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By Chris Maston 5/16/91
HA Hummer 5/16/91

HANFORD
MARCH 15, 1954 54346 DEL

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1953

at HANFORD

HANFORD ATOMIC PRODUCTS OPERATION
GENERAL ELECTRIC

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summary

Measure of achievements at Hanford in 1953 was the 38% increase in separated plutonium over the 1952 level. 1953's output was more than seven times that of 1947, the first full year of General Electric's operation of Hanford. Although much of this gain resulted from new reactors, some was due to improved safety devices, and much was due to increased knowledge of the controlling factors which permitted more efficient operation of old piles and better design of new ones.

Year-by-year reductions in the cost of converting uranium to plutonium tell the real story of progress at Hanford. The annual production gains could have been made by building many 1944 model piles, though at fantastic cost. Contrasted with this is the actual case -- a few new, improved piles plus more production from the old ones.

PLUTONIUM PRODUCTION

Another way to examine progress at Hanford is to compare production gains with changes in total operating costs. Comparisons show that output has risen much faster than operating costs.

This report documents the progress made by the Hanford Atomic Products Operations during 1953 in increasing production and lowering unit cost. Additional manufacturing data may be found in the annual report of the Manufacturing Department, HW-30466.

Slugs are removed
after mechanical
agitation in aluminum-
silicon dip pot.

metal preparation

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PRODUCTION

Preparation of jacketed fuel elements for pile charging reached new high levels in 1953. This record production, 40% greater than in 1952, was reached in spite of such difficulties as increasingly rigid manufacturing specifications, and in spite of canning some 16,000 tritium-producer slugs.

UNIT COST

As in the past several years, the unit cost of canning slugs was reduced -- down 25% from 1952. Employee morale entered into 1953's lower costs: output per man hour rose 50% after the metal preparation organization adopted its own personnel progression schedules. Costs were also lower due to elimination in May of the machining and scrap recovery operations. (Slugs are now machined at the Feed Material Production Center.) The increased manufacture of 8-inch slugs (89% of the total weight of slugs canned were of the eight inch size) also saved money.

Uranium slugs are received at Hanford after machining off-site.

SLUG QUALITY inspection

Ever higher pile power levels and the prospect of increased irradiation per slug placed more emphasis on the need for proper uranium crystal structure. They also emphasized the need for aluminum jackets that will not fail during irradiation. Therefore, quality control was improved through tighter inspection standards, better inspection techniques, and more efficient inspection procedures.

To exercise even more stringent quality control, nondestructive tests were developed at Hanford embodying new types of equipment with which all slugs soon will be tested prior to irradiation. Electromagnetic test equipment will detect jacket penetration by the aluminum-silicon bonding layer, offering increased corrosion protection. Radiographic equipment will detect voids in the braze material between cap and can and locate imperfect welds. Ultrasonic equipment will test whether the desirable random crystal arrangement was produced by the beta heat treatment.

improvement

Better slugs -- one key to increased production -- are continually sought. For example, tighter controls were established for manufacturing procedures; and vigorous efforts were made to reduce impurities in uranium slugs. Also, a new process has been developed to reduce slug deformation.

Improved procedures permit more efficient canned slug inspection.

Nondestructive slug inspection techniques were developed for better quality control.

Canned slug improvements are sought with experimental canning facilities.

mechanization

An experimental slug-canning machine -- which canned slugs equivalent to others canned manually -- was finished early in the year. Also, a prototype production model canning machine was fabricated off-site to Hanford design, and installed late in the year. Test canning of uranium with this machine is scheduled for early in 1954.

Prototype canning machine forecasts more precise canning process control through mechanization.

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Expansion of slug canning building will permit increased capacity.

EXPANSION

The two K reactors, now under construction, will require nearly 1,000 tons of canned uranium for startup and additional amounts for recharging. It was recognized that this load, plus supplying increasingly large amounts of uranium for recharging present reactors, would be too great for existing

metal fabrication facilities. Therefore, a \$7,000,000 construction program was started to provide new facilities. The building shell for the metal preparation addition was completed late in the year. Equipment installation is scheduled for completion about the middle of 1954.

With perfect "fit" insured by mock-up,
each graphite bar is destined for spe-
cific position in a K pile.

irradiation

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RAISED OPERATING LIMITS

Contributing to the increases in power levels was the changing of several operating limits as a result of better equipment and increased "know how." Improved instrumentation and more reliable control mechanisms, which will shut down the pile before the cooling water boiling point is reached, have permitted abolition of what is called the "excess header pressure limit" in certain process tubes. Maximum graphite temperature, raised to 410°C in 1952, was again raised -- to 460°C -- after extensive graphite studies. (Production testing at 500°C was underway at year's end.)

The virtual elimination of the excess header pressure limit and the rise in graphite temperature meant that the outlet water temperature became a limiting factor in power levels. Less corrosion with the new process water

allowed a five degree increase of this temperature. In addition, lower film-forming properties of the water reduced "down time" for purging and permitted sustained high flow rates. Additional production gains then came from increasing the water flow. (In December, 1953, the total flow through all reactors was 14% greater than in December, 1952.)

MODERATOR ATMOSPHERE

Limited amounts of helium were added to the pile gas in four of the reactors. Since these mixtures of gases carry off heat more efficiently than carbon dioxide alone, higher power outputs were possible without exceeding graphite temperature limits. (The change did not markedly aggravate graphite growth rates.)

Interior of "worn-out" pile process tubes are examined for corrosion and film formation.

Heat conductivity of selected gases is studied in search for greater reactor efficiency.

PRODUCTION

Reactor plutonium production in 1953 was

It is interesting to note that due to years of intensive development work, the two piles that operated during 1947 turned out more than twice as much plutonium in 1953 as in 1947.

Operation of the new C reactor for its first full year made the major contribution to the 1953 production increase. Higher power levels in all the reactors were of next greatest importance. Still another factor was the development of a new technique for charging and discharging "poison," neutron-absorbing slugs without shutting down the pile. (This technique was also used experimentally to discharge the uranium slugs from one tube.)

PERFORMANCE power levels

Power levels of all piles were boosted during the year. The largest of these occurred at C and H piles -- 54% and 36% higher, respectively, than at the close of 1952. The outstanding performance of C pile was due in large measure to the many improvements incorporated into the original design.

Neutron spectrometer yields physics data useful in improved reactor design.

FLATTENING

One of the early refinements of pile operation, called "flattening," increases the overall power output by the addition of "poison" slugs in the pile's central zone. This allows more power to develop in the fringe tubes. During 1953, flattening techniques were improved.

An even more significant method of flattening was afforded by "enrichment." This involves distribution of uranium 235-aluminum alloy slugs in the pile to further raise power levels. This was done at H pile where a production gain of about ten per cent was realized.

C PILE OUTPUT

Production increases during the year were most striking at C pile. Operation reached a point 74 per cent above the "name plate" power level rating.

Key to this performance was the use of selected central zone process tubes to pilot power level increases. As corrosion experience and slug performance proved acceptable,

tubes outside the test zone were also increased in power. This procedure was repeated again and again.

Enrichment contributed a lesser, but significant, additional increase.

slug performance and fuel developments

Slug performance during 1953 continued at the level reached near the end of 1952. (By that time ruptures no longer represented a serious loss of production.) Less than half as many failures occurred in 1953 as in the previous year. This is particularly significant in view of the higher pile power levels and increased severity of slug exposure conditions.

Major contributor to better slug experience was the use of eight-inch instead of four-inch slugs in a considerable fraction of the pile tubes. To reduce production losses by rapid detection of slug failures, an improved slug-rupture monitor was designed and a test installation made in one pile to date. This instrument, a gamma ray spectrometer, is more stable and sensitive than the older beta detection system.

Sensitive gamma ray spectrometer quickly detects slug ruptures.

New facilities permitted, for the first time, micro-structural comparison between "cold" (left) and irradiated uranium samples.

Even further improvement in slugs can be expected from the more precise knowledge of uranium behavior obtained at Hanford during the year. A direct relationship has been established between crystallographic orientation of the uranium and slug growth in the pile. (Slugs fabricated to give proper crystal arrangement do not change dimensionally during irradiation.) Other important findings include proof, through X-ray diffraction studies, that no permanent damage to crystallographic structure results from irradiation. Also, non-pile tests offered the possibility that slug central temperature may someday safely be raised above that now permitted.

New underwater testing facility permits detailed study of irradiated slugs.

Pile graphite samples are burned in a calorimeter to obtain "stored energy" data.

moderator behavior

Behavior of the graphite moderator in Hanford reactors has presented a number of major difficulties over the years. The problem of graphite expansion, which once threatened to shut down the piles, has long since been brought under control. Continued study indicated that under the present process specifications no serious operational difficulty will result from graphite distortion within the next five years.

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Another strange behavior of graphite, observed only in the operation of nuclear reactors, is the storage of energy. Although not desirable, this has been put to use at Hanford. Calorimetric measurements with samples of graphite mined from the piles provide data on pile temperature gradients and general moderator performance. (The possibility of a sudden release of damaging

amounts of such stored energy has been carefully considered. However, this appears to be very unlikely.)

pile control and repair

Sensitivity and reliability of pile instrumentation have been improved to provide increased safety, efficiency, and production. For instance, seismoscopes, which will shut down the pile automatically before an earthquake can damage the normal safety controls, were installed on all Hanford reactors. Also, installation in all piles of the "Ball 3 X" safety system, which uses boron steel balls as

Quick, accurate recordings of pile tube outlet temperatures are made automatically.

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Production increased despite "down time" caused by installation of "Ball 3-X" safety system in Hanford piles.

a last ditch shut down device, was completed in 1953. The approximately 150 pile-days of lost production due to installation and maintenance of this reactor safety system was considered well spent in light of the increased protection obtained.

While the reactors were shut down for Ball 3-X installation, necessary maintenance was scheduled. This included work on retention basins, replacement of tube and moderator thermocouples, and repair of reactor "downcomers," through which effluent cooling water leaves the pile.

SPECIAL OPERATIONS

special irradiations

Neutron bombardment to obtain special products or to test materials is an important activity at Hanford. There were more than 400 such special irradiations during the year with about half going to the Oak Ridge radioisotope distribution program.

Many of the remaining irradiations were in support of various AEC reactor programs. An example is the testing of reactor materials and fuel elements in the H pile's high pressure - high temperature recirculating water loop.

Reactor materials and fuel elements are tested remotely in H pile's recirculating water loop.

RADIATION HAZARD CONTROL

Improved procedures, increased emphasis on the wearing of protective equipment and detailed job instruction contributed to even better contamination and radiation control during 1953.

Discharge of reactor cooling water into the Columbia River creates potential hazards for aquatic life. Continued studies show that only in the immediate vicinity of the effluent discharge points are the chemicals and radioactivity from the cooling water dangerous.

The tremendous volume and turbulence of water in the Columbia soon disperses these high concentrations downstream.

Despite the temporary retention of the pile effluent, residual heat raises the temperature slightly in portions of the river. As power levels have gone up, it has been felt desirable to investigate the effects of this river-warming upon the life cycle of the Salmon. Such tests are currently underway in Hanford's new aquatic biology laboratory.

EXPANSION

The design rating of each of the new K reactors, originally set at 1300 megawatts, has been increased to 1800 megawatts because of the favorable performance of C pile. The reactors will have separate and independent, but interconnected, water plants. Shops, administration buildings, and other service facilities will be for joint use. Existing transmission, communication, and railway systems will be extended.

Scale model permits inside look at K pile.

Each K pile, now under construction, will operate at greatly increased production rate.

Such noteworthy aspects of the K plant scope as the greater capacity, smaller lattice spacing, and improved water plant were indicated in "1952 at Hanford Works." Significant design developments made during the past year include substitution of a more economical heavy concrete shielding material for the iron-masonite used in former piles; replacement of orifices by venturi tubes in the central pile zone; improved horizontal control rods; heating of the K plant buildings with heat energy recovered from the reactor cooling water; and use of a new type of vibration-free effluent downcomer.

As a result of the experience gained in building and operating existing reactors, very

significant cost savings are forecast for the construction and operation of the K reactors. For instance, the ratio of capital cost to megawatt output at a K pile will be only about 76% of that at C plant. Likewise, annual operating cost at K is expected to be about 51% of that at C, on the per megawatt basis.

Estimated total cost of the K project is \$173,000,000. The reactors and their buildings were designed by General Electric engineers while Architect-Engineers designed the associated facilities. The KW reactor is expected to be completed toward the end of 1954; and KE reactor some four or five months later.

Mock-up, scaled to 1/100 actual volume, guided design of K pile downcomer.

DUAL PURPOSE REACTOR PROPOSAL

Since General Electric first took over the operation of Hanford, it has continuously sought ways of radically reducing the cost of producing plutonium.

The increased output and more economical operation of the two K reactors will cut unit cost still more. There appears to be little hope that such conventional methods as increasing power levels will effect further major reductions in unit costs, although significant gross dollar savings may result. Power recovery has therefore been investigated, with attention centered on a "dual-

purpose" reactor to produce both fissionable materials and electric power. Evaluation studies during 1953 have shown that with such a reactor, plutonium unit cost may be further cut through sale of power. (Unit cost should get progressively lower as new developments are made in the field of power production.) Further developments may then lead to the operation of "power-only" reactors producing electricity at competitive cost.

Consequently, a proposal was made to the Atomic Energy Commission on October 13 that the General Electric Company develop, design, and place in operation at Hanford such a dual-purpose reactor.

separation, fabrication and recovery

New thermal
analysis equipment
adds to knowledge
of plutonium
metallurgy.

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separation

PRODUCTION

In 1953, 38% more plutonium was separated than in 1952. The Redox solvent extraction plant provided 88% of the total output. Only by an aggressive process and plant improvement program was it possible for the separation plants to keep pace with the mounting reactor output. Redox production rates of two to three times the design basis were reached by the end of the year.

PERFORMANCE plant improvements

Average monthly Redox production for 1953 was 85% greater than the 1952 average, which was nearly design capacity. Production rose from about 100% of design capacity to 246% during the year. These production gains resulted from changes in equipment, process and operating procedures.

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Redox plant production rates climbed to a new high in 1953.

For instance, three extraction columns were replaced with larger capacity units and adjustments in composition of solutions and changes in flow ratios were made. Also, the output of auxiliary facilities and process operations was expanded in step with solvent extraction capacities. (Uranium slugs now can be dissolved at nearly four times the design rate.)

hot semiworks

Development of two important Redox improvements was completed in 1953; and they were proven practical in the Hot Semiworks. As Redox flow rates were stepped up, the decontamination efficiency of the process fell off. To meet this situation, alteration was made on the treatment of feed solutions before the first solvent extraction cycle. Successful runs in the Hot Semiworks proved the merit of this plan and resulted in plant adoption. In addition, a plan to recirculate waste solutions from the second and third cycles was tested and accepted. This will effect annual savings of about \$1,900,000 through reduction in raw material consumption and waste storage needs.

Cell clean-up got underway at Hot Semiworks in preparation for change-over to Purex-type equipment.

self concentration

Of passing interest was an application of heat from fission product decay. Heat from the radioactivity in several Redox waste storage tanks was used to boil off water within the tanks, and concentrate the solutions. This provided additional waste storage space, and is expected to be a continuing economy.

Automatic, remote sampling of radioactive solutions in laboratory hood, preceding tests at Hot Semiworks, paved way for process improvements in Redox plant.

fabrication

PRODUCTION

Plutonium shipments in 1953 took three forms. Most, 67%, was shipped as finished weapon core assemblies; ten per cent went as raw metal "buttons," and the balance as plutonium nitrate. The total of these three streams was 34% greater than last year. (Excluding nitrate, the metal shipped was 22% more than in 1952.)

UNIT COST

Unit cost for fabrication was 38% lower than in 1952. This reflects increased production, shorter time cycles, shutdown of the rubber-glove line, and reduced labor and material costs.

WEAPON
CORE
PRODUCTION
and
UNIT COST*

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Addition of second machining hood permits concurrent production of two models of weapon-cores.

PERFORMANCE

Modification of the remote mechanical line, which completely replaced the rubber-glove line during 1953, increased its fabrication capacity. For example, a second machining hood was added which permits production of two core models at the same time.

Other modifications were aimed at process simplification. A single peroxide precipitation for Redox product replaced the two formerly needed to purify product from the bismuth phosphate plants. Combination of the reduction and casting operations into a single step has been investigated in the laboratory.

Gas pressure studies help insure safe shipment of plutonium solutions.

UO₃ PRODUCTION and UNIT COST*

uranium recovery

PRODUCTION

112 carloads of uranium oxide were shipped to other AEC operations in 1953. This returned 825 more tons of uranium to the AEC program than were received as metal at Hanford this year. Of the total returned, 60% came from underground storage tanks and the rest from Redox current production. A large fraction of the buried uranium has now been removed.

UNIT COST

The unit cost of the total uranium recovery operation was 57% of that achieved in 1952. Unit cost, which was relatively high during start-up in 1952, has been reduced month-by-month due to increased production and higher operating efficiency.

PERFORMANCE

tank farm

Difficulties early in the year with removal of uranium waste from the storage tanks limited the rate of uranium recovery. Improvement of tank farm equipment, availability of facilities at two more farms, and process changes boosted production by year's end.

TBP plant

Decontamination and purification of the thousands of tons of uranium removed from tank farms was the job of the TBP plant.

Its monthly production rate increased during the year and averaged 75% of the design basis. The rate varied from 46% to 106% of the design capacity due to tank farm difficulties, process trouble and equipment failures.

While the process in the TBP plant was adequate when handling 6 to 8 year old waste, it was inadequate to decontaminate the younger, more radioactive waste scheduled for recovery in 1954. Therefore, at year's end it was planned to join the two parallel production lines in series to provide two successive decontamination cycles.* To keep this from cutting production in half, the extraction columns were being replaced by new columns of double capacity. These columns are equipped with newly-designed swirl plate cartridges which are expected to reduce extraction losses from three and one-half per cent to less than one per cent.

* POSTPONED DUE TO IMPROVED DECONTAMINATION OBTAINED IN JANUARY 1954 SINGLE-CYCLE OPERATION WITH THE NEW SWIRL PLATE COLUMNS.

New "swirl plate" cartridge in extraction columns will greatly reduce uranium losses.

Process waste volumes have been reduced by using bismuth phosphate waste evaporators. Still further reductions appear possible through utilization of a scavenging agent to concentrate radioactive materials into a small volume.

UO₃ plant

As the UO₃ plant began receiving uranyl nitrate from the TBP plant, two problems arose. One of these, caking in the calcination pots, was brought under control by improved TBP operating conditions.

Foaming in the pots during calcination was a more severe problem. This was found to be caused by the presence of TBP (Tributylphosphate) and its decomposition products. Removal of these residues was effected by adapting one of the nitric acid fractionators to steam-strip the uranium nitrate solution. These changes plus a number of other improvements increased UO₃ plant capacity to 25% above design capacity.

Improved operation of calcination furnaces was one of many factors which helped boost UO₃ output.

During the first part of the year, it was necessary to send much of the recovered UO₃ to an intermediate plant for further purification before shipment to Oak Ridge. Revisions in the TBP process reduced the offending concentration of metallic impurities and decreased the nitric acid content of the final uranium solution. In turn, this lowered acidity reduced corrosion impurities in the UO₃ plant concentrator product stream. The net result of these changes was a purer and more reactive UO₃ powder. Tests were made at Oak Ridge to evaluate this improved Hanford product. As a result of this cooperative program, it was possible in the last half of the year to by-pass the intermediate purification operation and to ship UO₃ directly to Oak Ridge.

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RADIATION HAZARD CONTROL

In separation processes hazard control there were four fields of particular interest investigated during the year. These involved tritium, radioactive iodine, radioactive dust or fog particles, and liquid waste disposal.

Protection from tritium is especially difficult because both the element and its oxide diffuse readily. Both inhalation and absorption through the skin are potentially dangerous. Studies with animals are under way to find out more about this hazard. Meanwhile, monitoring of employee urine specimens warns of approach to exposure limits.

Research on the effects of radioiodine, which is discharged into the air by separation plants, was continued with sheep and started with pigs during the year. Injurious effects on sheep, previously noted at levels ranging from 1800 to 15 microcuries daily intake, have now been noted at five microcuries. However, injury due to iodine in the thyroid appears limited at this level, which is approximately 500 times the maximum permissible concentration presently established for man. Experiments at even lower levels have been initiated.

Surveys throughout the Pacific Northwest have been made routinely to determine the extent of spread of radioactive particles from Hanford separation plants. Satisfactory control of the problem is evident from the data, although contamination originating from nuclear detonations (both domestic and foreign) has complicated the monitoring.

Portable mast provides wide variety of meteorological data at chosen locations.

Re-evaluation of waste disposal practices has resulted in the cribbing of certain wastes formerly tanked, allowing millions of dollars worth of waste storage tanks to be reused. This relaxation of cribbing limits was based on new information about the rate of underground water movement and about rates of body absorption of plutonium.

ANALYTICAL INSTRUMENTATION

Production control by instrumental methods became more important during the year. For instance, instrumental monitoring was applied to the uranium recovery plant: in-line analyses are now made for uranium in the feed solution, for uranium in waste solution, and for gamma activity of the recovered uranium. By detecting an off-standard waste stream within 10 to 15 minutes, potential waste losses are reduced. In addition, the continuous monitoring saves much sampling and analytical time.

Similar improvements were made in methods of analysis for the laboratory. For example, coulometric titration, which makes quantitative analyses electrically, has been adapted to uranium, acidity, and plutonium analyses.

EXPANSION

Construction of the new Purex plant was started in April. This plant, together with the associated developmental and production facilities, is expected to cost about \$71,000,000.

Purex plant will help boost
Hanford production.

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When completed, Purex plant will help process increased pile output.

Operation of Purex column prototypes during 1953 led to improved separation equipment design.

These new facilities for separating plutonium and recovering uranium will more than double Hanford's plutonium separation capacity. The Purex plant is designed to separate plutonium from 200 tons of uranium per month. (This design permits even larger production rates through installation of larger capacity equipment.)

Full-scale prototypes of the key solvent-extraction pulse columns were tested with unirradiated uranium. As a result, pulse column cartridges were improved by inserting swirl plates into the columns at selected heights. This modification was also put into effect in the TBP plant.

Based on experience in the Redox plant, the Purex concentrators were redesigned to permit remote removal of the heat-transfer surfaces. This will reduce both repair costs and the probability of prolonged building shutdowns.

Completion of the current Redox expansion (Phase II) will increase capacity to about three times its 1952 level. Although the cost of this expansion will be about \$2,680,000, about \$4,500,000 will be saved in a two-year period through the earlier shutdown of the bismuth phosphate and TBP metal recovery plants.

Waste storage capacity is also being increased. This involves construction of fifteen 1,000,000-gallon buried tanks at a cost of \$3,300,000 and the addition of three waste transport lines to existing storage farms.

The additional UO_3 capacity needed to keep up with future uranium production requirements was met by the installation of two 60-ton-per-month calcination pots.

Greater Redox output increased the need for expanded waste storage facilities.

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Each of two new gas-fired calcination furnaces will exceed the output of three electrically-heated pots.

Goals of the Fabrication Building changes now underway are increased capacity and consolidation of its operations with those now conducted in the Isolation Building. Focal point of these changes is the Recuplex process which employs solvent extraction to recover plutonium from stored and future fabrication wastes; to purify all bismuth

phosphate product solutions, as well as off-standard solutions from Redox and Purex; and to decontaminate and load for off-site shipment Hanford's plutonium nitrate quotas. This Fabrication Building construction program, which will cost about \$2,040,000, is scheduled for completion late in 1954.

New Laboratory Area
consolidated Hanford's research
and development activities.

new supporting facilities

LABORATORY AREA

Completion of the new Laboratory Area near the end of 1953 marked a milestone in the program initiated in 1948 to make Hanford a self-sufficient production center. The program provided a group of modern laboratories for radiochemical, radiometallurgical, biophysics, pile, and fuel element studies at a budgeted cost of \$14,563,000. Supporting development shops and library reference facilities were also included.

The Library and Files Building, occupied in December, 1952, provides high-quality reference service for the plant and more efficient circulation, control and storage of classified documents.

New Radiometallurgy Laboratory provides vastly improved facilities for examining radioactive materials.

Vastly improved facilities for metallurgical examination of radioactive materials without excessive personnel exposure or spread of radioactive contamination are provided by the new Radiometallurgy Laboratory. Significant information regarding micro-structural changes in uranium fuel elements due to irradiation has already been obtained.

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Counting radioactive disintegrations is key step in wide variety of studies at new Biophysics Laboratory.

The Biophysics Laboratory was the other facility of the Laboratory Area placed in service early enough in 1953 to obtain significant results. Typical of the many studies under way in this new laboratory was an investigation of measurement techniques for low concentrations of tritium and tritium oxide.

The Mechanical Development Building, which is a service facility, was completed in September; both the Pile Research and Development and Radiochemistry Buildings were completed during December.

CENTRAL STORES

Completion of the new Central Stores Building in the middle of the year permitted consolidation into one centralized facility of the receiving, storage and disbursement activities formerly carried on in a number of widely scattered warehouses throughout the plant. The \$1,330,000 facility, which includes a central warehouse and two auxiliary buildings, totals 171,500 square feet of floor space, and provides room for some 45,000 items necessary to operate Hanford.

TRANSPORTATION CENTER

Ground was broken during July for the new Transportation Center located adjacent to North Richland. To be built at a cost of approximately \$2,750,000, the half-mile by 800-foot "lot" will contain a 90,000-square-foot main shop, a dispatcher's building, plus parking space for cars, trucks, buses and cranes. Completion is scheduled for August, 1954.

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At year's end,
production of
plutonium required
the services of
8523 GE men and
women at Hanford.

plutonium and people

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Since General Electric first assumed responsibility for operating Hanford, it has placed great emphasis on insuring continued and increasing production through fair and intelligent treatment of its employees; through offering them the same benefit plans for which all GE employees are eligible; and through providing them with healthful surroundings in which both to work and to enjoy their home lives. Without the thousands of men and women who actually operate Hanford and provide necessary services, not a gram of plutonium would be made.

The success of the Company's program is indicated by such figures as employment statistics, absenteeism and separation rates.

In addition, two plant-wide attitude surveys--one in 1952 and the other in 1953--showed that Hanford people like their work and think highly of their employer.

EMPLOYMENT

Getting people on the job--filling the need for employees as the need arises--is the first of many steps toward maintaining good relations with employees.

Employment applications usually are received as a result of visits by interviewers to state employment offices or educational institutions; or by applicants "walking in the door" at the GE employment office. In both cases, qualified people are stimulated to apply for work through recruitment advertising and through dissemination of news about Hanford throughout the Pacific Northwest.

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Satisfactory placement of new employees stems from private interviews with job applicants.

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Orientation sessions acquaint new employees with their jobs.

During 1953, these efforts, coupled with the Company's efforts to maintain its reputation as a good employer, resulted in 9357 job applications.

After interviewing by trained personnel interviewers, applicants are screened to further determine their desirability as employees as job openings occur. If the applicant "passes" this preliminary investigation, a more intensive search into his background is conducted by government agencies. Appropriate security clearances are then issued.

All new employees attend a three-hour orientation session during which they "get acquainted" with the Company, and obtain information to help them better fit into their jobs.

College graduates in scientific and technical fields may enter Hanford's Rotational Training Program. After training successively in

various plants, laboratories and engineering offices, these "tech grads" are better able to be placed in permanent positions on the plant.

PAY

Since pay is one of the prime considerations of all employees, the Company makes every reasonable effort to see that its employees are fairly compensated for the skill, care and effort they put into their jobs.

Contributing greatly to employees' pay satisfaction are the regularity and dependability with which they receive their pay. Efforts of accountants, clerks, payroll people and business machine operators were combined during 1953 to assure that nearly 6300 weekly and approximately 2200 monthly pay checks were drawn up accurately and distributed promptly.

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Prompt, accurate pay check preparation helps build employee morale.

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Insurance Plan claims benefiting employees and their dependents totaled 11,519 during 1953.

EXTRA JOB DIVIDENDS

An added measure of job security and satisfaction is offered Hanford people by General Electric's Employee Benefit Plans. A high percentage of all employees participate in these plans.

BENEFIT PLANS PARTICIPATION

PENSION PLAN	97%
INSURANCE PLAN	99%
SAVINGS and STOCK BONUS PLAN	46.2%

1953 SUGGESTIONS

SUGGESTIONS ADOPTED	699	22% of all submitted (GE average 13%)
AWARDS	\$13,090	Ratio 12:1 (GE average 17:1)
SAVINGS	\$108,000	Ratio 12:1 (GE average 17:1)

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SAFETY

An employee who feels safe from injury on the job is more efficient; and because of the vital nature of Hanford's product, it is especially important that every employee be on the job full time. For these, as well as humane reasons, a constant effort is made to operate Hanford safely and to continue to reduce on-the-job injuries.

Directed by the Central Safety Council, which includes each department manager, the over-all safety program emphasizes the personal responsibility of both supervisor and employee for safety. An intensive, year-round education program backed by safety engineers and equipment and by insistence on operation of safe plants has paid many safety dividends over the years.

Safety is an integral part of every job.

EMPLOYEE HEALTH

An extensive industrial medical program is carried on at Hanford primarily to keep Hanford people well so they may work profitably on their jobs. This program includes: preplacement and periodic medical examinations to make sure that each employee is physically qualified for his work and to detect symptoms of poor health; emergency medical care at dispensaries located in or near all working areas; investigation of suspected unhealthy working conditions; and health education through films, monthly health bulletins, group discussions, and medical staff contacts with employees.

Fire and Safety Engineers inspect work facilities regularly.

More than 1000 preplacement and 6500 periodic medical examinations were given during 1953.

Informative health bulletins are well-read each month by Hanford employees.

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Statistical analyses of absenteeism and injury figures made at Hanford last year showed that a small percentage of employees were responsible for a relatively large percentage of all absences and injuries. These employees with above average absence or accident experiences now receive special medical help and consultations.

EDUCATION and TRAINING

Opportunities for Hanford people to broaden their knowledge and capabilities, and to increase their potential for future assignments and responsibilities, are provided through employee training and educational programs.

An extensive on-the-job training program helps develop maximum leadership qualities at various levels of management and builds "team spirit" among all employees.

Since the training and development program was established four years ago, an average of 16 programs, from one to 40 hours' duration, have been conducted annually, with a cumulative attendance of more than 19,000 by the end of 1953.

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In addition, undergraduate and graduate-level college courses in scientific, engineering and business subjects are offered through GE's off-the-job Graduate School of Nuclear Engineering. An average of sixteen 19-week courses, many of which are recognized for credit by major Pacific Northwest colleges and universities, are conducted each School semester. Five employees earned master's degrees through the School in 1953.

UNION RELATIONS

General Electric Company's dealings with organized labor at Hanford represent another successful area of relations with employees.

There has never been a work stoppage resulting from a dispute between GE and unions representing Hanford's four bargaining units composed of approximately 4000 employees.

Helping to maintain a friendly atmosphere is a progressive grievance procedure through which all employees are encouraged to get their troubles "off their chests." Through this procedure, the majority of grievances are settled by discussion between employee and supervisor. Others are resolved in discussions with the Company's negotiating committee.

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The three Hanford unions signed new agreements with the Company in 1953--the first time the agreements had been re-opened. The new agreements preserve all the desirable features of the old, including the "no strike" clause. Such demands as union shop, severance and hazard pay, and guaranteed 40-hour week were brought up for discussion during friendly, relaxed and open-minded negotiations, but were not included in the new agreement.

New agreements signed in 1953 show harmonious relationship between GE and Hanford unions.

COMMUNICATIONS

Another important factor in building and maintaining good employee morale and enabling employees to do their jobs well is effective management-employee communications. In 1953, therefore, General Electric intensified its effort to keep Hanford people informed of matters that affect their jobs.

Information meetings led by section managers gave increased emphasis to employee communications program during 1953.

Communication to employees covered such matters as security, health and safety; Company policies; work procedures; improved or new facilities; suggestion awards; Company benefit plans eligibility and administration; and employee activities.

The GE NEWS is a popular medium of information to and about employees.

Written, visual and word-of-mouth information and exchange of ideas were facilitated through such media as employee information meetings, letters, booklets, posters, movies, sound-slide films and a weekly plant newspaper, the GE NEWS.

To assure a two-way flow of communications, employees were encouraged to voice to management their questions, opinions and

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objectives. This was done through an attitude survey, "talk it over" sessions between individual employees and their supervisors, and the question-soliciting "Can You Tell Me?" column in the GE NEWS.

COMMUNITY LIFE

community management

Realizing the importance of having a place for Hanford employees to live if they were to remain on the job and man the plant, the government built the community of Richland adjacent to the production areas. As part of its operation of Hanford, General Electric Company manages the community --home of 80 per cent of the employees. It provides necessary municipal services and administers the government's residential and commercial property, keeping Richland a pleasant, healthful place to live while preparing the community for future incorporation as a self-governing municipality.

The completion during 1953 of commercial buildings valued at \$483,000 and the establishment of 44 new businesses pushed total private investments in Richland's commercial buildings to \$3,370,000 and the number of businesses serving residents to 200. Also, 1000 new rental units, costing approximately \$8 million, were built by housing contractors, dealing directly with AEC under the Wherry Act. As a result of these new housing accommodations, the population jumped an estimated 3000 people to a total of some 28,500.

Although no increase in personnel was required to provide community service to these new Richlanders, some additions to the physical plant were necessary. During 1953, the Company began operating a new five-million gallon water reservoir, 28,000 feet of additional water mains, and five new wells to help meet the increasing demand for water made by the growing community.

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Occupancy of two housing developments completed in 1953 added approximately 3000 to Richland's population.

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In line with the policy of better defining Richland's municipal activities in preparation for future incorporation, the Company turned over to School District 400 for operation and maintenance most recreation areas adjacent to schools. It also established a new electrical utility unit--separate from plant operations--to serve Richland's more than 7000 residential and 300 commercial customers.

community health

That Richland is a healthy place to live is shown by a five-year health survey completed early in 1953 by the Medical Department. For example, death rates in Richland were found to be one-half those of the nation even after correcting for population age differences. Important factors influencing this high level of community health are the Company-managed public health service and hospital, and their coordination with the plant industrial medical program.

The fully-accredited, 109-bed Kadlec Hospital with 30 private practitioners on its staff offers medical, obstetrical, pediatric, and surgical care to Richland residents and other project-connected people. During 1953, the average stay for all patients except new-born babies was 4.5 days--compared with the estimated national average of 7.7 days. And since July 1944, when the hospital opened, there have been no maternal deaths in more than 6700 births.

The extensive public health activities include communicable disease control, maternal and child health work, sanitation inspections and guidance, social service counseling, and health education activities. During 1953, for example, public health nurses made 8477 field visits; 1762 sanitation inspections were made; 244 people were helped through social service counseling; and five series of classes for expectant parents were held.

Richland electrical unit extended service to 1000 new housing units during 1953.

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Public Health sanitarians periodically check Richland restaurants for complete compliance with state and county health standards.

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Mosquito control measures in and near Richland were carried out from March to September.

community costs

However, no government "out-of-pocket" expenditures were necessary during 1953 for the operation of those community activities which General Electric manages-- public works and utilities, police and fire protection, real estate administration, public health and

the hospital, civil defense, and public parks and library. Through careful planning, efficient organization, and economical operations, total expenditures were held to \$5,122,194. Total revenue of \$6,000,834 reflected the AEC's recent increase in dwelling rents.

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organization

ATOMIC PRODUCTS DIVISION

Francis K. McCune
General Manager
Atomic Products Division

Wilfrid E. Johnson
General Manager
Hanford Atomic Products Operation

Karl R. VanTassel
General Manager
Knolls
Atomic Power
Laboratory

D. Roy Shoults
General Manager
Aircraft
Nuclear Propulsion
Department

HANFORD ATOMIC PRODUCTS OPERATION

George C. Butler
Counsel

Douglas M. Johnson
Manager
Finance

Charles N. Gross
Manager
Employee and
Public Relations

Herbert M. Parker
Director
Radiological Sciences

W. Daggett Norwood, M.D.
Medical Director

William K. MacCreedy
Manager
Administrative Practices

Alden B. Greninger
Manager
Engineering

J. Emmett Maider
Manager
Manufacturing

Hendrik D. Middel
Manager
Plant Auxiliary Operations

Lewis F. Huck
Manager
Community Operations
and Real Estate

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