal workers, and painters (over 100 each). The hiring of asbestos workers had just begun. Two-thirds of the needed force for laborers, teamsters, and operating engineers had already been hired. Also onsite were individuals (about 1,000) within specialty crafts working under specific contracts.[45] Employees of B. F. Shaw Co. (piping), Miller Electric Co and Dunn Electric Company (electricians), Johns-Manville Sales Corporation (insulators), Interstate Paint Company (painters), Combustion Engineering Superheater (boilermakers), and Pittsburgh Testing Laboratory (inspectors and testers) fell into this category.

Augusta's Municipal Auditorium housed the first employment office until it was moved to TC-2. Three supervisors and 120 employees comprised the Employment Group in charge of hiring in 1951. In general, a potential employee had to be between 18 and 64 years of age. There was a pre-interview, interview, and physical examination to pass before a new employee could sign up. A prospective employee could be turned back for medical reasons, lack of qualifications, or because they did not pass the security requirements. By, August 31, 1952, the employment office had conducted a record 73,000 interviews.[46]

If hired, an individual was assigned a payroll number, photographed for a badge, and fingerprinted. Further forms were required for a necessary security clearance. All workers received a mandatory half-day orientation on safety and security. For some that was just the beginning of the training program. An extensive supervisory training program was in effect, on-the-job training was available to office personnel, and a short-term skill improvement training program was instituted for 107 apprentices in the electrician and ironworkers crafts.[47]



Manual construction labor was recruited through the American Federation of Labor building-trades unions, with two exceptions. Displaced residents of the project area were given priority in hiring and between 20 and 30 previous residents were

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hired.[48] Du Pont also ordered a specific number of workers to be hired "at the gate." Despite this official policy, hiring at the gate rarely happened. Typically, the unions would fill labor "requisitions" prepared in advance by Du Pont; therefore, the company ended up hiring only union-referred workers. Even with this advance notice, the unions were also forced to recruit as the local availability of various craftsmen and their experience level varied tremendously.[49]

"Lunch Box" cafeteria in 300/700 Area, 1951. Air conditioning was limited. Only the administration buildings and the bank were cooled. First-aid stations, drafting rooms, and "lunch boxes" were cooled with room air conditioners. Courtesy of SRS Archives, negative M-280.

WORKING LIFE

Workers traveled to the plant by car pool or by bus at first to start an 8-hour work day, 5 days a week. Highway 19 brought workers in from Aiken while Highway 28 brought workers in from Jackson, Beech Island, and Augusta. As work progressed, shifts were added and workweeks extended to keep the project on schedule. On May 14, 1951, two shifts were added so that work proceeded around the clock. The workweek was extended to 45 hours of five 9-hour days in August. Between March 25, 1952 and September 27, 1953, a 54-hour workweek was observed, consisting of six 9-hour days, Monday through Saturday. Peak employment was reached in September during the 54 hour work week. By March 1954, the 40-hour workweek was reinstated.[50]

Thirty-seven pre-existing buildings were adapted for use, including a school building in Dunbarton that was converted into a weather station.[51] Historic views show the juxtaposition of uses, such as a photograph of hordes of workers in hard hats in front of the

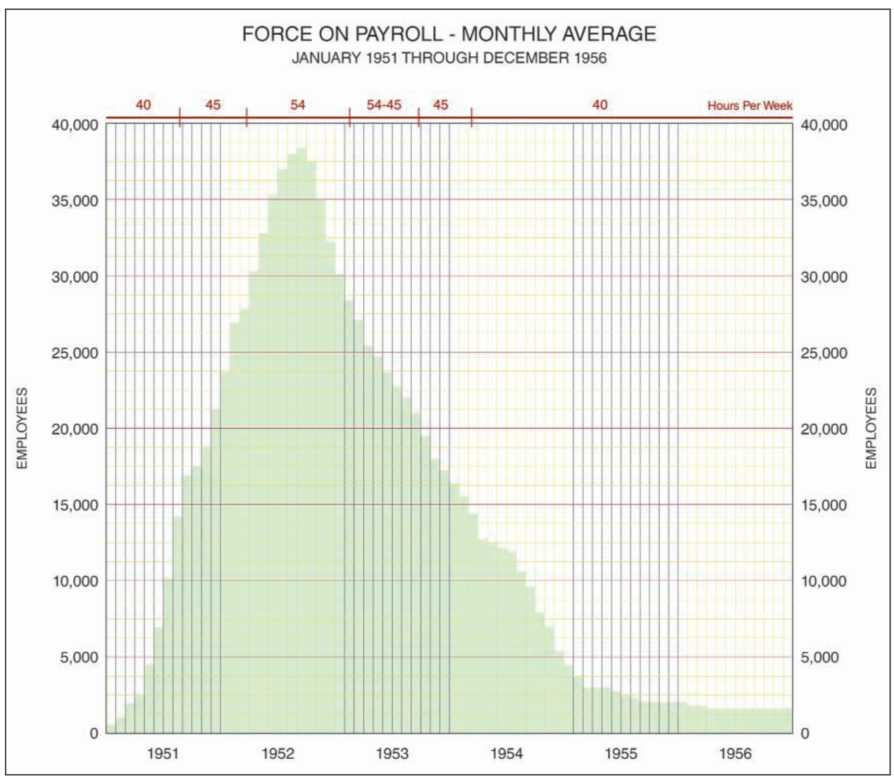

Chart showing the construction era workforce which reached its height in September 1952 when 38,582 men and women labored at the facility. Source: Engineering Department, E. I. du Pont de Nemours & Co. *Savannah River Plant Construction History*, Volume I, Report No. DPE (1957).

(Opposite Page) Interior view of Cassels' Long Store in Ellenton. Courtesy of SRS Archives, negative DPESF-6702. Source (quote): SRS History Project.

columns of the stately Buckingham House. In contrast, the new architecture of the construction era was temporary, simply designed, and expedient. Metal prefabricated buildings of every conceivable size and configuration and simple wood-frame sheds and shops with celo-siding walls and metal roofs contained shops and work stations, and stored building materials and supplies. Air conditioning was scarce. Only TC 1, TC 2, and the bank were completely cooled. First-aid stations, drafting rooms, and "lunch boxes" were cooled with room air conditioners. Otherwise fans did the job. Safety signs, slogans, and security reminders abounded, and area signs showed work accomplishments.

Twenty-five long wood-frame clock alleys through which each worker passed were used to keep hours at construction areas. A cafeteria was constructed at the TC administration area, and stationary and mobile field canteens served the roving construction forces. Between 1951 and 1953, Nilon Brothers Catering of Chester, Pennsylvania, operated the plant's food service. The concession firm kept records of their sales during the peak of employment, citing sales in the millions for sandwiches, cartons of milk, cigarettes, and candy bars.[52] Forty-three field canteens were in business at the peak of construction.

In addition to each individual's work place, there were community facilities on the plant to promote morale and to provide some conveniences for the workforce. The South Carolina National Bank of Columbia provided onsite banking for the construction forces in a temporary building in the TC Area and a check-cashing annex was added to it. A temporary check-cashing facility was also made available in the Dunbarton area. Three recreation areas were built out where team play of all types and craft or "area" picnics could be held to foster plant community. Pecan Grove Park was located near the intersection of Road C and Road 1, Pine Grove Park was located on Road 1, and Oak Grove Park was situated on Road B. Each park had playgrounds, two softball diamonds, two baseball diamonds, ovens and barbecue pits, volleyball courts, and horseshoe courts.[53] Two parks were closed after construction, and the third was later turned over to Operations.

Safety and security played a large role in the life of every construction worker. From their hiring, a positive and proactive mindset on safety was inculcated in each employee. The initial safety briefing was followed with regular seminars and talks that stressed work safety. Large area safety meetings were held at intervals with Du Pont's safety superintendent and other Wilmington staff, and a competitive program for safety suggestions and slogans in which winners received cash awards was launched. This suggestion plan "encouraged each employee to think constructively about his work, and to seek new, safer, or better methods, materials, and tools." An idea program was also sponsored under the suggestion program in 1953 that allowed employees a two-week window of opportunity to submit ideas on a cost-savings drive. A total of 27,747 ideas were submitted, financial awards totaled $78,125 when the suggestions were acted upon, and their ideas saved the project $2,430,000.[54] The suggestion program fostered the involvement of all employees in the plant and how it was run.

The Original Cafeteria

"When we first started to work on the Plant site back in December 1950 and January 1951, there was no formal eating places operated by the company as yet. Mike Cassels ran a general store in Ellenton. Every day a lot of the workers went there to buy lunch. Mike seat up a long counter for them to wait on themselves. He put loaves of bread, cold cuts, cakes and soft drinks (pop) out for them to wait on themselves. They would make their sandwiches. Mike sat at the end of the counter and charged them according to their 'fixens.'"

- W. A. Monihon

The need for industrial safety was immense, and Du Pont brought a well-developed "safety culture" to the plant. The construction forces would win a world safety award for the construction industry for 4,862,763 safe exposure hours in January of 1952.[55] A second world's safety record was set in April, and a third, of 10,018,160 hours, in July.[56] These awards and subsequent recognitions were well-publicized in the site newspaper and local newspapers to reinforce Du Pont's safety ethic among the older employees and to set expectations for the new person at the plant.

(Right) Billboard sign located at the plant announcing that the employees had set a third world record for safety, 1952. Courtesy of SRS Archives.

Operations Recreation Association

A front-page banner headline in the *SRP News and Views* for July 3, 1952, notified employees that recreation areas were to be established, on site property just outside the perimeter fence. They would provide areas for "baseball, softball, volley ball and horse shoe pitching," as well as children's playgrounds and picnic facilities. The Operations Recreation Association (ORA) was established in early 1953. Relying on proceeds from soft drink machine sales and nominal membership fees ($1.50), the ORA managed what would become "one of the largest recreational programs for any one plant in the world." The first outing was held at Lake Olmstead and it featured sack races, broom balancing and a tug of war. Some of the participants wore a coat and tie. Later activities included not only athletics but also picnics, dances, and a variety of other entertainment events like a boxing exhibition presented by world champion Beau Jack or top name big bands such as Tex Beneke and Blue Barron.

Sultan of Magic cast at SRP's Musical Varieties, sponsored by the Employee Recreation Associations and held at Augusta's Bell Auditorium on three consecutive nights in March 1953. Source: *Highlights SRS Musical Varieties of 1953* (booklet). Courtesy of the Mason Family.

There were initially two recreation associations. Set up in August 1952, the Colored Recreation Association provided entertainment for African-American construction employees. When the association was discontinued at the end of 1954, it was noted to have been the largest and most active recreation group at the plant, with a peak membership of 3,358. After 1955, instead of a separate organizations, separate events were organized by the ORA, which had both black and white members. This pattern was influenced by local custom. Many of the hotels, restaurants, lounges, and other venues of recreation activities in the SRP area remained segregated into the 1960s, which would have effectively segregated offsite recreation activities.

From its inception to 1979, Tony Orsini was Executive Director of the association which expanded its programs into golfing, tennis, interplant sports competitions, and inter-area teams over the years in response to its membership's interests. R.S. (Joe) Lewis and Don Strosnider, later Executive Directors, helped in this expansion. Presidents Alf Kargaard, Lamar Cato, Vic Johnson, Sally Patterson, Charlie Goforth, F. L. (Speedy) Lee, Andre Holley Gray, Roger Duke, and Jim Crow played a role in building a strong foundation for the association, which won the Eastwood Award as the best recreation association in the country in 1982.

Throughout the Site's history, the ORA has been a community builder. From children's events to Atlanta Braves tickets, it has provided members of the Site community, current and retired, avenues for recreation and fellowship at events throughout the CSRA and the region.

Source: *SRP News and Views*, "3 Recreation Parks Near Completion Big Athletic Program is Shaping Up," Volume 1, No. 11, July 18, 1952.

Security at SRP had many meanings. Entry into the site and information leaving the site had been an issue of control, as required by the Atomic Energy Act and the McCarran Internal Security Act, from the earliest days of design. Stringent security measures were in place during construction and were firmly established by the time operations began. In

SRP News and Views

"I was working in Orangeburg as managing editor of the *Times and Democrat*. And a guy from Du Pont came over to talk to the Rotary Club about the huge new construction project underway not too far from Orangeburg. I interviewed him. And as I tell people, whenever I interviewed anybody I always asked them for a job in those days, because I was working about a fourteen hour day on a daily newspaper. Anyway, as a result of that interview, Howard Miller with Du Pont sent me an application and I filled it in, and about a year later I was called over for an interview. I was hired to start a newspaper for the construction force which got up to about 30,000 people at that time, and so I started up a biweekly tabloid for the construction. It got up to 38,000 and was one of biggest circulation of any paper in the state I guess. And I did that for about two or three years and then I transferred over to Operations. I was editor of the paper for twenty years or so."

Source: Oral History Interview, Don Law, 1999, SRS History Project.

As soon as construction was underway, the plant's first newspaper went into print, and was published on alternate Fridays throughout initial construction. Named the *SRP News and Views*, the construction-era paper was produced to foster plant identity and community. Politics, controversy, private advertising, embarrassing news to individuals, and sensitive issues were to be avoided according to Du Pont policy. When the first issue came out, the masthead featured a large question mark rather than a title. The selection of the new paper's title was used as a way to involve site employees in aspects of site operation that went beyond their work. John Campbell, an electrician with electrical subcontractor Miller-Dunn Electric Company, won a fifty-dollar savings bond for suggesting the name in an employee contest.

Articles included items of interest to locals and new arrivals, from birth and marriage notices to information about places to live. Beauty queens, especially those who worked at the plant, were photographed and interviewed. The recreation association's events were covered in words and in photographs that generously showed their games, dances, and talks. Historical pieces on the surrounding communities and on the pre-federal history of the plant were written. If a Savannah River Plant family was in need, a brief article was written highlighting their situation and informing all where funds could be sent.

Safety was a theme that recurred in nearly every issue. Traffic accidents both onsite and off were noted, and the "Traffic Score" ran in a small box on the front page of most issues, giving the number of accidents, warrants, and arrests broken out by the areas in which drivers worked. Community involvement was also encouraged through the promotion of the Community Chest program. Award winners for the Suggestion program or "Plumbob" award winners were prominently featured. Of a more general nature, events significant to the nation (especially those related to atomic energy) and to Du Pont were covered. Many issues had a "Meet the Management" article, where one of Du Pont's construction managers was introduced. Items of a more specific interest included stories about former site residents, sports scores, and human interest columns like Mim Woodring's "One Gal's Opinion" or "Fin, Feather, and Fur" written by Tom Latsch.

one history of their efforts, Du Pont described the Savannah River Plant as "one of the key efforts in America's post-war defense program, and probably as the most significant single production enterprise ever planned by a government or private industry…. [For these reasons] design, procurement and construction were by their very nature, secret undertakings, demanding strict security measures."[57] Security issues were pressed not only with Du Pont employees but with all subcontractors. In the beginning this required "constant vigilance to prevent the disclosure of any significant phase of the project to unauthorized persons. The importance of effective security tempered the actions of everyone working on the

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project, limited [the] exchange of information and opinion, and caused some delays. The practice of security became ingrained, however, and as the work progressed, its effect on work schedules was gradually reduced to a minimum."[58]

Security checkpoints controlled traffic at the plant's perimeters. Courtesy of SRS Archives, negative M-2802-2.

Security measures included controlling entry to the installation; issuing clearances to employees, with the type of clearance approved shown on an identification badge; designating restricted-access areas; document classification, control, and tracking; and inculcating personal responsibility for safeguarding sensitive information.[59] Personnel movement onto and throughout the plant was based on a badge system. Each employee was issued a badge after their clearance was approved, which was worn in plain view and displayed the employee's photo, identification details, and level of clearance (either L level or Q level). Visitors were issued temporary passes.

Most if not all employees had to pass through a liminal stage between initial hiring and their admission to the area where their fellow employees were working. This period was used for training in exclusion or limited areas. During this general employee training period, the security check would be conducted. Potential employees who were not cleared were let go after training, the remainder were badged and assigned to an area.

Forgetting a badge caused work delays and was perceived as reflecting a lax attitude toward security. Du Pont worked to make the concept of security a constant companion of employees. Plastic stickers were passed out to personnel asking them "Got Your Badge?"[60] These were placed on walls, beside light switches, on hard hats, and at other places around employees' homes. Patrolman Joe Roberts said that he and all the other persons in his car pool placed their stickers on the dashboards of their cars; file clerk Marjorie Welcher placed one on the car dashboard and another on the mirror of her dresser. D Area project engineer Carlo Frasco also placed his in his car, but on the windshield.[61] Although the first three times employees forgot a badge they were issued temporary entrance passes, they would have to return to get the badge on the fourth offense.[62]

Security reminders were posted throughout the site, even on cafeteria napkins and matchbooks. Source: SRS History Project.

LABOR RELATIONS AND INVESTIGATIONS

Prior to the project, union organization in the Augusta-Aiken area was limited to a small group of building trades in Augusta that were affiliated with the American

Federation of Labor. Carpenters, bricklayers, plumbers, electricians, and painters were represented in this highly organized group. Other unions that supplied workers to the project were chartered nearby, principally in Savannah and Charleston. There was no organized labor outside of these organizations in the project area, although a local organization, the Building and Construction Trades Council, had voluntary membership.

> New union organizational arrangements were made beginning immediately after announcement of the project in November 1950. The AFL operating engineers, teamsters and laborers each set up offices in Aiken. The teamsters chartered a new local, and the operating engineers established a fourth branch office of the local chartered originally in Charleston for the state of South Carolina. The laborers locals in Savannah, Charleston, and Spartanburg were pooled to form a new temporary unit, the Construction and General Laborers Council, with each local maintaining its identity. The boilermakers and sheet metal workers handled union affairs through the Savannah and Charleston locals, respectively. The ironworkers' general executive board set up an Augusta office under an international representative.[63]

Short-duration work stoppages occurred during construction—four in 1951, twelve in 1952, and nine in 1953. A list of reasons compiled by Du Pont shows dissatisfaction with supervisors, grievances over working conditions, the discharge of a fellow union member, and strikes in sympathy with other union groups as the main causes of the work stoppages. No stoppages occurred after 1953.[64]

Government intervention in the plant's construction was also a factor, creating "work stoppages" for the AEC and Du Pont managers who had to answer a miscellany of charges from overlapping investigations of conduct during the plant's construction. The first investigation occurred as a result of Congressman W. M. Wheeler (D-GA.) and his assistant's unofficial visit to the plant on August 28, 1951. "Wheeler, on a recent trip to the plant area, donned overalls, brogans, and khaki shirt so as not to be recognized and spent a day going over the project."[65] The Georgia congressman, in a UPI interview, said that he would ask for a full-scale investigation of "loafing on the job, wasted manpower, feather-bedding and labor union racketeering" at the Savannah River Plant. Wheeler's charges began a series of investigations. Du Pont, the AEC, and the Joint Committee on Atomic Energy issued statements welcoming competent investigations and extending cooperation. "The plant site was crawling with investigators. They came from the House Appropriations Committee, the Senate Appropriations Committee, the Senate Banking and Currency Committee, the Joint Congressional Committee on Defense Production, the Joint Committee on Atomic Energy, and the House Committee on Labor and Education. There was no doubt that Washington

During the construction era, the Savannah River Project was visited by a number of federal investigators. On February 21, 1952, U.S. Senate members came to inspect the plant, its progress, housing and finance issues. State representatives joined them. Left to right: U.S. Senator Wallace F. Bennett, Utah; S.C. Senator Edgar A. Brown; U.S. Senator Homer E. Capehart, Indiana; U.S. Senator J. Allen Frear, Jr., Delaware; U.S. Senator Burnet Maybank, South Carolina and Chairman of the Banking and Currency Committee; and Winchester Smith of Barnwell. Edgar A. Brown Collection, Mss 100. Courtesy of the Special Collections, Clemson University Libraries, Clemson, South Carolina.

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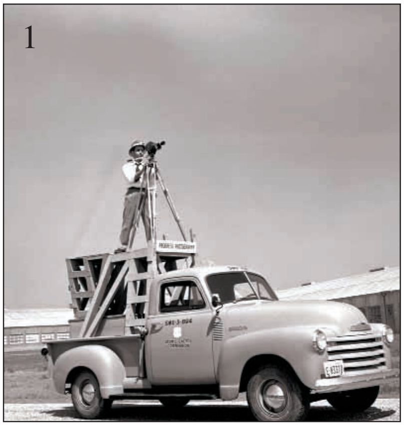
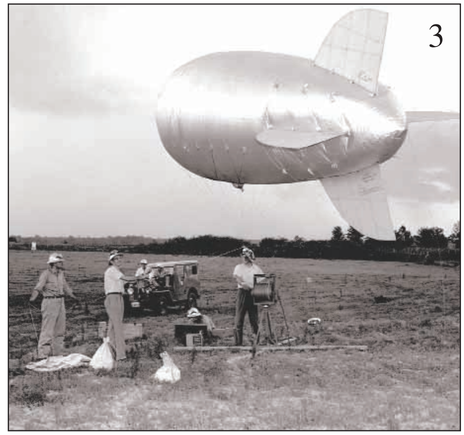
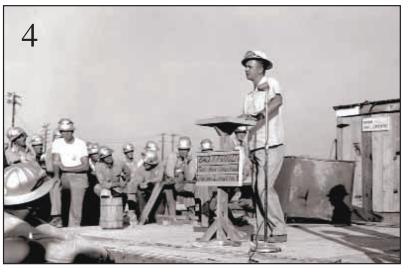
1. Negative M-849-5. 2. Negative M-578-2. 3. Negative M-157-8. 4. Negative M-1257. 5. Negative M-1193. 6. Negative M-477. 7. Negative DPESF 733-1. 8. Negative DPESF 1-663. 9. Negative DPESF 5285-3. 10. Negative M-902-1. 11. Negative M-542. 12. Negative 3434. 13. Negative M-3411.

An Era Captured on Film







1. Photographer documenting construction progress, May 1, 1952. 2. Safety Meeting, D Area, February 28,1952. 3. Onsite weather forecasting, June 21, 1951. 4. Tool Box Meeting at 681-G, speaker Joe Hutto, August 17, 1952. 5. Nilon Cafeteria workers in training. 6. Rigger at work. 7. Check cashing at Dunbarton, April 11, 1952. 8. Building K-Area powerhouse, December 16, 1952.

Traffic Score

Area	Ac.	Wa.	Ar.	To.
5-6-8-900	0	0	0	0
100-C	0	1	0	1
300-700	0	1	0	1
400-D	0	0	1	1
200-H	2	0	0	2
100-L	0	1	2	3
Adm.	0	1	2	3
100-P	0	2	2	4
200-F	1	3	2	6
100-R	1	0	7	8
Central Shops	2	3	4	9
100-K	1	3	8	12

(Ac. — Accidents; Wa. — Warnings; Ar.—Arrests; To.—Total — The traffic incidents are listed according to the area in which the drivers work.)

9. New Badge. 10. P-Area master welders and brothers E. H. Davis (center), and Eugene Davis Jr. (right) were SRP's only movie stars, having performed in the film, *The Wizard of Oz*. Fire Inspector R. J. Dorsey, Jr to the left, June, 1952. 11. The family contribution of the Adams-Smith clan- five Adams brothers, and their brother-in-law, made news in February, 1952. Left to right, Grady Adams, heavy equipment; Alvin Adams, electrical helper; Raymond Adams, electrical foreman; Jack Adams, electrical clerk; Joseph L. Smith, electrical foreman; and Clyde Adams, boilermaker. 12. Interviewing for a summer job, June 4, 1956. 13. Colored Recreation Association Officers, April, 1954. First row from left, M. E. Cummings, 100-K Labor, treasurer; Hoover Utley, Central Shops Transportation, vice-president; J. A. Washington, Central Shops Labor, president; and A.C. Wright, 200-H Labor, secretary. Standing, Directors George Gray, Administration Labor; J. A. Gadson, Central Shops Transportation; Walter Singleton, 100-K Labor; Nathaniel Johnson, 200-H Labor; J. F. Washington, 100-C Labor; and J.Q. Miller, 200-F Labor. Newspaper clippings from *SRS News and Views*.

was interested in the political gold in the Savannah River Project."[66] Ray Shockley, State News Editor for *The Augusta Chronicle,* was invited to the site to report Du Pont's side of the story. Shockley's article was the first rebuttal to the Wheeler charges, noting that without a visitor's badge one really couldn't get a sense of the project. Congressman Wheeler, due to his disguise and his explanation of his purpose, did not have entry to "where the real work was going on."[67] The Shockley article helped with Du Pont's damage control.

Senator Burnet R. Maybank of South Carolina, the Chairman of the Senate subcommittee in charge of appropriations for the AEC, took responsibility for the developing inquiry. Reports were filed that dispelled Wheeler's allegations concerning the engineering and construction work. However, Du Pont's hiring practices still drew fire from the Special Subcommittee of the House of Representatives, who held five days of hearings in Augusta in November 1951. Referred to as the Barden Committee after its chairman Rep. Graham A. Barden (D-NC), the committee heard testimony from AEC SROO Manager Curtis Nelson, Du Pont's Bob Mason, officials from the state employment offices, and representatives of the labor unions.

Nelson stated that due to the urgency of the project the AEC "could not run the risk involved in deviating from the normal practices which prevail in the construction industry."[68] The committee's report was not favorable. It characterized the hiring practices for manual labor at SRP as preferential towards union labor, as no hiring at the gate actually occurred and testimony indicated that qualified non-union labor was turned away. In their opinion, Du Pont was running a "closed shop." They understood the vital need and urgent schedule for the project that led to this situation, but recommended that the AEC and Du Pont correct the situation.[69] Du Pont took the Wheeler charges very seriously, mounting a campaign from Wilmington that refuted the claims made after Wheeler's "over the fence" inspection.

Perhaps the most important of the investigations was focused on racial discrimination. The Savannah River Project attracted and held the attention of the NAACP and the National Urban League's Southern Field Division from December 1950 onward. The federal project was a window of opportunity for change for African Americans in the South and particularly in South Carolina. Clarence Mitchell, the Director of the Washington Office of the NAACP, wrote, "It is very important that the Federal Government make certain that the racial patterns of the State of South Carolina will not be imposed in the territory which is used for the production of the H Bomb."[70]

Mitchell, in a letter to Carlton Shugg of the AEC dated December 1, 1950, asked specifically about employment policies and housing at the new plant. Before responding, the AEC conducted a survey of "conditions and practices" in the plant area. Before this was carried out, Mitchell visited the AEC's office in Washington to raise questions concerning segregation in housing, transportation, restaurants, and other eating facilities. He firmly let all AEC members present know that such matters were the domain of the AEC, not Du Pont. Mitchell also advised the Washington office that he had set up an appointment with Arthur Tackman, the AEC personnel officer at SRP, to speak with AEC and Du Pont officials in Augusta in January. He set an agenda that covered fair compensation for land owned by African Americans in the project area, as well as discussion of fair hiring of skilled labor.

Sumner Pike, then Acting Chairman of the Commission, wrote to Mitchell stating that a visit by both AEC and Du Pont men had been made in the plant area to collect information that was now under consideration. He further stated that no community buildings were planned, and that the Commission's contractor was responsible for the employment of both the construction and operating staff for the new plant.

Between January 3 and 5, 1951, AEC officials from Washington and Savannah River visited the area's federal reservations, Camp Gordon, Clarks Hill Dam, the Augusta Arsenal, and Fort Jackson. Their survey showed that the Defense Department's policy of complete integration was upheld at Camp Gordon and Fort Jackson. Even the civilian organizations on the posts conformed to this policy. While skilled and unskilled laborers made up the majority of the workforce, African Americans were certified for civil service positions at both installations. On Fort Jackson, all transportation was integrated; however, the bus system that serviced the post was segregated in accordance with South Carolina law and custom.

Camp Gordon, served by a privately-owned bus company, had integrated transportation on and off the post. Augusta Arsenal was in the throes of desegregation, but no problems were found there with this change. Clarks Hill had only a few African Americans on the payroll and the facilities were segregated. The survey notes finished with a list of South Carolina's African American construction workers that were taken from the South Carolina State Employment Service on January 1, 1951. There were 788 skilled workers, the majority of whom were bricklayers, carpenters, cement finishers, and painters. Semi-skilled laborers included 1,444 individuals and unskilled laborers were in the majority with 4,177 individuals.

By March 23, R. W. Cook from the AEC's Production Division Headquarters sent recommendations to Curtis Nelson on fair employment in response to Nelson's queries from the field office. Nelson was advised that federal law did not tolerate discrimination in hiring construction or operations staff and that a policy of "eventual" employment of African Americans for office staff was not following the law. Cook also recommended that no signs denoting a segregationist policy appear at the plant, and that transportation in the area should be integrated.[71] South Carolina state labor laws were at odds with these recommendations. Under labor laws structuring the textile manufacturing business, segregation was mandated. Du Pont seems to have straddled the issue at least initially. There were separate toilet facilities identified in the TC Area, but there does not appear to have been signage.[72]

The Wheeler charges in August on hiring spiraled into charges of segregation and racial discrimination in hiring and promotion. When the members of the Joint Congressional Committee came to the plant in September, hiring practices for African Americans were a topic of discussion. It was essentially the same argument but with a racial twist—that by working solely with the AFL, the site did not consider African American union member and others for employment.

During his presidency, Truman had formed an eleven-member presidential Contracts Compliance Committee charged with watching for racial or religious discrimination under federal contracts. When the charges against the Savannah River Plant were made, Vice President Richard Nixon had become chair of that committee. When the committee met on September 15, 1953, the NAACP filed a protest against the AEC for discrimination in hiring. Savannah River management sent an immediate return volley that denied the charges. Curtis Nelson once again was called in front of an investigating committee. Having adopted the earlier recommendations from headquarters, he stated that the AEC had a firm policy against discrimination and that over 5,000 African Americans were already employed at the project. This information quelled the immediate discussion but debate would continue through late 1953.

The plant was built during a time of great social change and its presence, along with other federal projects and military installations, contributed to that change. It is ironic that Du Pont, in addition to the discrimination charges discussed above, was also the subject of discrimination charges made by the Grand Dragon of the Associated Carolina Dragons of the Knights of the Ku Klux Klan for its hiring practices.[73] Change may have not been immediately discernible or fast enough, but there is no doubt that the plant was a prime mover in changing race relations in the region.

SAVANNAH RIVER PLANT GEOGRAPHY

In the geography of the plant, "areas" are the important organizing concept. Buildings or facilities are located within areas. Each building area was given a number and a unique letter designation. Function is reflected in the area numbers; letters identify site geography. This code, used first at Hanford to identify building areas and their associated facilities, and the road-lettering system heightened the anonymous and utilitarian character that evolved at the Savannah River Plant.

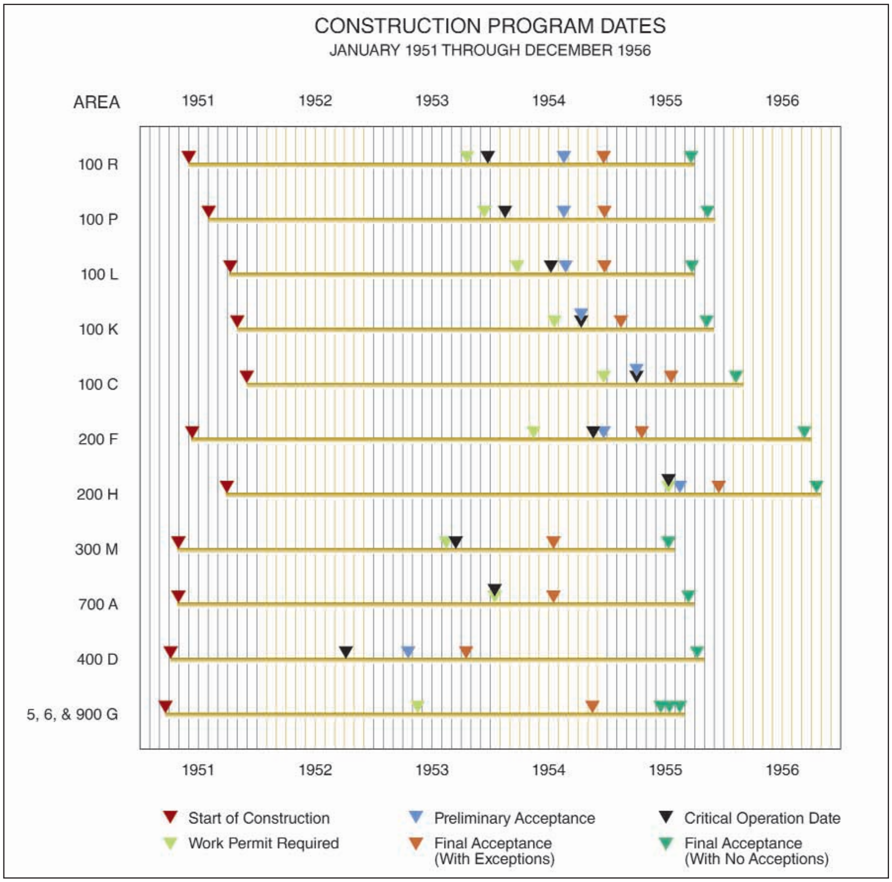
The numbering system reflected the building types and their function. The 700 building series, for example, housed administration, safety, and support functions. In this series, specific duplicated building types, such as gatehouses, were all referred to as 701 buildings, and a suffix (such as the -5A in 701-5A) indicated its geography and the number of gatehouses in a building area. This numbering system allowed for expansion should more of a given building type be needed. With the exception of the 700 and 600 buildings, the hundreds place in each buildings' three digit number indicated a process area. The remaining places in the numerical label indicated a building's function. Thus, a powerhouse in 100-R Area was 184-R, a cooling tower 185-R. The same building types in the 700 Area were labeled 784-A and 785-A.

100 - Reactor Area	100-R, P, L, K, and C
200 - Separations Areas	200-F, H
300 - Fuel and Target Fabrication Area	300-M
400 - Heavy Water Production Area	400-D
500 - General (lighting, transmission lines, substations, etc)	500-G
600 - General	600-G
700 - Administration Area	700-A
900 - General	900-G

The plant was originally organized into ten permanent areas that included nine integrated but self-sufficient manufacturing areas, (R, P, L, K, C, D, F, H, and M) and a central administration area (A). The two "temporary" building areas known as the Temporary Construction Area (TC Area) and Central Shops are discussed above. All building areas were linked by a well-designed transportation system, that, when completed, included 210 miles of surfaced highways, a cloverleaf that was the first constructed in the state, and 60 miles of railroad track. The plant, a model of functional, clean, energy-efficient, and economical design, incorporated two levels of organization. First and foremost, the basis for the layout was the safety and environmental concerns that stemmed from its unique mission and the risks involved. On a secondary level, the building areas showed good industrial organizational design.

PERMANENT CONSTRUCTION AND SCHEDULE

The G-Area facilities, namely roads and railroads, were built first in preparation for construction. The next construction priority was the Heavy Water or 400-D Area. Construction began in D Area on April 2, 1951. R Area, followed by P Area, were the next priorities. Construction began on R Area on June 1, 1951, and construction of P Area began the month after. While construction began on A/M Areas in May 1951, the administrative area and the fuel and target area were given lower priority. Construction was ongoing but not as pressing. F Area was the next priority after P; and work began in F Area on June 8, 1951. The construction sequence after that was L Area, K Area, C Area, then H Area. Du Pont's engineers then assigned priority to the major process facilities within each of those priority areas. Notably, construction of the reactor or 105 building in each 100 area accounted for 75 percent of the work in the total building area.[74]



The construction schedule was rigorous and the construction of areas staged to meet defense production goals. Thus D, M, R, and F areas were the priority process areas. A and G areas were also on the fast track to support the ongoing construction. Source: Engineering Department, E. I. du Pont de Nemours & Co. *Savannah River Plant Construction History*, Volume I, Report No. DPE (1957).

At an early date the Atomic Energy Commission mandated that all building design conform to its policy of Spartan simplicity in design. This policy required Du Pont and its subcontractors to design facilities with maximum economy consistent with functional requirements and to standardize designs and specifications for buildings and associated facilities.[75] Standardized design saved money, promoted uniformity, and better allowed the construction force to adhere to its tight construction schedule. The plant buildings also had to be strong enough to survive an atomic blast and, in the face of an attack, be so constructed that the facility could either wholly or in part continue to be operated. Professor H. L. Bowman of Drexel Institute of Technology and Du Pont engineers tackled these building criteria. Three types of construction for the plant were developed, and this classification system was codified and placed into a supplement to the Uniform Building Code published in January 1, 1946, which was adopted for plant construction use.[76]

Transite™ was the siding of choice for Savannah River's first generation of buildings. This circa 1950 advertisement extols the advantages of the building material for industrial buildings. Source: *Architectural Forum*, March 1950.

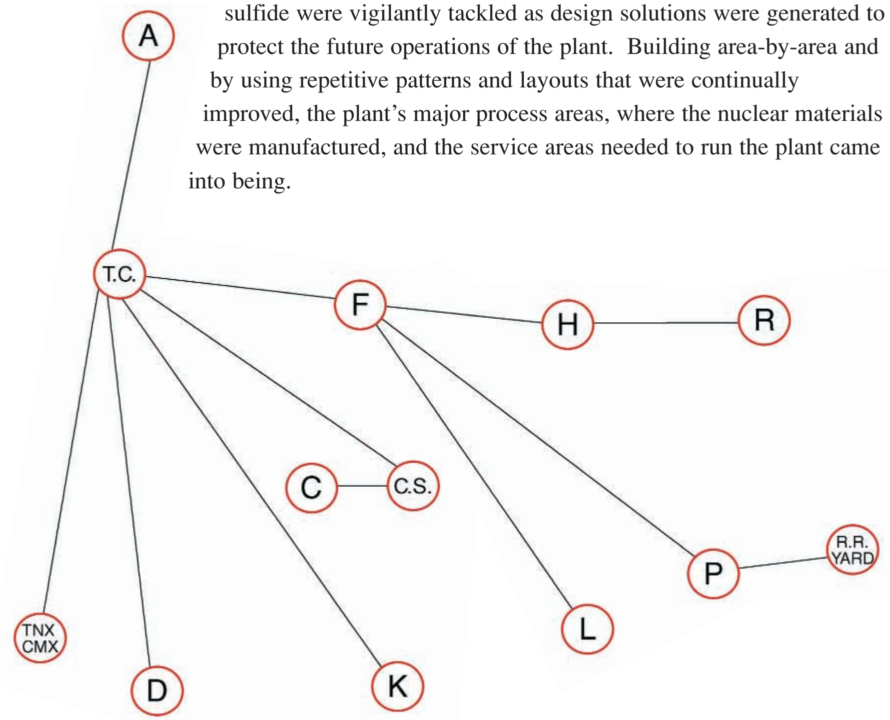
Class I buildings were massive, reinforced concrete, monolithic structures with a static live load of 1000 pounds per square foot. Their exterior walls and roof were poured, reinforced concrete with a supporting frame of reinforced concrete or structural steel. Preferably, buildings such as reactors or canyons should be constructed of blast-proof materials throughout. Reinforced concrete construction was selected for its ability to take stress, the protection it afforded from alpha and gamma rays and intense heat, and the speed and economy it would lend to construction.

Class II buildings were built with a structural frame of reinforced concrete or structural steel and expendable wall materials: if bombed, the structural frame would remain intact. Extensive tests were undertaken at Sandia National Laboratory in New Mexico to identify possible friable wall materials by exposing the candidate materials to TNT explosions that simulated atomic bomb blasts. After analysis, Transite™, a short-fiber, cement–asbestos siding material, was chosen.[77] Transite™ was sold in the form of flat and corrugated sheets. As an exterior sheathing it reduced the load-bearing factor considerably from 120 to 20 pounds per square foot compared to masonry walls. It did not rot, rust, or burn and was impervious to insects and rodents.[78] Advertised as smart, modern, and economical in period advertisements, Transite™ panels became the primary building material for exterior walls on Class II construction.

Class III construction was considered normal construction carried out under the regular building code.

CONSTRUCTING THE AREAS

The scale of the construction of the plant and the wide breadth of talents and skills that were needed are hard to grasp. Du Pont's engineers and their subcontractors designed everything from delicate instrumentation to monumental concrete reactors using the new SRP building code. Hazards from radiation and the use of hydrogen sulfide were vigilantly tackled as design solutions were generated to protect the future operations of the plant. Building area-by-area and by using repetitive patterns and layouts that were continually improved, the plant's major process areas, where the nuclear materials were manufactured, and the service areas needed to run the plant came into being.



SRP Building areas. Source: *Savannah River Site Atlas*. Facilities and Services Site Development Control and Mapping Section, January 1997.

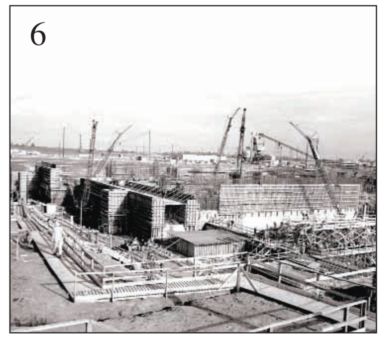
100 AREAS

Five reactor areas were situated in an arc within a 35-mile-square area in the reservation's interior. Each area contained approximately 40 buildings. They were built in a sequence that allowed the first to go into operation while the next was under construction. This method also allowed for lessons learned and cost savings to be applied to the next one built. Thus K and C Reactors included innovative ideas worked out on the first three (R, P, and L). These differences are discernable in the quantities of construction materials used for each.[79]

Area	Excavation Cubic Yards	Concrete Cubic Yards	Reinforcing Steel Tons
100-R	2,300,000	235,500	19,300
100-P	2,325,000	200,600	18,175
100-L	2,051,000	165,700	14,100
100-K	2,145,000	166,750	14,300
100-C	1,470,000	155,000	13,900

Building a Reactor

1. Corn field occupies 105-R site, May 28, 1951, negative DPESF 1-126. 2. Excavation for 105-R involved moving 2,300,000 cubic yards of earth, August 24, 1951, negative 1-44-1. 3. Reactor building begins to take shape, September, 25, 1951, negative 1-158-1. 4. Below-ground area built and levels above grade are readied for concrete pours, December 19, 1951, negative 1-206-1. 5. Concrete forms and supporting scaffolding on reactor building,



negative 1672-4E. 6. 105-R's construction required 19,300 tons of reinforcing steel and 235,500 cubic yards of concrete, June 28, 1952, negative 1-206-1. 7. Construction proceeds around the clock, June 16, 1952, negative 3692. 8. Completed 105 building, April 30, 1953 and timeline of the entire process involved from conception to start of operations, negative 1-855-2. 9. Source (graph): Engineering Department, *Engineering and Design History,* Vol. II. E. I. du Pont de Nemours & Co., 1957.

Constructing the Site's Monumental Architecture

8

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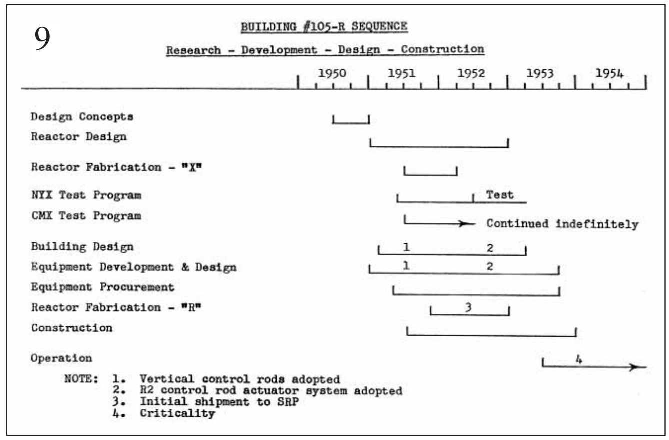

Building a Canyon

1. Excavation and below grade construction of F canyon, negative 2-135. 2. Sectional construction above grade, April 23, 1952, negative 2-212-1. 3. South end of F canyon railroad car portal in place, April 23, 1952, negative 2-212-2. 4. North end of F canyon, negative 2-297-1. 5. Concrete shell completed. North end of canyon shown, February 29, 1953, negative 2-554-1.

All photographs courtesy of SRS Archives.

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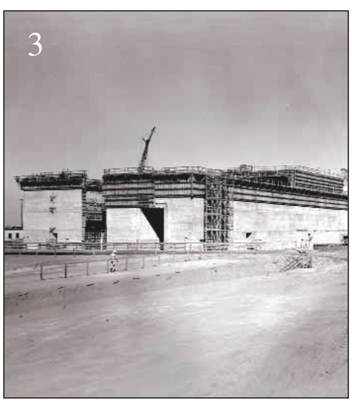

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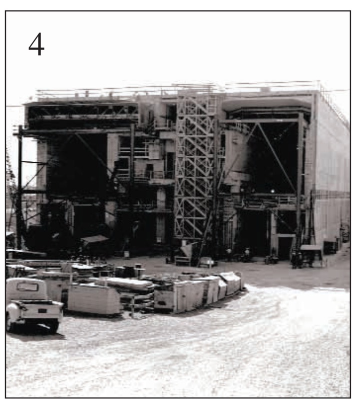


5

The Corps of Engineers took soil borings at each reactor area to determine subsurface conditions in preparation for reactor building construction. Where soil zones were encountered that contained porous ground, concrete grout was used as a filler to prevent building subsidence. Excavation for the 105 buildings was extensive, measuring approximately 610 feet by 725 feet. The excavation area was comparable to an average-size stadium. As concrete pours required shadow-free work areas, flood lighting akin to stadium lighting was installed. The planning, construction, erection, and stripping of concrete forms for the 105 buildings required a prodigious effort. Concrete was typically placed through pumpcrete lines supplied from a batch plant.

The installation of heavy equipment had to be planned well in advance, and the 105 building's permanent cranes were used for installation during construction. Given the height of the reactor building as construction progressed, cranes were lifted from level to level by other boom cranes to facilitate construction. Stiff-legged derricks with a 15-ton rated capacity and 100-foot booms were used at the 105 areas to handle the placement of material and equipment for the telescoping actuator system through construction openings. A variety of materials entered the building in this manner; openings left in the buildings allowed materials to be continuously placed in or near their point of installation. The construction histories list the heavy equipment used at the reactor areas: crawler cranes, motor cranes, crawler tractors, roustabout cranes, batch hoppers, boilers, concrete buckets, concrete mixers, conveyors, air compressors, welders, farm tractors, pumpcretes, pumps, derricks, hoists and winches, motor graders, tanks, dragline buckets, and clambuckets.

The construction men working at the reactor and separations areas quickly became familiar with the concept of restricted areas within the work site. Only Q-cleared personnel could work within these areas. Thus, a certain number of men in each craft were targeted for this clearance level when they were hired.

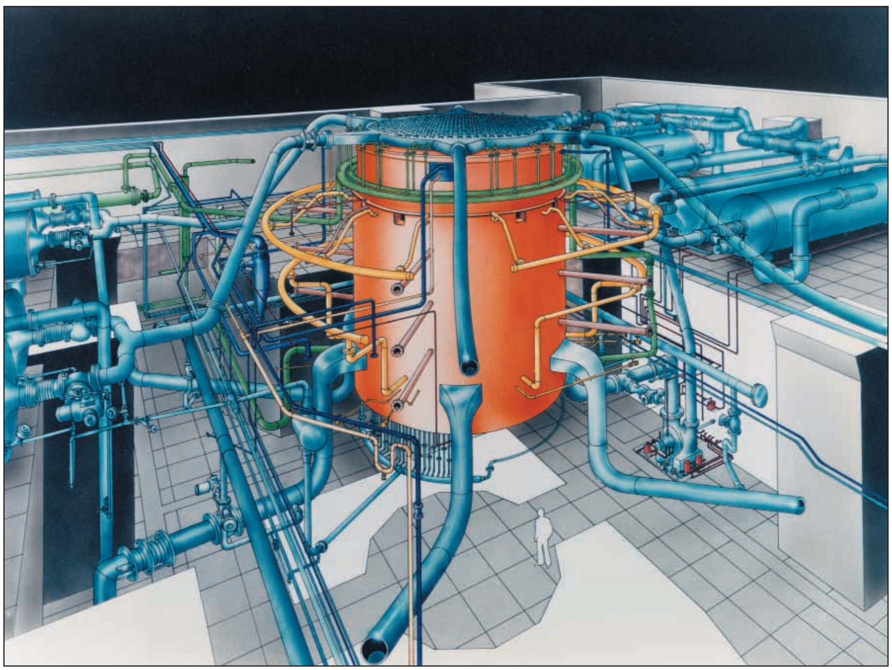
While security was an added work dimension, other construction challenges were met. The need for cleanliness and the application of protective coatings in the 105 buildings was closely followed, and a well point system was placed in excavation areas to help lower the water table. The construction history also states that the specifications for the 105 buildings covering the building layout, instrument placement, and equipment were

"The first barge shipment of material from New York Shipbuilding Corporation landed at the Savannah River dock at 1:30," August 2, 1952. Source: Engineering Department, E. I. du Pont de Nemours & Co. *Savannah River Plant Construction History*, Volume II, 1957, DPES 1403: 575.

The reactor, the vessel and the plenum, arrived by barge at the plant's Savannah River dock that was constructed for this purpose. A series of photographs document the reactor's progress from the dock to R Area under heavy security. Courtesy of SRS Archives, negative DPESF-1-2227-12.

exacting. Two tools were acquired to achieve the required accuracy: a Wild III, a Swiss precision-leveling instrument, and the British-made Watts "Micropotic No. 2 theodolite," which was ordered from England. These tools were used to provide horizontal control lines on top of the reactor and to precisely install special equipment in the reactors.

The five stainless-steel reactor vessels, fabricated by New York Shipbuilding between 1951 and 1954 under the codename "NYX Project," were shipped to the plant by barge. R. H. Barto supervised the project for New York Shipbuilding. Eleven Du Pont engineers worked with the Camden fabricators, some for the entire project, others for one-year stints. The reactor vessels, composed of a plenum, a top tube assembly, the main tank, and a bottom tube assembly (the plenum, and top and bottom tube assemblies had matching patterns so that tubes could be raised from or lowered into the vessel), were enormous. The approximately 225-ton vessels were unloaded by a stiff-legged derrick at an unloading dock on the river, then transported to each reactor area on "low boys" purchased to handle their weight. R Reactor was shipped from Camden, New Jersey, on August 2, 1952. P, K, and L Reactors arrived in 1953 and C Reactor arrived in spring of 1954.[80]

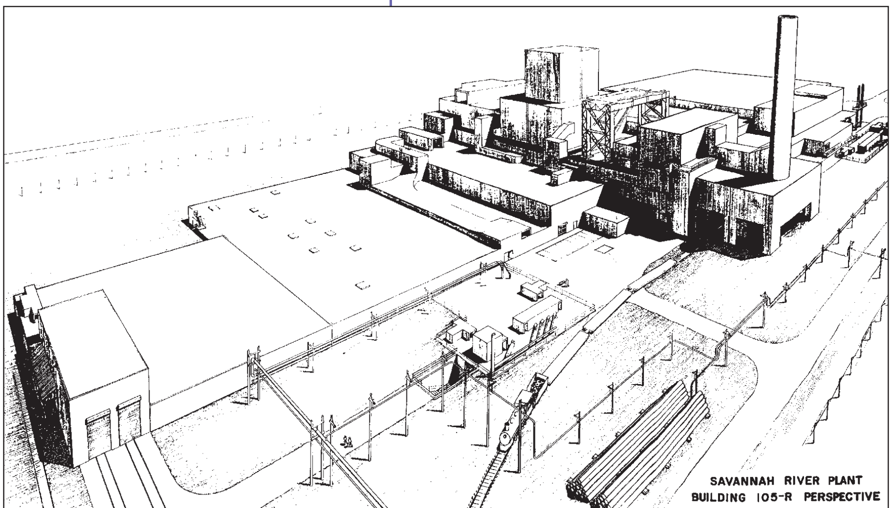


Conceptual drawing of reactor vessel (orange) and plenum, circular sieve-like part at top of reactor vessel, at –40 level, completed circa 1953. Illustration attributed to Voorhees, Walker, Foley & Smith. Courtesy of SRS Archives, negative 43960-6.

The installation of the reactor equipment was also unlike any other job:

> The reactors C and D machines, a 120-ton crane and a purification area crane, were all automatically and remotely controlled, and included complex cable assemblies and the most intricate electronic circuits. Installation of such equipment is not normally encountered on construction jobs. To aid the field force in the interpretation of the design and installation of equipment, vendors provided specialized technical personnel during the final stages of assembly and testing.[81]

When finished, all SRP reactors were multilevel, irregular-shaped buildings primarily constructed of reinforced concrete. From the air, they resemble concrete machines. Only R reactor was wholly built with blastproof construction; the remaining 105 buildings feature both Class I and Class II construction. Their substructures, made of blast proof construction, extend many feet below grade, and the building's overall size at grade varies. The concrete stack at a height of over 100 feet is each reactor's highest elevation.



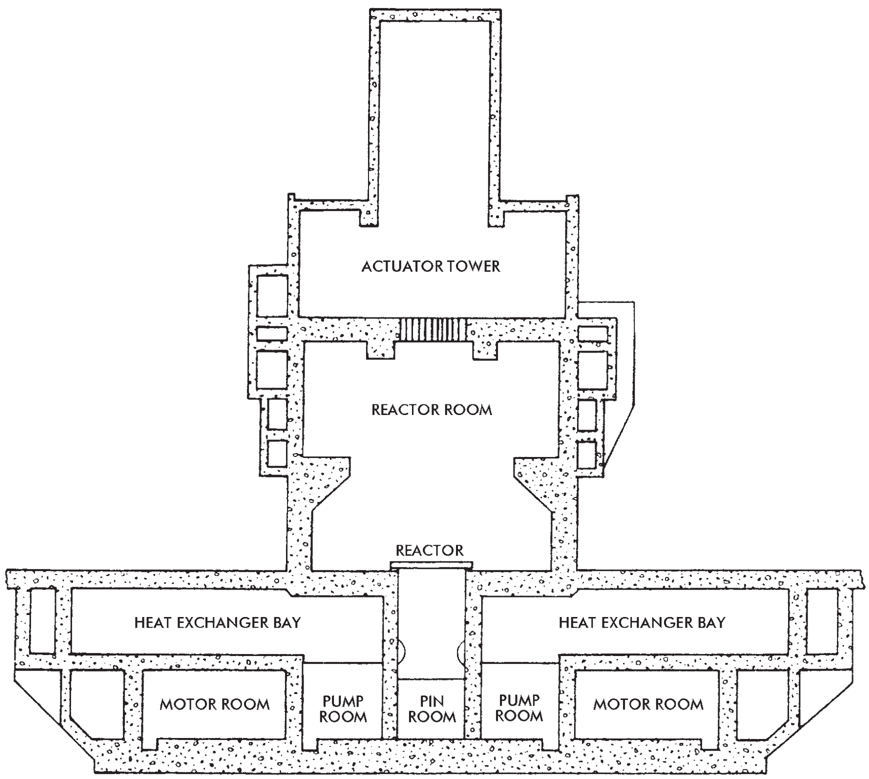
Profile of 105-R, the largest of SRP's five production reactors and the first to achieve criticality. The reactor building was essentially an envelope covering four main process areas: the assembly area, the process area, disassembly, and the purification area. Source: Engineering Department, E. I. du Pont de Nemours & Co. *Savannah River Plant Construction History,* Volume I, Report No. DPE, 1957.

Each 105 building is essentially an envelope covering a group of complex processes, and it was these processes contained in four core areas that created its unusual form and size. The process sequence for reactor materials included preliminary handling, irradiation, disassembly, and purification. Fuel elements and target materials to be irradiated were cleaned, loaded, inspected, tested, and stored prior to use in the reactor in the assembly area.[82] These materials were irradiated in the process room. At one end of the process room, fuel–target assemblies were readied for vertical insertion into 16-foot-diameter stainless-steel reactor tanks. Fuels were loaded and unloaded via charging and discharging machines that transported the fuels to the reactor and placed them in their precise lattice location by remote control. Carried on gantries that extended the length of the reactor room, these robot-like machines found the precisely located holes at the top and pins in corresponding places at the bottom that "accept and hold in place the 'lattice' of fuel, target, control rod, safety rod and instrument assemblies." The "forest," a complex array of control and safety assemblies, was positioned over the reactor's face or plenum; the forest was raised when the reactor was charged or discharged and the reactor room height accommodated this vertical assembly process. A basin was located at the other end of the reactor room to store irradiated assemblies, where a conveyor would transport the spent fuel and assemblies through a canal into the disassembly basin. The process or reactor room area of each reactor is multilevel in profile including a "high hat" to house the actuator when it retracted upward to make room in the reactor room for the charge and discharge machines during reactor shutdowns. A cylindrical cement stack was mounted on the building to exhaust air from the building.

Heavy water was used as both moderator and primary coolant that removed fission heat from fuel elements. The coolant was circulated through heat exchangers, where it was cooled by river water that would be released to plant streams or cooling ponds. The heavy water flowed out of the base of the reactor tank, through the heat exchanger, and then was recirculated to the top of the reactor plenum.

The irradiated materials and the depleted fuels were aged to allow decay of the shorter-lived fission products, disassembled, and transferred in casks for shipment by rail to other plant areas for additional processing. This part of the process took place in the reactor's disassembly area. All work in this area was performed under water with remote mechanisms, as irradiated assemblies were transported through a canal from the reactor room to the disassembly basin. Concrete walkways stretch over the disassembly basin. The fourth process area in the reactor was the purification area. This area contained equipment for continuously purifying the heavy-water moderator and helium blanket gas during reactor operations.

Service facilities, operating control rooms, heating and ventilating equipment, electric equipment, and offices were dispersed throughout the reactor. Personnel areas had their own ventilation systems. Unlike most buildings, reactor buildings are not considered to have stories, instead they have levels or elevations. These elevations are designated by feet above and below grade. Ground surface is designated 0-0; other levels are designated by their distance to and from ground level.

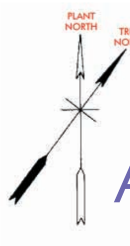


Cross Section of a Reactor Building showing the process area. Source: William P. Bebbington, *History of Du Pont at Savannah River Plant*, (Wilmington, Delaware: E. I. du Pont de Nemours and Company, 1990).

105-R is the largest of the reactors; its design and general configuration were an amalgam of initial design decisions that were later improved to increase production, allow greater flexibility, and to hold costs down. R and P Reactors were the first designed, sharing many design features while L and K Reactors, which were part of the later AEC expansion program, are more alike in design. The design changes in L and K derive from a desire for higher power levels and the use of depleted or enriched fuel types. C Reactor, the fifth to be completed, differed from its counterparts in design changes that allowed the

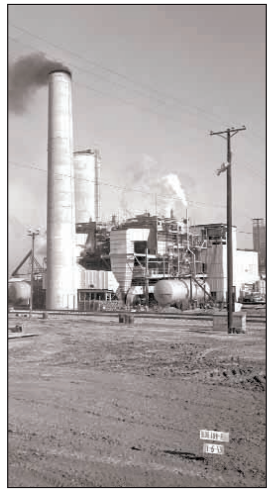
CONTENTS

Reactor, negative 1-227-2. Cooling Tower, negative 1-737-9. Pumphouse, negative 1-738-4. Gate House, negative 1-305. 184-R, negative 1-651-7. Administration, negative 1-333-9. Courtesy of SRS Archives. Source: Basic Information Maps, 100-R Area, 1956.



100 AREA

Reactor



Powerhouse

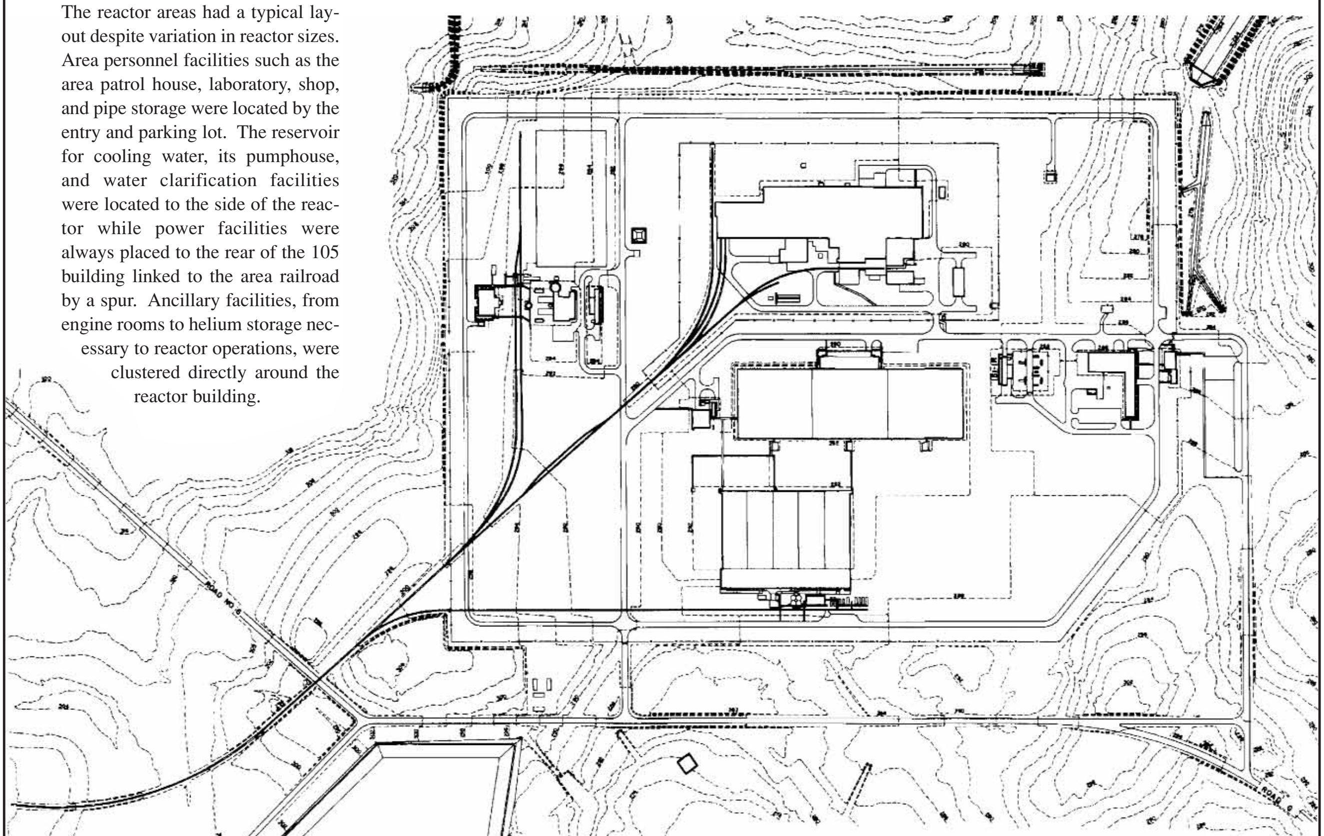
Cooling Tower

Pumphouse

Gate House

Administration

The reactor areas had a typical layout despite variation in reactor sizes. Area personnel facilities such as the area patrol house, laboratory, shop, and pipe storage were located by the entry and parking lot. The reservoir for cooling water, its pumphouse, and water clarification facilities were located to the side of the reactor while power facilities were always placed to the rear of the 105 building linked to the area railroad by a spur. Ancillary facilities, from engine rooms to helium storage necessary to reactor operations, were clustered directly around the reactor building.



handling of different fuel elements, higher power levels, greater moderator flow and structural changes needed to handle the higher power levels desired.

In each, the reactor room was placed at the center with the assembly, disassembly, and purification areas adjoining. Materials handling, the location of the reactor and heat exchangers and pumping facilities, and positioning of control mechanisms were all design problems that, when solved and refined, would produce compressed disassembly areas. Vertical loading mechanisms and the placement of heat exchangers under the reactor allowed a more condensed reactor layout. Design improvements also allowed changes in the classes of construction to be used in certain parts of the 105 building.

Power-generation facilities, water-purification and -clarification units, a cooling water pumphouse and basin, storage, shops, a gatehouse, and parking lot surrounded each reactor building in a standardized layout. Two river-water pumphouses were also integral to the reactor's operation. Reactors need a steady flow of cooling water both during operation and after shutdown. Each pumphouse supplied the necessary water through a network of miles of concrete pipe to the 100 areas.

Cooling-water basins, containing millions of gallons of water, were also constructed at each area for additional protection. This river water cooled the heavy water that was used as a moderator and coolant for the irradiated fuel elements, and was recirculated through the reactor. When the heavy water was pumped through the reactor's heat exchangers, it was cooled by river water. The pumphouses and water distribution systems, and basins were extremely important facilities within the reactor areas.

The reactor areas were models of industrial efficiency from their well-designed electrical network to the buildings themselves. R Reactor, the first and the largest of the five reactor buildings, was largely completed by the end of 1953. P Reactor was completed in 1954 and the remaining reactors were completed in 1955.[83]

Aerial view of F Area, view to the west, January 1953. The canyon, the focal point of the 200 Area, is the long building to the right of the center. The long excavated area in the front of the photograph is an ash basin (286-F). Courtesy of SRS, negative cy-f-1-1-53.

200 AREAS

Construction proceeded on two separations areas, one fully built out (F Area) and a second integrated but expandable for future needs. The 200 Areas, 200-F and 200-H, were centrally located within the site's core area, approximately 2.5 miles from the closest reactor area and about 6 miles from the project area perimeter. Construction statistics show that 50 major buildings were constructed in the 200 Areas, 300 acres of land were graded, about 2,500,000 cubic yards of earth were moved, and over 300,000 cubic yards of concrete were poured.[84]

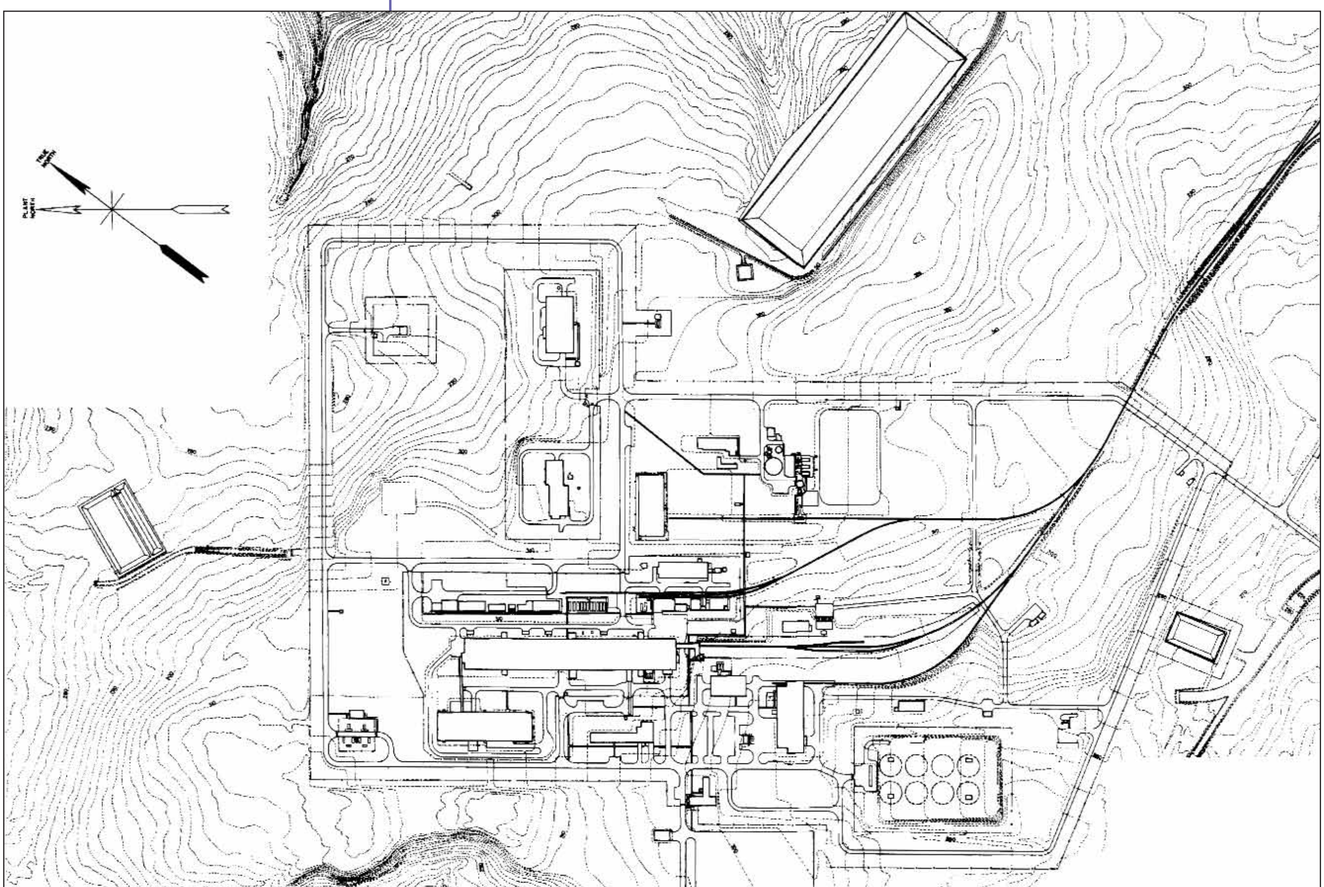
The canyon buildings are monumental, reinforced-concrete narrow rectangular structures eight times longer than they are wide. They are four stories in height. The SRP examples owe much of their design to Hanford's canyon buildings called "Queen Marys," This map shows F Area in 1957 and its linkage to the site railroad which transported irradiated materials to the cargo bay at the south end of the canyon. Personnel buildings were situated to the west of the canyon, power facilities to the southeast. The original tritium facility, a second manufacturing facility, the storage facility for the finished product, were situated in a separate area east of the canyon. The waste tank farm was located southwest of the canyon. Source: Basic Information Maps, 200-F Area, 1956.

200 AREA

and to the first separations building constructed at ORNL. Savannah River canyons are divided into 16 midsections of equal lengths while the sections on both ends are longer to accommodate receiving and shipping.

Inside the building, there are two interior "canyons," stretching the length of the building. The various separation processes took place within these interior canyons. The hot canyon is on one side and materials entered it by railcars; the warm canyon is along the opposite wall. The Purex process called for dissolvers, tanks, evaporators, and mixer-settlers. The liquids were moved from section to section by piping that allowed liquids to flow between equipment elements. Each section of the hot canyon was built as a dimensional duplicate so that equipment could be easily and remotely replaced by crane. Between the canyons is a multistory hall that housed remote handling equipment, a personnel corridor, control room, piping, pumps, etc. The railroad tunnel is located on the south end of the canyon; a shielding door large enough to allow a rail car entry is located at the railroad tunnel entrance.

The canyon buildings were built to house equipment and processes involved in the Purex process, the B-Line, offices, change rooms, and other personnel service rooms. Uranium, plutonium, and fission products were separated to produce plutonium metal buttons and a decontaminated uranyl nitrate solution, which was accomplished by processing equipment in the hot and warm canyons, which were controlled from the first-story central



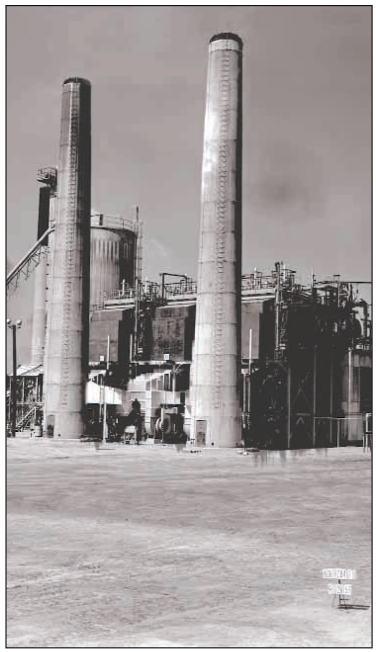
Courtesy of SRS Archives. Storage Building, negative 2-481-11. Canyon, negative 3771-60. Metallurgical Building, negative 2-364-9. Tritium, negative 2-650-4. Powerhouse, negative 2-509-8. Patrol House, negative 2-228-7. Administration, negative 2-428-6. Fire Station, negative 2-392-8. Shop and Mockup Building, negative 2-234-12. Laundry, negative 2-223-7. Laboratory, negative 2-607-10.


Storage Building


Canyon


Metallurgical Building

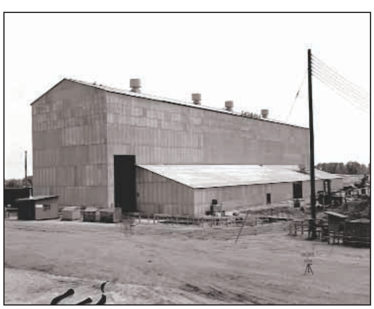

Tritium


Powerhouse


Patrol House


Administration


Fire Station


Shop and Mockup Building


Laundry

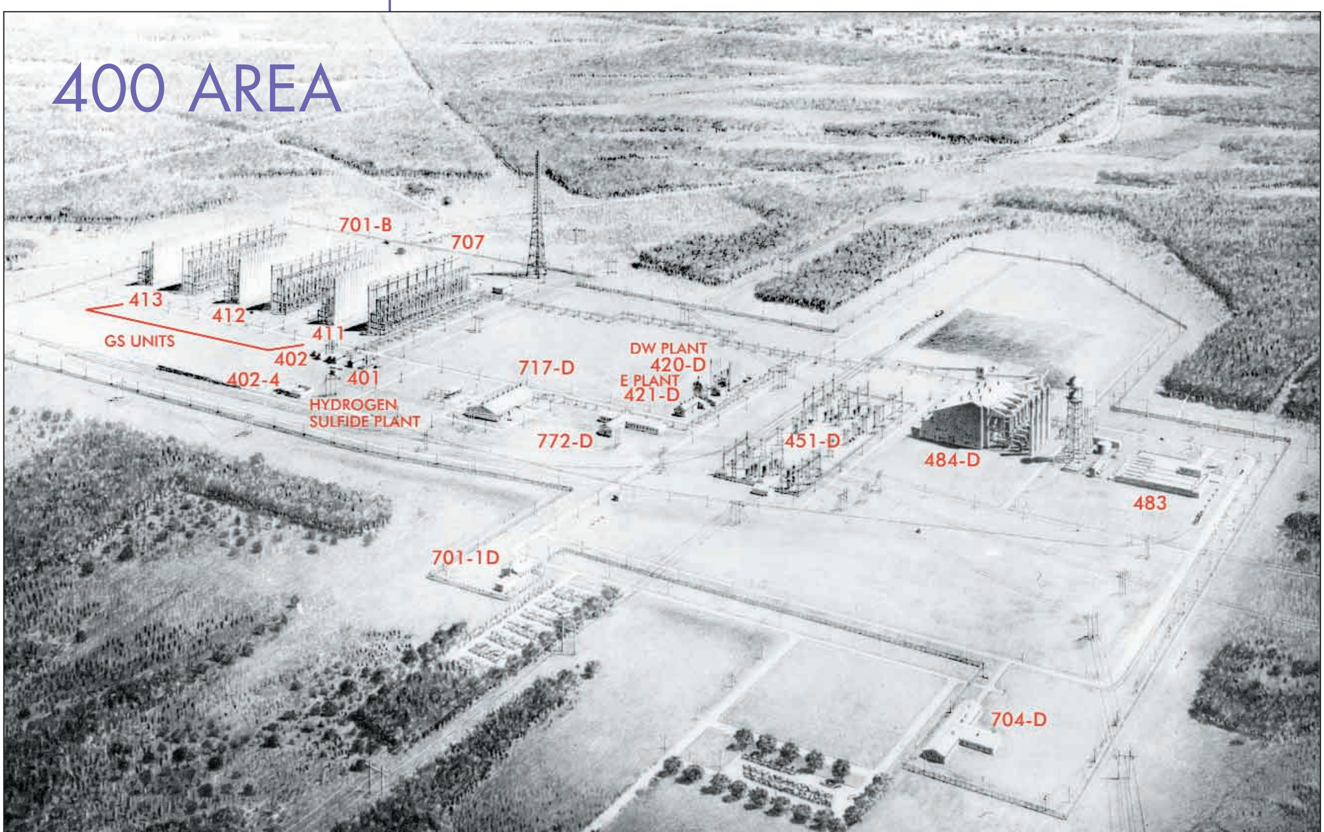

Laboratory

hall. The most highly radioactive steps within the processes were handled in the hot canyon, those of lesser intensity were handled in the warm canyon. Two cranes remotely handled the mechanical operations. Telescopic vision was used initially only on the hot canyon side; direct vision in the warm canyon. The B-Line was a production facility that concentrated plutonium nitrate and reduced it to metal. This was a separate process housed in F Canyon on the third to fourth levels of sections 1 through 4.

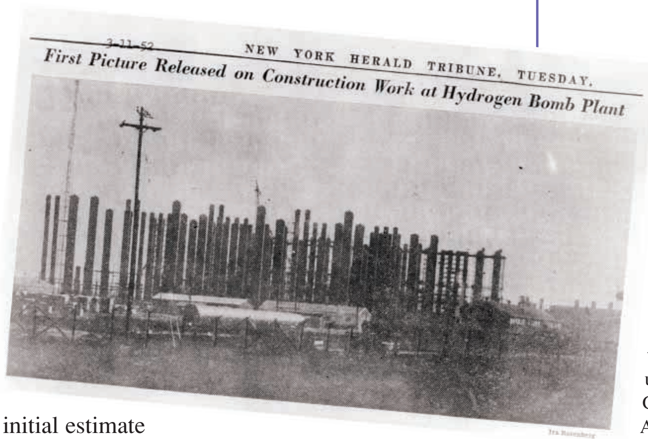
F Canyon was completed first. The plutonium finishing and storage facility, or B-Line, was later placed within a linear enclosed metal structure on F Canyon's roof in the late 1950s. Like the reactor areas, a number of support buildings were constructed at the 200 Areas: sand filters, substations, monitoring houses, chemical feed buildings, basins, power houses, cooling towers, a fan house, gatehouses, administration buildings, storage, a laundry, and a firehouse. F Area originally contained four process buildings and was built to be self-sufficient. H Area did not contain the same complement of process buildings but space was allotted for its future expansion.

Steel tanks were used to store radioactive waste. Tanks were made of mild, carbon steel, and not stainless steel. Consequently, the acidic waste stream had to be treated with alkali to avoid serious tank erosion. Grouped in farms in the separations areas, the tanks were large welded units with internal supports encased in concrete and placed in a steel saucer covered by nine feet of earth. Separate tanks were designed for high-and low-level wastes. Solid wastes were buried in a "burial ground."

Bird's eye view drawing of the 400 Area created by Voorhees, Walker, Foley & Smith in 1953. Building numbers added to original. The architectural rendering shows the GS units and flare tower located at the eastern end of the building area. The hydrogen sulfide plant was located by the GS units while the DW and E processes were housed in buildings 420-D and 421-D. The massive powerhouse, substation, and ancillary facilities were grouped at the western end with the laboratory, rework and storage facilities, and shop in the center. Savannah River 400 Area, No. 14, Env. 14 Courtesy of the Hagley Museum and Library.



400 AREA AND DANA


3-11-52 NEW YORK HERALD TRIBUNE, TUESDAY,

First Picture Released on Construction Work at Hydrogen Bomb Plant

Reminiscent of an oil refinery in their appearance, the 144 tower units (411, 412, and 413) used in the GS process were 120 feet in height. A photograph taken of them and their control buildings from a window of an Atlantic Coast Line train en route to Augusta made news as "the first picture of actual construction" at the "top secret plant" in the *New York Herald Tribune* on March 11, 1952. Courtesy of SRS Archives, negative 653-1.

The Dana Plant, or Project 8987, at the Wabash River Ordnance Works in Indiana contained a pilot plant for the dual-temperature process and a supporting laboratory facility for heavy-water production. The Girdler Company of Louisville, Kentucky, handled the design work on a contract that predated the Du Pont contract for the Savannah River Plant. The initial estimate of heavy water needed for SRP reactors was increased when the program was expanded from two to five reactors. The Dana Plant's heavy-water production capacity, built to handle the needs of two heavy-water reactors, was not equal to the task. A second plant was immediately deemed necessary and that plant became SRP's 400 Area. Construction on the 400 Area received top construction priority at the South Carolina project site. Without heavy water, the reactors could not operate. Du Pont shifted gears, and responded to this critical change in scope by hiring the Lummus Company to design the South Carolina heavy-water production facilities. The Lummus Company's learning curve was cut considerably by Du Pont's hiring of staff from the Girdler Company as consultants. Du Pont's designers and the Lummus team pulled extensively from the information that the Girdler representatives provided on the design and operation of the Dana Plant. Particular attention was given to corrosion problems, and two-thirds of the GS towers mounted at SRP had stainless steel rather than carbon steel liners.[85]

The 400 or D Area, located near the Savannah River's southwest perimeter approximately 1 mile from the river, housed heavy-water production units (GS units) and support buildings. There were 144 tower units, each 120 feet in height, ranging in diameter from 6.5 to 12 feet. These towers were sent to the plant from various shops completely fabricated via heavy-duty railroad flat cars. The use of a 200-ton stiff-legged derrick to erect these large towers, which were specially fabricated for the job, was a showstopper. The derrick, placed on parallel railroad tracks laid along the ends of and between the legs of the tower, would lift a tower from a car and set it on its foundation. Bebbington states that in one demonstration a tower was erected in six minutes. It was so successful that the erection of the GS units was completed in almost assembly-line style, allowing early operation of each unit as soon as it was completed and the prefabricated piping made in Central Shops was attached. Heralded as a timesaving device, the derrick, created by the vendor, was featured in *Engineering News Record* and in equipment magazines. Gin poles and crawler cranes were used to erect Dana's ninety-six 128-foot-high towers. Like their Savannah River counterparts, Dana's construction force worked faster as the construction of the towers proceeded. The Dana construction history notes that the first tower took five hours while later towers were placed on their foundations in 30 minutes.[86]

This 200- ton machine, known as a stiff-legged derrick, enabled the D Area construction force to lift the GS towers from the railcar and set them on their foundations with unprecedented speed and assembly line precision. Courtesy of SRS Archives, negative M-477.

The GS units at Savannah River were known as Buildings 411-D, 412-D, and 413-D. The GS towers described above rest on octagonal reinforced concrete pedestals. A control house, substations, breathing stations, maintenance shelter, and an analyzer house com-

Birds Eye View of Dana Plant, Dana, Indiana. Dana had a more compact layout with the flare tower placed between the GS units. Savannah River, Dana Area, Env. 22. Courtesy of the Hagley Museum and Library.

plete the facility. The 375 feet high steel flare tower, constructed to burn emergency discharges and routine leakage of H_2S, was situated south of the GS units. While the distinctive GS units and flare tower which could be seen from outside the site boundaries were the visual image that most area residents connected with SRP, other facilities were present. A concentrator for the DW process (420-D), the second step in the heavy water production process was built with twelve distillation towers and support buildings. The towers ranged in height from 78 to 92 feet in height and between 4 and 6 feet in diameter. The finishing of the heavy water took place in 421-D, a multi-level steel frame building that housed the E process equipment. The E process further increased the concentration of plant's heavy water output. Two cylinder-loading buildings were involved in the final finishing and storage of the heavy water. Other area facilities include gatehouses and patrol headquarters, a supervisor's office and first aid building, change house, fire house, and a control laboratory and supervisor's office. A river pumphouse supplied water to 400 Area while steam and electricity was furnished by the plant's largest powerhouse, 484-D. At the time of construction this was the largest powerhouse constructed by Du Pont. It was outfitted with a coal-handling system that could handle 350 tons per hour.

The Dana Plant was very similar to Savannah River's D Area in its physical organization, particularly in its process area. Dana was composed of six subareas:100, 200, 300, 400, 500, and 600 areas. The 100 area was devoted to auxiliary facilities for the storage of raw materials and generators. Its 200 or production area consisted of six GS units, instrument and switch buildings, mass spectrometer buildings, weigh tank buildings, a flare tower, pilot plant, concentrator building, and an air sampling system. The 300 or finishing and storage area had two buildings: the "E" process finishing building and a storage facility for heavy water. Power-generation facilities comprised the 400 area, electrical lines the 500 area, and the 600 area was composed of general facilities.[87]

River pumphouse supplied river water to D Area. Courtesy of SRS Archives negative 3178-5.

300 AREA

The 300 Area, a linear group of manufacturing buildings, was situated near the northwest perimeter of the plant, where it was integrated into the adjoining 700 Area. The two areas were joined in a U-shaped configuration. M Area contained testing and fabrication facilities for reactor fuel and targets. Across the plant, the buildings and the installed equipment in this area most resembled a commercial industrial plant. These box-like

Building Models

Following an industrial design practice established by Du Pont, three-dimensional models of manufacturing or process buildings were fabricated. Du Pont chose to use building models as an important design source in addition to blueprints in the 1940s. Showing venting, piping and other interior details, these built-to-scale detailed models helped to troubleshoot design and acted as reference guides for future modifications. They could also be used later as explanatory tools to introduce visitors to the plant and its processes. Prior to 1969, all models were constructed in Wilmington. The Savannah River Laboratory's Services Model Shop produced models for Site facilities under the direction of Ray Hale after that date. The Site's inventory of building models shows the transition in model building materials from wood and wire typically used on the first building models to plastic components and miniature parts that allowed the later SRP's model engineer greater design freedom.

Source: "SRL Model Shop No 'Kids' Play," *Savannah River Plant News*, August 14, 1979.

Model of the Heavy Water Components Test Reactor built in Wilmington prior to start of its construction at the site in B Area in 1959. Courtesy of SRS Archives, negative 7081-1.

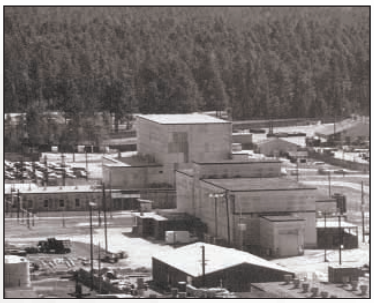
buildings, both one story and multi-level, are Transite™ and steel frame structures designed to handle initial manufacturing needs and to allow for expansion. Most of the 300 area equipment was produced and acquired offsite, then shipped to the plant, for installation.


Test Pile


Alloy Building

300 AREA

Test Pile, negative 3-205-6. Alloy Building, negative 3-186-7. Physics Laboratory, no negative number. Office and Change House, negative 3-199-6. Manufacturing Building, no negative number. Canning and Storage, negative 3-185-8.


Physic's Laboratory

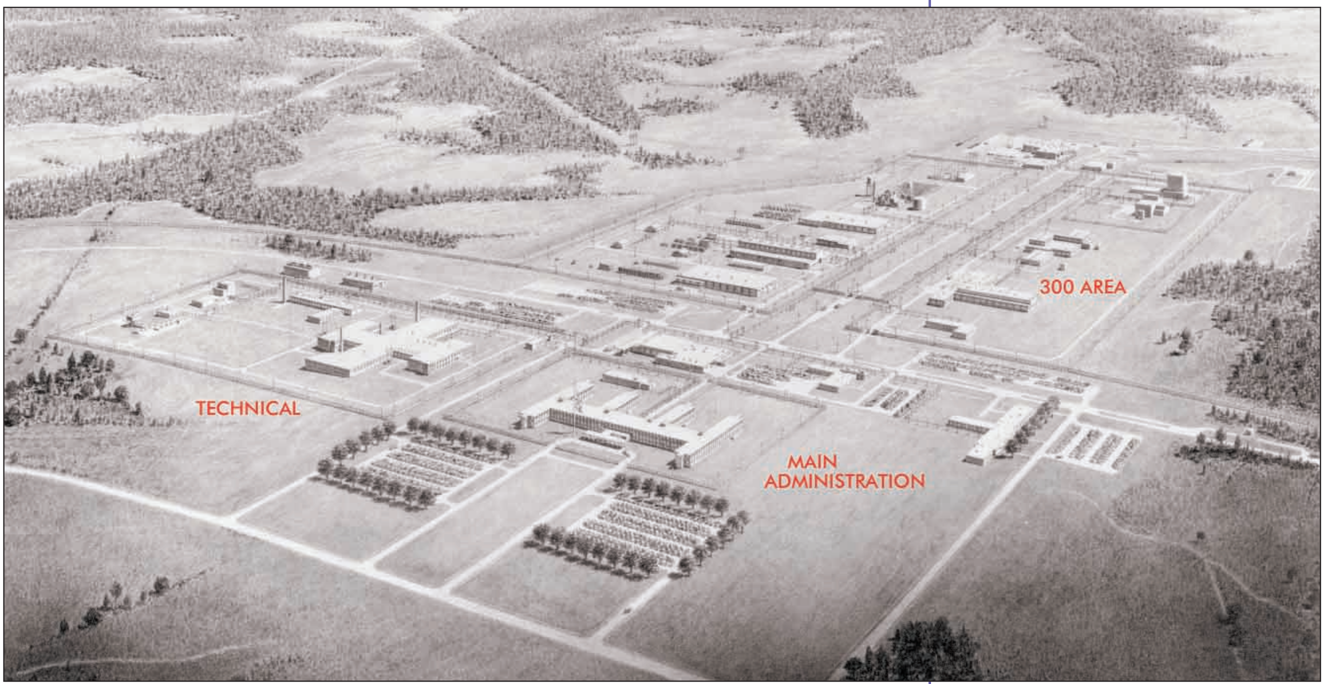

Office and Change House


Manufacturing Building


Canning and Storage

Two buildings, Test Pile and the Physics Laboratory, originally contained test reactors that were used to test the components manufactured in the 300 Area and to aid development and testing for SRP reactor design. Both buildings are irregular in shape and were constructed of reinforced concrete and Transite™. The test reactor in the Test Pile

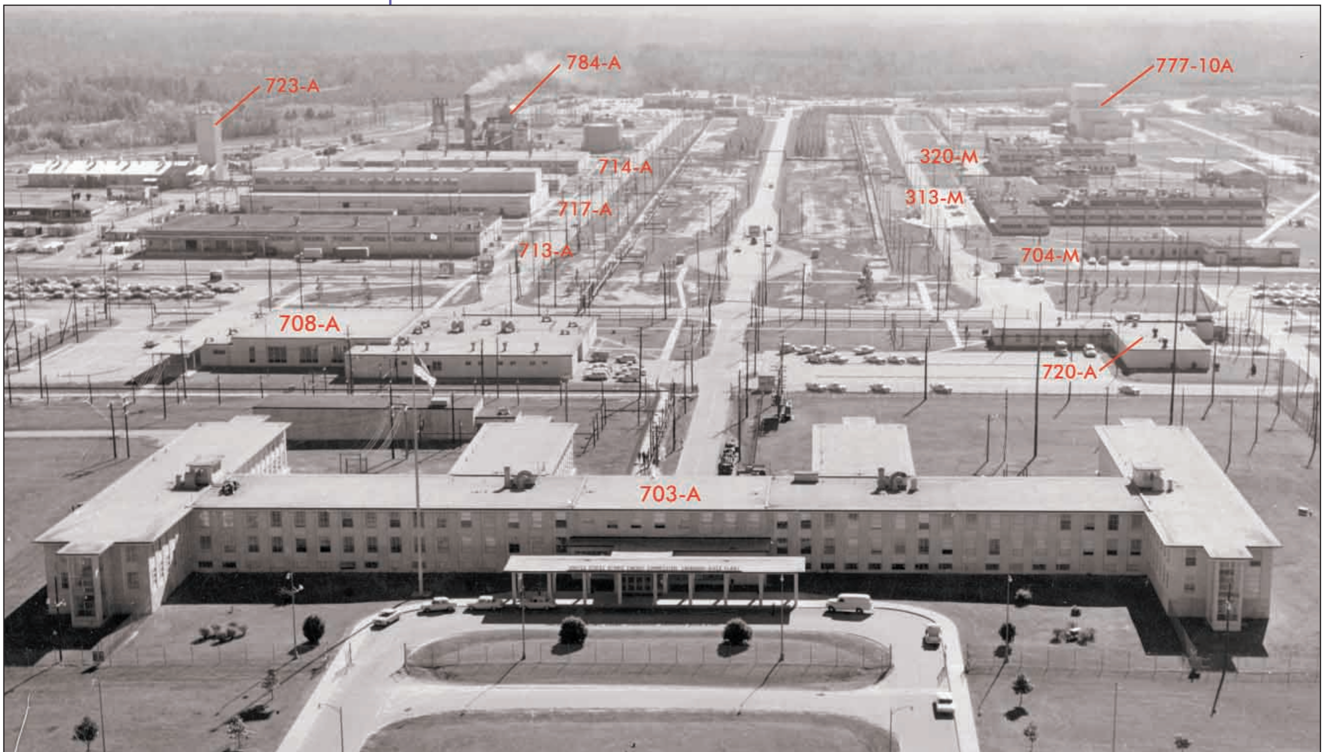
Building was a graphite reactor; 200 tons of graphite blocks machined at Hanford were used in its construction. The Physics Laboratory contained three test reactors as well as a laboratory wing. The 300 or M Area included a canning and storage building for uranium and other slug types, an alloy building in which reactor control rods and blanket rods were manufactured, a large manufacturing building which housed an extrusion press and other process areas, a metallurgical laboratory, substations, a tank farm, gatehouses at both ends of the area, and an area administration and change house. Some of these facilities were added to the 300 Area after 1955 when experiments on the design and fabrication of fuels yielded data on a new fuel element that, if used, would remove previous limitations on the plant's reactor power levels.



The 300 (manufacturing) Area and the 700 (administrative) Area were joined in a U-shape layout that was military in its configuration. The 300 or M Area buildings were placed in straightforward fashion along Road D in a line. Road D, which leads into the plant, ends at the rear of 703-A, the main administration building. 700 Area support buildings were aligned on the opposite Road D frontage. Administration buildings, including the laboratory area were placed at the base of the U. Expansion for both areas would occur on the outer perimeter of the original U in which the original buildings are situated. Savannah River Building No. 300/700 Env. 30. Courtesy of the Hagley Museum and Library.

700 AREA

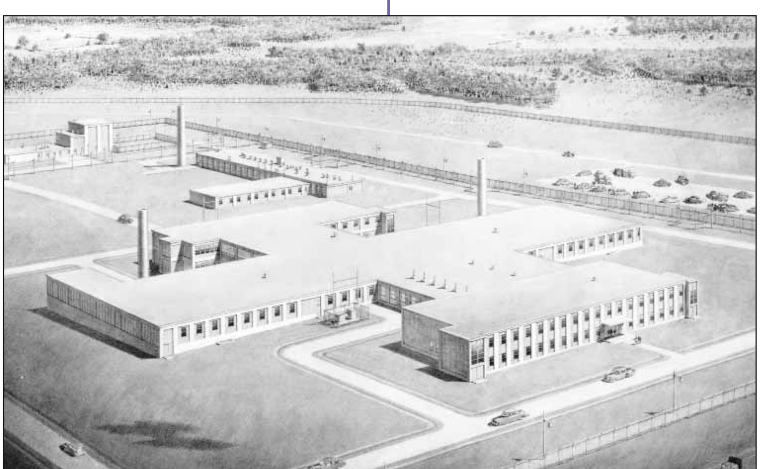
The 700 Area was Savannah River Plant's administrative and "service" center. It contained the main administration building, the medical facility, fire station, communications facilities, patrol headquarters as well as a variety of maintenance, stores, and storage buildings. 700 Area's placement at the plant's northwest perimeter appears to have been deliberate, providing a public face for the Site. Laid out in a U-shaped configuration, the 700 Area is dominated by the monumental main administration building, an imposing two-story building with clerestory towers and four rear wings. The architectural style of both process and non- process buildings was dictated by the AEC, which called for Spartan simplicity in design. The 700 Area reflects this ethic with its simple Transite™ flat-roofed buildings in which form follows function. Behind the administration building, the remaining 700 Area buildings devoted to support functions including stores, warehouse, facilities, a fire station and transportation buildings, and the 300 Area buildings, already described, line Road D which leads to the heart of the plant, the production area.



Aerial view of 300/700 areas circa 1959 with building numbers shown. Administration Building 703-A's design was simply executed in a modern functional style. Courtesy of SRS Archives, negative 7885-3.

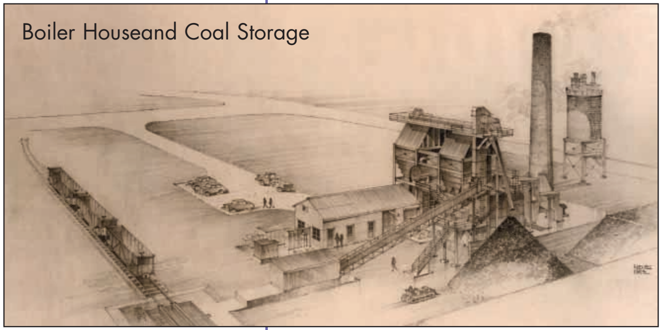
A Area also contains the plant laboratory located to the east of the main administration building in the "technical area." 773-A, the main building of the Savannah River Laboratory, in which plant processes were planned, researched, designed, and tested, and other research facilities are situated in this locale. The main laboratory, designed by laboratory designers Voorhees, Walker, Foley & Smith is a multi-wing, multi-level building covered by a flat roof which has been enlarged over time. Support structures are laid out in a large rectangle of buildings that range from sand filters to ancillary laboratories, chemical feed buildings, a cooling tower, storage and gatehouses.

Architectural drawing for Savannah River Laboratory by Voorhees, Walker, Foley & Smith. Savannah River Building No. 773-A. Env. 29. Courtesy of the Hagley Museum and Library.



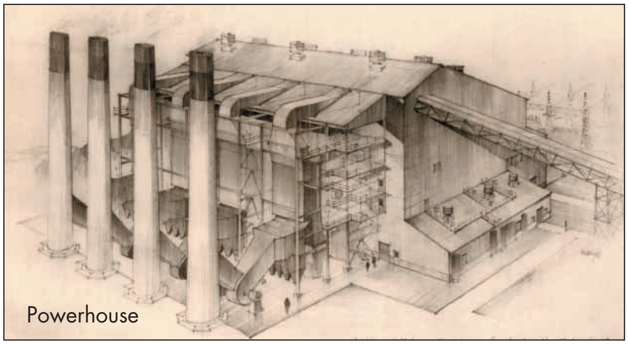
CMX AND TNX

Two research facilities, code named CMX and TNX, were located near the 400 Area. These research facilities, the first completed, were housed in large metal prefabricated buildings. CMX initially housed reactor-related research into the use of Savannah River water for reactor cooling. CMX provided the project one of its many success stories. Laboratory tests run there to evaluate the effect of muddy river water on the performance of heat exchangers established that there was no impact. This allowed Du Pont to eliminate expensive flocculation and filtration facilities that were constructed in the R Area (183-R) at four of the five reactor areas. As that problem was solved, the facility was used to test new types of fuels and assemblies. TNX was a pilot plant for separation processes, complete with technical development facilities.[88]

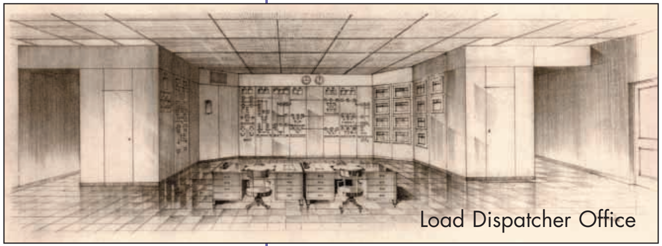

Boiler Houseand Coal Storage

POWER GENERATION

Purchased electrical power was initially preferred over site-generated power. Negotiations with South Carolina Electric & Gas Co. and the Southeastern Power Authority (SEPA) had been ongoing. The latter controlled the distribution of electrical power from Clarks Hill Dam, under construction, and Congressional approval was needed to construct a transmission line from the dam to the site. As the scope of work developed, the need for reliable electricity sources heightened. The addition of the 400 Area to the project called for an immediate power source; no production reactor at SRP would go into production without heavy water, and the 400 Area had been given top priority. Timing did not allow for purchased power and, as a consequence, the 400 Area received its own powerhouse. Other areas were studied to evaluate overall electrical requirements, and the result was a mix of site-generated and purchased power systems running off a central transmission line.[89]


Powerhouse

When constructed, nine coal-burning powerhouses located in building areas supplied steam to the process areas and the overall site. The large pipes that carried the steam were placed above ground, arching over roadways where necessary and paralleling the road system. Outside the manufacturing and service-building areas, general facilities needed for either process support or general site support included the three river-water pumphouses mentioned above and a railroad classification yard.


Load Dispatcher Office

Gibbs and Hill Engineers-Contractors of New York and Los Angeles were responsible for the site's electric, power, water supply and treatment facilities. Their historical summary of their work for the site is illustrated with colorized line drawings of each of the building/facility types from switchyards to the river pumphouses they designed for SRP. (Above) Boiler House and Coal Storage. (Left) The D Area powerhouse was the largest of nine built at the site. View from switchyard. (Below) Interior view of Load Dispatcher Office and Supervisor's Control Board. All electrical power for the site was controlled through this office. Source: Gibbs & Hill Inc., *Savannah River Plant Engineering and Design History*, Subcontractor for Engineering Department E. I. du Pont de Nemours & Co. Inc. (Five volumes), 1954.

MILITARY DEFENSE PROGRAM

Sabotage, defense against possible bombing, and entry from the air was guarded against by extensive antiaircraft emplacements, constructed at several locations around the

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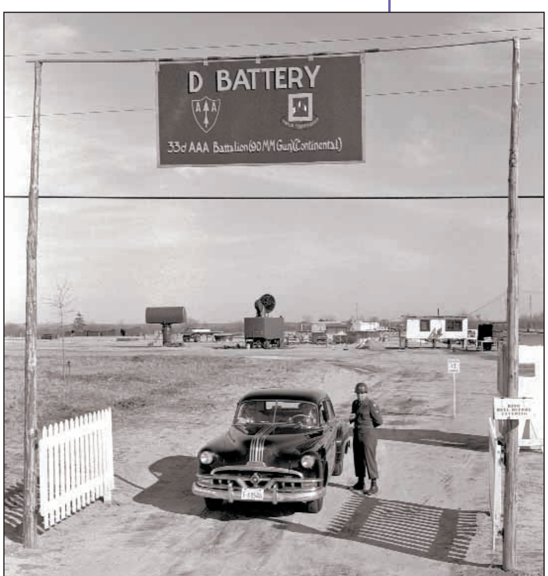
installation and operated by Army troops. Between 1955 and 1959, three antiaircraft (AAA) battalions—the 33rd, 425th, and 478th—of the Army's Antiaircraft Artillery Command's (ARAACOM) 11th Antiaircraft Group protected the Site from air attack.[90] These battalions included 90 officers and 1,023 enlisted personnel.[91]

View of 90-millimeter gun placed on the site for its defense. The gun bears the battalion crest and motto, "Virgilia Triumphamus" (In Vigilance We Shall Triumph). Gun crewman on platform: Corporal Leroy Strain, Ashland City, Tennessee, PFC Rafael De Larosa, Rock Spring, Texas, PFC Oscar McGowan Dallas, Texas, PFC Ernest Guillot, Winnsboro, Louisiana, and, in background, gun commander Sergeant Robert Richardson, Brooklyn, NY. Courtesy of SRS Archives, negative DPSPF–2718-6.

ARAACOM had responsibility for operational planning of the nation's anti-aircraft defenses in 1950 and was charged with defending the nation's Air Force bases of the Strategic Air Command (SAC) and the locks at Sault Sainte Marie, Michigan. The 90-mm battalion was the most common of the units with the ARAACOM, typically placed around urban areas including New York City, Washington, Baltimore, Chicago, Pittsburgh, etc. They were also deployed to protect other sites necessary to the nation's defense such as SRP.[92]

The Engineering Department's Construction History notes that Du Pont's scope of work was enlarged to include the construction of thirty 75-mm and eight 90-mm anti-aircraft gun sites for two lines of defense—the so-called Inner and Outer Rings of Defense—and support facilities for the troops that would be stationed onsite.[93] The two rings of defense were strategically placed so that the guns would be able to hit and destroy incoming aircraft before they could reach the production facilities. They were aligned in two parallel arcs surrounding the production areas.



Entry to the 33rd AAA Battalion's D Battery, one of four on site. Courtesy of SRS Archives, negative M4085-4.

Four 90-mm gun sites were completed by April 1956 and thirteen 75-mm gun sites were under construction by September of the same year. The 90-mm gun sites were designed to house 120 men in concrete barracks. A mess hall, administration building, command post, motor pool area, and gun pads completed this type. The 33rd AAA Battalion with four batteries, four guns to a battery, were the first to arrive in 1955, serving until 1957. This unit was outfitted with 90-mm guns that were controlled by a fire-control system based on air-to-ground radar and tracking radar linked to a computer. Essentially, the radar would identify incoming targets and the computer would generate the needed data to position the guns to destroy the targets. The 425th and 478th AAA Battalions, equipped with 75-mm "Skysweeper" guns, followed the 33rd battalion.[94]

The 75-mm gun sites were to include prefabricated temporary housing for 3 to 11 men and gun revetments. The TC Area was set aside for refurbishment into a military enclave. One of the star-shaped buildings (TC-2) used during construction was renovated for housing and office space for military personnel, and an Antiaircraft Operations Center was built along with additional support buildings. As a cost-saving measure, a number of temporary buildings were readapted for military use.

The historical record does not show that SRP was ever threatened by an air attack, so the guns were not used. Also, antiaircraft guns were considered an interim weapons system that would be replaced in the late 1950s by Nike antiaircraft missiles. The expense of upgrading the Site's defenses was weighed against the potential threat of attack, and the

Department of Defense opted to cancel the program. The two Skysweeper units at SRP were then disbanded.[95] Further construction related to the military program was canceled in 1957. Excess construction materials were transferred to Fort Gordon's Post Engineer, and work on the remaining gun sites within the Outer Ring of Defense was never completed. The Army discontinued use of the onsite facilities in 1960, and SRP management found new uses for the military buildings it had constructed.

The threat of air attack was in retrospect more perceived than real. The site-selection committee had done a thorough job, eliminating the chance of a military attack by virtue of the plant's geography. However, the installation of military units at the fledgling production site underscores its importance to the nation and brings into relief the tension and warlike atmosphere under which the site was constructed.

The last batch of concrete mixed by Kolinski Concrete Company, a firm under subcontract to Du Pont, occurred on December 31, 1954 at 221-H. On hand for the event were from left to right, M. J. Knopf, contracts supervisor; P. J. Masciocchi, assistant engineering office superintendent; R. M. Bigger, chief inspector, Contracts; B. W. Lewallen, Contracts; J. F. Coker, Kolinski superintendent at Savannah River; and W. C. Kidd, concrete control inspector for Pittsburgh Testing Laboratories. The truck driver on the far side is L. Prosser. During the three years the Kolinski firm worked at the site, it was reported that it batched 1,470,401 cubic yards sufficient concrete "to build a modern highway from SRP to Key West." At the close of the Kolinski subcontract, future concrete mixing at the site was handled by Du Pont. Courtesy of SRS Archives, negative 3745-8.

PROJECT CLOSES

The Savannah River Project lasted for five years. By the close of 1955, all areas were in operation. Seventy-five percent of the overall construction occurred in 1952 and 1953 during the 54-hour work-week phase when the construction force was at it's peak.[96] The plant was considered essentially complete by January 1, 1956, at a total cost of $1,065,500,500. The Dana Plant, or Project 8987, was also complete by 1956. Curtis Nelson passed control of the new plant over to Robert Blair, ending his five years at Savannah River. He moved on to Washington, where he became the first Director of the Atomic Energy Commission's Inspection Division, a division newly created under the Atomic Energy Act of 1954. Du Pont's Field Project Manager, Bob Mason, would also take his leave in 1955 with the close of construction, heading back to the Wilmington area. Don Miller would steer the plant during startup and first operations. Both Nelson and Mason would be invited back on numerous occasions to celebrate their accomplishments as the plant went into operation.

(Inset) Entry sign prior to closing of site area on December 14, 1952. Courtesy of SRS Archives, negative 6709-1.

At project's end, the plant area was transformed and a new identity rooted. This new identity became a force of change that spilled past the plant perimeter and into its surrounds. Savannah River's "one mighty force" needed to be housed, their children educated, and the community's needs met. This construction force came with families. The town of New Ellenton was born and Aiken, Augusta, North Augusta, Williston, and Barnwell begin periods of vigorous expansion and change. The area's politics and economy would shift as South Carolinians and residents of the CSRA eagerly adopted science and atomic energy as the way of their future.