INDUSTRIAL RADIOACTIVE WASTE DISPOSAL

2947

HEARINGS

BEFORE THE

SPECIAL SUBCOMMITTEE ON RADIATION

OF THE

JOINT COMMITTEE ON ATOMIC ENERGY

CONGRESS OF THE UNITED STATES

EIGHTY-SIXTH CONGRESS

FIRST SESSION

ON

INDUSTRIAL RADIOACTIVE WASTE DISPOSAL

JANUARY 28, 29, AND 30; FEBRUARY 2 AND 3, 1959

Volume 1

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NOTE

This is Volume 1 of four volumes of the record of "Hearings on Industrial Radioactive Waste Disposal." It covers the portion of the hearings concerned with the origin and nature of various types of radioactive wastes evolved from nuclear energy activities and operations in use to manage these wastes at various AEC and other installations. Volume 2 deals with the first half of the current waste disposal research and development program. It describes and discusses the treatment and controlled dispersal of low and intermediate level wastes to the atmosphere, surface waterways, the ground, and the ocean and environmental investigations associated with this phase of the development program. Volume 3 covers the second half of the current waste disposal research and development program. It describes and discusses the handling, treatment, and proposed ultimate disposal systems for highly radioactive wastes that are primarily evolved from irradiated fuel reprocessing plants and discusses the future estimates and economics of disposal of radioactive wastes. It also includes a summary of environmental factors related to these estimates and a discussion of the industrial viewpoint of the radioactive waste problem. Volume 4 discusses the activities of Federal and State governmental agencies in radioactive effluent control and administrative relationships between these agencies. The international aspects of the problem are also dealt with in this volume.

11. Sanitary Engineering Aspects of the Atomic Energy Industry, TID-7517:

(a) E. J. Witkowski, "Operating Experience in the Disposal of Radioactive Wastes in Open Pits," p. 105.

(b) H. H. Abee, "Problems in the Burial of Solid Wastes at ORNL," p. 223.

12. K. E. Cowser, R. J. Morton, and E. J. Witkowski,(ORNL), "The Treatment of Large-Volume, Low-Level Waste by the Lime-Soda Softening Process," Proceedings of Second United Nations International Conference on the Peaceful Uses of Atomic Energy, UN-2354 or OIC-1504 (Sept. 1958).

13. "Process Waste Treatment Plant," AECU-3370.

14. "Process Waste Water Treatment Plant, Design Criteria and Operational Data," Burns and McDonell Engineering Company, Kansas City, Missouri, Job No. 55-15D.

15. F. E. Gillespie and R. E. Zedler (ORNL), "Continuous Water Monitor for Radioactive Wastes," Paper No. PNW-6-58, Instrument Society of America, meeting September 16, 1958, Philadelphia, Pennsylvania.

16. K. E. Cowser, "Selection of a Burial Ground Site at ORNL for Solid Waste Disposal," ORNL-CF-58-2-140.

17. R. E. Myers and D. R. Purdy, "Calculations for Unit Emissions of Air-borne Contaminants," U. S. Weather Bureau, Oak Ridge, Tennessee (unpublished).

18. D. M. Davis and A. D. Warden, Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee, "Air Activity Studies at Corryton and Kingston for Period January 1, 1952, through December 31, 1952." (unpublished).

19. K. Z. Morgan (ORNL), "Operating Equations and Procedures Involved in Water Counting at Site'X'," CH-2565 (January 1945).

20. J. M. Garner, Jr., and O. W. Kochtitzky, "Radioactive Sediments in the Tennessee River System," Journal of the Sanitary Engineering Division of the American Society of Civil Engineers, Vol. 82, Paper 1051, SA 4 (Aug. 1956).

21. W. D. Cottrell, "Radioactivity in Silt of the Clinch and Tennessee Rivers" (unpublished).

22. Dennis I. Krobf, "Studies of Radioactivity in Fish from White Oak Lake and the Clinch River," ORNL-1031.

Frank N. Browder, born October 29, 1920, in Montgomery, Alabama; B.S. in Chemical Engineering 1942 from Alabama Polytechnic Institute, Auburn, Alabama; chemical engineer in production and process improvement work at Huntsville Arsenal, Alabama, and Rohm and Haas Company, Knoxville, Tennessee, from 1942-1945; from 1945 to present served in research and development engineering in atomic energy field at Clinton Engineer Works - Tennessee Eastman Corporation (Y-12) and at Oak Ridge National Laboratory (X-10). From 1948 to present served as design engineer for ORNL and Idaho Chemical Processing Plant radioactive waste disposal systems.

STATEMENT ON WASTE MANAGEMENT AT THE OAK RIDGE AND PADUCAH PRODUCTION PLANTS

Logan B. Emlet, Manager of Production
Union Carbide Nuclear Company
Division of Union Carbide Corporation (see p. 523)

The purpose of this paper is to describe the manner in which radioactive waste management problems are handled at the production plants which Union Carbide Nuclear Company operates for the Atomic Energy Commission, radioactive waste being defined as comprising two categories: (1) contaminated material containing small quantities of uranium for which the cost of recovery would exceed the value of the material obtained, and (2) production tails; that is, relatively pure uranium compounds depleted in U-235. The term "disposal" includes (1) release to the environment, and (2) commission to storage for an indefinite period.

The procedures to be discussed are those involved in the collection, handling, processing, disposal and monitoring of the radioactive wastes generated. These wastes are of three types: liquids, solids, and gases. The liquids consist of mixtures of solutions of various types but primarily of raffinate, spent chemical solutions, and very dilute aqueous solutions originating from equipment cleaning operations. The solids are more diverse in nature, ranging from contaminated paper and floor sweeping compound to relatively pure material, depleted in U-235, which is committed to storage as hexafluoride and other forms. The radioactive waste gases are principally dilute uranium hexafluoride in stack gases, and dusts or mists from machining and chemical operations.

There are two principal considerations which influence the quantities of radioactive material released to the environment; namely, economy and safety, economy being the guiding principal provided that governing health and safety regulations are met.

The safety standards used are those published by the National Committee on Radiation Protection and adopted by the AEC (Manual Chapter 0550), establishing the maximum levels of radioactivity permissible in the atmosphere and streams affected by the operations, and on surplus and scrap materials released. It is our aim to combine the interests of economy and safety in such a way that the cost of our product is minimized and the environment both inside and outside the plant area is not impaired.

Existing operational methods and procedures are described separately for the three production facilities operated by our Company.

Waste Disposal at the Oak Ridge Gaseous Diffusion Plant

Waste disposal operations at the Oak Ridge Gaseous Diffusion Plant are concerned exclusively with uranium. The problem does not involve highly radioactive waste materials such as those associated with reactor operations. Most of the discard flows at this plant originate from process equipment cleaning operations. In addition to this, small quantities escape to the atmosphere in the form of uranium hexafluoride.

A map of the Oak Ridge Gaseous Diffusion Plant area is appended to show the location of operations which release wastes to the environment and locations where monitoring operations are performed. Those roads open to the public are indicated; numerous auxiliary roads restricted to authorized personnel are not shown.

Liquid Waste

The decontamination facilities for process equipment cleaning are designed to remove surface contamination through nitric acid scrubbing. This acid solution is then stripped of uranium through a sequence of extraction steps. The acid is reused in the decontamination step while the uranium is converted to oxide form for ultimate return to production cycles. This process operates essentially on a continuous basis. Therefore, the waste material flows associated with the process originate and are discarded on essentially a continuous basis. These discard flows are in the form of aqueous extraction column tailings (raffinate), condensate, spent acid, and rinse water.

Each of these discard flows is monitored routinely for uranium content. This means that a liquid sample representative of each discard batch is withdrawn for laboratory analysis. The frequency of discard batch generation is dependent upon operational needs, but, under normal conditions, will be in the order of 15 to 20 batches per day for all discard flows. Evidence of excessive uranium is defined as that quantity having an economic value greater than the cost of further recovery processing. In view of the dollar value associated with this material, particularly when enriched in the isotope 235, very small relative quantities become excessive. As the solutions become sufficiently depleted, they are discharged batchwise to the settling basin. The route of these flows is noted as Point A on the ORGDP map. The settling basin is an earth retained, open pit body of water approximately 50 yards wide by 100 yards long and averages about four feet in depth. The overflow water from the settling basin discharges to an off area flowing stream (Poplar Creek) which, in turn, empties into the Clinch River on the west side of the area. Downstream from the plant premises, the alpha activity of the water in the Clinch River is approximately 3.5×10^{-9} microcuries per milliliter, the range being about 2 to 5×10^{-9} microcuries per milliliter. This concentration is based upon samples withdrawn from the flow channel approximately one mile below the discharge point of Poplar Creek. Background

measurements for the Clinch River indicate an alpha activity of about 7×10^{-13} microcuries per milliliter. It is to be noted that the downstream uranium contamination in the Clinch River is well below the maximum allowable concentration of 7×10^{-6} microcuries per milliliter. This concentration is based on limits recommended by the National Committee on Radiation Protection (AEC Manual, Chapter 0524). Future discards are expected to be in the order of 17 millicuries per year. This activity will be contained in about 3,000,000 liters of solution which will pass through the settling basin before entering the off-area effluence. No increase in the present uranium burden of the Clinch River is expected. The alpha activity of the discard flows is expected to be about 5.5×10^{-6} microcuries per milliliter, which is below the maximum allowable concentration without the dilution effect of Poplar Creek.

Gaseous Waste

A second category falling within the definition of radioactive waste involves uranium hexafluoride. This effluence occurs as a discharge to the atmosphere at the location shown as point B on the ORGDP map, and originates from the conversion of uranium tetrafluoride to the hexafluoride form. The feed material for gaseous diffusion plants being uranium hexafluoride, uranium is processed to this form from oxides in feed manufacturing facilities. In the last processing step, the product, in the gas phase, is passed through a series of refrigerated traps where virtually all of the material is condensed. Because there are also noncondensable gases, such as nitrogen and oxygen, in this stream, it is necessary to maintain a vent to the atmosphere. A small amount of uranium hexafluoride escapes in this venting operation. These vent gases are sampled at eight-hour intervals to determine the amount of uranium passing to the atmosphere. Experience has indicated this flow to be approximately 0.7 millicurie per day.

Air samples within the plant control area are obtained over an eight-hour period every eighth day, at a fixed point indicated on the ORGDP map. The sampling station is located away from the effects of large buildings on air currents and near the downwind direction from the principal point of discharge of uranium compounds to the atmosphere. The average concentration found, 5×10^{-13} microcuries per milliliter, is below the maximum permissible concentration for use beyond the control area, 1.7×10^{-12} microcuries per milliliter, the limit recommended by the National Committee on Radiation Protection (AEC Manual, Chapter 0524).

Solid and Sundry Waste

In the course of diffusion plant operations, a great many commonly used materials become contaminated with uranium. These may be lubricants, such as hydrocarbon and fluorocarbon oils, absorbent paper, activated alumina,

and both metal and fiberboard containers. Because of the nature of the operation, there is generally a backlog of contaminated materials awaiting recovery. These materials consist of both solids and solutions. As such, these are not considered waste material, however, because some recovery can be accomplished. For example, combustibles are burned in specially adapted incinerators with the uranium remaining in the ash. Activated alumina is dissolved in nitric acid and metal containers are washed, the resultant solutions being passed through the recovery equipment. These instances are mentioned to point up the fact that while uranium may appear in many unusable forms, the ultimate discard to the environs, being a function of the decontamination and recovery process, is in the form of aqueous extraction column tailings, condensate, spent acid, or rinse water.

Part of the uranium oxides processed at ORGDP consists of material recovered from plutonium-producing reactors and contains minute quantities of fission products and plutonium. These constituents are retained in the feed plant ash. The major portion of the ash is stored in iron drums. One shipment was made to Oak Ridge National Laboratory for further recovery.

Instances occur when the contamination level of unserviceable equipment is excessive or when contaminated solid materials are accumulated which do not warrant recovery processing from an economic viewpoint. In these cases, the equipment or material is buried at the ORNL facility.

Unserviceable or surplus equipment having resale value is sold on an "as is" basis if security and contamination restrictions are met. In certain instances smelting may be performed to achieve decontamination. Equipment to be sold must meet the contamination limits set forth by AEC regulations (AEC Manual, Chapter 5170-1411, "Utilization and Disposal of Excess and Surplus Personal Property"). Material to be disposed by sale as scrap must meet the AEC regulations on scrap (AEC Manual, Chapter 5182-05, "Disposal of Surface Uranium-Contaminated Metal Scrap").

Waste Disposal at the Paducah Plant

The principal functions of the Paducah Plant are similar to those of the Oak Ridge Gaseous Diffusion Plant. It follows that the majority of wastes are similar in nature. The exceptions, for example solid waste from the Metals Plant at Paducah, are described in the text which follows.

A map of the Paducah Plant and the immediately surrounding area is appended, showing the tributaries to the Ohio River which receive the liquid effluents from the plant, and the locations where monitoring of the drainage water is performed. The solids waste pit and cylinder storage yard for uranium hexafluoride are also shown.

Liquid Waste

Effluents containing radioactive waste materials come primarily from three sources: the Decontamination and Recovery Building, the Feed Plant, and the Metals Plant. Filtrate from uranium precipitation processes, aqueous extraction column tailings, and miscellaneous sources of uranium-contaminated water are conducted directly into one of two creeks which lead to the Ohio River. The radioactive waste effluents from the Decontamination and Recovery Building and the Feed Plant are directed to a branch of the Little Bayou Creek via an open diversion channel. The uranium-bearing effluent from the Metals Plant enters the Little Bayou Creek by a pipe line directly east of this facility. The Little Bayou as well as the Big Bayou Creek carries other Plant waste waters in addition to run-off from a large area as can be seen on the map.

The Big and Little Bayou Creeks are monitored for uranium content at points marked A, B, and C. Samples are obtained weekly at points A and C and monthly at point B. Average uranium concentrations in activity units obtained from point A are 5×10^{-8} microcuries per milliliter; point B, 1.1×10^{-8} microcuries per milliliter; and point C, 1.2×10^{-7} microcuries per milliliter. These are well below the maximum permissible concentration recommended by the National Committee on Radiation Protection which is 7×10^{-6} microcuries per milliliter beyond the control area (AEC Manual, Chapter 0524).

Part of the feed material at the Paducah Plant consists of uranium compounds recovered from plutonium-producing reactors, and contains minute quantities of residual fission products and plutonium in concentrations so low that the oxides from this source can be handled as any other uranium oxide. These contaminants are separated from the uranium in the uranium hexafluoride manufacturing plant and eventually, in the course of recovery and decontamination processes, are discarded in the aqueous waste streams from the Plant. The concentration of fission products and plutonium in the creek carrying these wastes is well within the maximum permissible concentration recommended by the National Committee on Radiation Protection (AEC Manual, Chapter 0524).

Gaseous Waste

There are two vent stacks in the Plant which vent systems handling uranium hexafluoride. These ventsdischarge approximately 1.75 millicuries per day of uranium hexafluoride to the atmosphere in the course of Plant operations. The major source of discharge occurs in the processing of uranium tetrafluoride to uranium hexafluoride. The uranium hexafluoride is removed by condensation in refrigerated traps for subsequent transfer to shipping containers. A minute portion, however, does not condense but is carried through the refrigerated traps with a flow of lighter gases such as nitrogen and oxygen. These gases discharge through a fluid bed absorber prior to being vented to the atmosphere. The other source of discharge occurs from the inclusion of minute traces of uranium hexafluoride in the venting of light

gases from the top of the gaseous diffusion cascade. These light gases are inadvertent diluents such as air and are separated from the uranium hexafluoride in the cascade and vented to the atmosphere.

While 1.75 millicuries per day of uranium hexafluoride is extremely small and represents no health hazard, it is our policy to continuously strive to reduce the uranium losses to negligible monetary losses. A more efficient absorber unit is presently being designed to further reduce the discharge of uranium hexafluoride to the atmosphere to approximately 0.25 millicuries per day.

Monitoring of the air inside the control Plant area has repeatedly shown no contamination above background by alpha counting continuous samples taken over an 8-hour period. Also an air sampling program was conducted to obtain samples around the clock inside the control area for photofluorimetric determination. The highest value found was 1×10^{-13} microcuries per milliliter of air. This is well below the maximum permissible concentration recommended by the National Committee on Radiation Protection which is 1.7×10^{-12} microcuries per milliliter beyond the control area (AEC Manual, Chapter 0524).

Solid Waste

Solid radioactive waste materials from which it is presently uneconomical to recover the uranium are being stored in an open pit that was formerly used as a holding pond for waste solutions. The pond was drained of its liquid content and now provides approximately 350,000 cubic feet of open storage space for solid waste materials from the Metals Plant. The major types of waste material containing uranium are crucible "burn-out" from the casting operation, sawdust from the ingot cutting operation, vacuum cleanings from various areas and magnesium fluoride slag from the metal reduction operation. The uranium contained in these solid wastes presently has no value and there are no plans for recovery. Since the uranium metal and compounds contained in these waste materials are relatively insoluble and since the subsoil is a dense clay, the uranium will not leach away into ground water. Periodically, the pond will be drained of accumulated rain water to one of the creeks. A recent analysis of the water in the pond indicated 1.3×10^{-6} microcuries per milliliter.

Ash or residue from the manufacture of uranium hexafluoride is sometimes stored temporarily in drums for recycle during periods of low feed availability. This type of activity is not considered a waste disposal problem as previously defined.

The quantities of uranium hexafluoride from which the U-235 has been stripped is stored in cylinders. This material will be stored indefinitely as the hexafluoride and other forms.

Waste Disposal at the Y-12 Plant

At the Y-12 Plant wastes are generated during the fabrication of nuclear weapon components and in the process of recovery of uranium from a wide variety of materials for other Commission contractors. The many and diverse operations involved generate a number of different types of wastes which may be either liquid, solid, or air-borne materials. These wastes are such that it is not necessary to process them merely for reduction of volume or level of radioactivity prior to storage or disposal. The one exception to this is some used equipment or materials which may require decontamination to permit their sale to the general public as salvage or excess.

A map of the plant area is appended showing the locations where wastes are released to the environment and the locations where monitoring operations are performed.

Liquid Wastes

Liquid wastes consist of solutions containing small concentrations of uranium, the recovery of which is not economically feasible. These wastes may be spent process solutions -- raffinates, supernatants, pickling and plating solutions; or they may be wastes from decontamination or cleaning operations, housekeeping procedures, etc.

Liquid wastes are pumped or drained to the disposal areas via pipelines. In some temporary situations they may be transported by tank truck. The major portions of the wastes are carried via the process sewers and released into the East Fork of Poplar Creek. The alpha activity of these liquids is less than 6×10^{-4} microcuries per milliliter before dilution and less than 4.5×10^{-7} microcuries per milliliter after dilution in the stream within the control area. It is noted that the East Fork of Poplar Creek joins another stream to form Poplar Creek which then passes through the ORGDP area and empties into the Clinch River. Thus, activity measurements of water samples downstream from ORGDP reflect the release of wastes from both ORGDP and the Y-12 Plant.

The more concentrated chemical or acid solutions, such as spent, pickling, or plating solutions, are disposed of via pipeline to settling basins west of the Y-12 Plant area. The earthen dikes of these basins permit no above-ground release of the impounded wastes or influx of ground waters. Evaporation provides adequate control of the liquid level. Alpha activity of the impounded liquids is less than 7.2×10^{-2} microcuries per milliliter.

The two streams which drain the Y-12 valley, Bear Creek and the East Fork of Poplar Creek, are sampled to monitor the release of radioactive liquid wastes to the environment beyond the control area. Sampling points are

indicated on the appended map. The sample from the East Fork of Poplar Creek is a weekly composite of daily samples. This stream, which is the larger of the two and traverses the length of the plant area, carries the major portion of the Y-12 Plant liquid wastes. The sample from Bear Creek is a once a week spot sample. Bear Creek rises to the west of the plant area and flows west. Its content of radioactivity possibly is suggestive of the gradual release of contamination from the settling basins, burning ground, and burial ground which are to the west of the Y-12 Plant. Samples from both of these streams are analyzed for both alpha and beta emitting radioactive materials. The levels of activity in these samples have been consistently less than the maximum permissible concentrations recommended by the National Committee on Radiation Protection and Measurement for water beyond the control area.

Solid Wastes

Solid wastes consist of contaminated used processing equipment and materials, contaminated trash and process residues, all of which may contain uranium in concentrations so small that further attempts at recovery are uneconomical. Solid wastes are routed to contaminated material storage areas, the decontamination and smelting area, Y-12 burning ground, the Y-12 burial ground, or the ORNL burial ground.

Contaminated combustible solid wastes having an alpha activity less than 10,000 disintegrations per minute per 100 square centimeters of surface area are burned in the Y-12 burning ground. Experience has shown that the burning of materials contaminated to this extent does not generate significant air-borne radioactivity. Combustibles, which are contaminated above this level, are buried.

Contaminated solid wastes having alpha activity less than 7×10^{-2} microcuries per gram are buried at the Y-12 burial ground. Wastes known to be contaminated with plutonium or thorium and those wastes having alpha activity greater than 7×10^{-2} microcuries per gram are sent to the ORNL burial ground.

Used contaminated equipment and/or materials are sold to the general public through property sales outlets. Items released to the public in this manner are considered to be excess or surplus and must fall within the contamination limits set forth in AEC Manual Chapters. Equipment and materials may require cleaning or decontamination to comply with the limits of subsection 5170-1411. Those items which cannot be decontaminated to within these limits may be either retained in contaminated storage areas or disposed of in one of the burial grounds. Certain types of metal scrap are released to the public if they meet the contamination limit requirements of Manual Chapter 5182-05. Some scrap metals contaminated with uranium in excess of the above limits are decontaminated by smelting as set forth in AEC Manual Chapter 5182-052. Slag from the

smelting operation is the final waste which contains the uranium contamination; it is buried in the ORNL burial ground.

Air-Borne Wastes

The air-borne materials released to the atmosphere within the Y-12 Plant are principally the uranium-containing dusts and mists from mechanical and chemical operations with small amounts of gaseous uranium hexafluoride from reduction operations. These atmospheric contaminants are actually minute concentrations of process material in off-gases after filtration and air cleaning equipment rather than wastes which must be disposed of. Sampling of these off-gases is performed at the several stacks to help estimate and control material loss.

Three outdoor air sampling stations are operated 24 hours per day, seven days per week, to monitor the radioactivity content of the atmosphere within the Y-12 Plant area. The location of these three samplers is noted on the appended map. The prevailing winds of the area blow from the uranium processing areas toward these three stations. The level of radioactivity in samples collected at these stations has been consistently less than the maximum permissible concentration of uranium in atmospheres beyond the control area (1.7×10^{-12} microcuries per milliliter), the limit recommended by the National Committee on Radiation Protection and Measurement.

Logan Bond Emlet was born on February 8, 1913, at New Oxford, Pennsylvania. He attended Dickinson College at Carlisle, Pennsylvania, where in 1935 he received a Bachelor of Science Degree in the field of Chemistry. He then attended the University of Pennsylvania, where he received a Master of Science Certificate in Chemistry in 1936.

Mr. Emlet was employed by E. I. duPont de Nemours & Company from 1935 to 1946. During his employment he held various positions in production supervision at duPont installations in Wilmington, Delaware; Pennsville, New Jersey; Gibbstown, New Jersey; Kankakee, Illinois; Chicago, Illinois; and Oak Ridge, Tennessee.

Mr. Emlet's work in the field of atomic energy began with his assignment by the duPont Company to the University of Chicago Metallurgical Laboratory in January, 1943. From there he was transferred to the Oak Ridge National Laboratory at Oak Ridge, Tennessee, and in 1946 he resigned his position with the duPont Company in order to remain in atomic energy work with the Monsanto Chemical Company at Oak Ridge. He was employed by Monsanto from 1946 until 1948, when the Union Carbide Nuclear Company assumed operation of the Oak Ridge National Laboratory. Mr. Emlet has continued in atomic energy work with Union Carbide since that time.

During his 16 years in atomic energy work, Mr. Emlet has held the following positions:

1943 - 1948:	**Supervision of operation of the Graphite Reactor, Oak Ridge National Laboratory, Oak Ridge, Tennessee**
1948 - 1950:	**Operations Division Superintendent, ORNL (Union Carbide)**
1950 - 1952:	**Executive Director, ORNL (Union Carbide)**
1952 - 1953:	**Superintendent, Y-12 Production Plant (Union Carbide)**
1954 - Present:	**Manager of Production (for the three atomic energy production plants operated by Union Carbide Nuclear Company at Oak Ridge, Tennessee, and Paducah, Kentucky.)**

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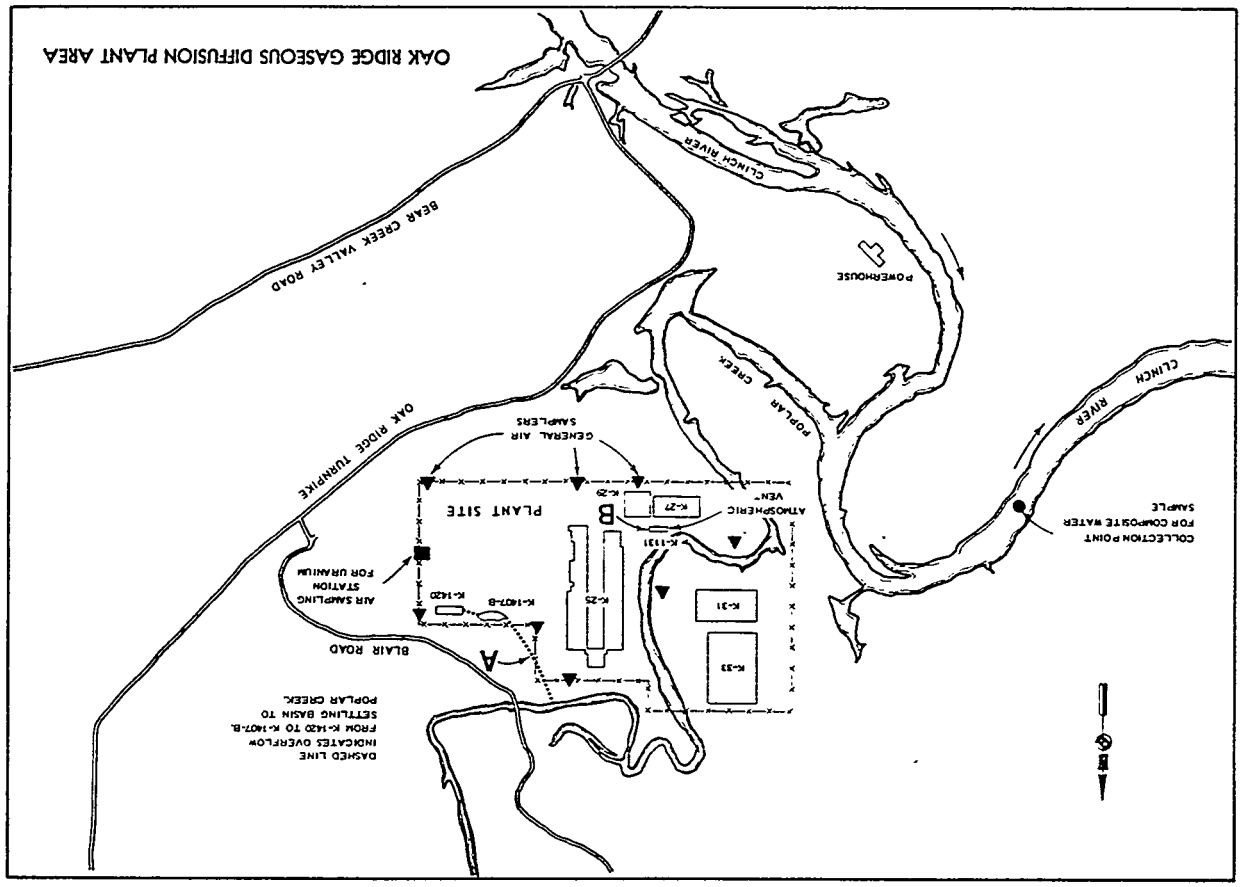
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CLINCH RIVER
POWERHOUSE
POPLAR CREEK
CLINCH RIVER
OAK RIDGE TURNPIKE
GENERAL AIR SAMPLERS
PLANT SITE
ATMOSPHERIC VENT
K-27
K-29
K-1131
K-25
K-31
K-33
K-1407-B
K-1420
AIR SAMPLING STATION FOR URANIUM
BLAIR ROAD
A
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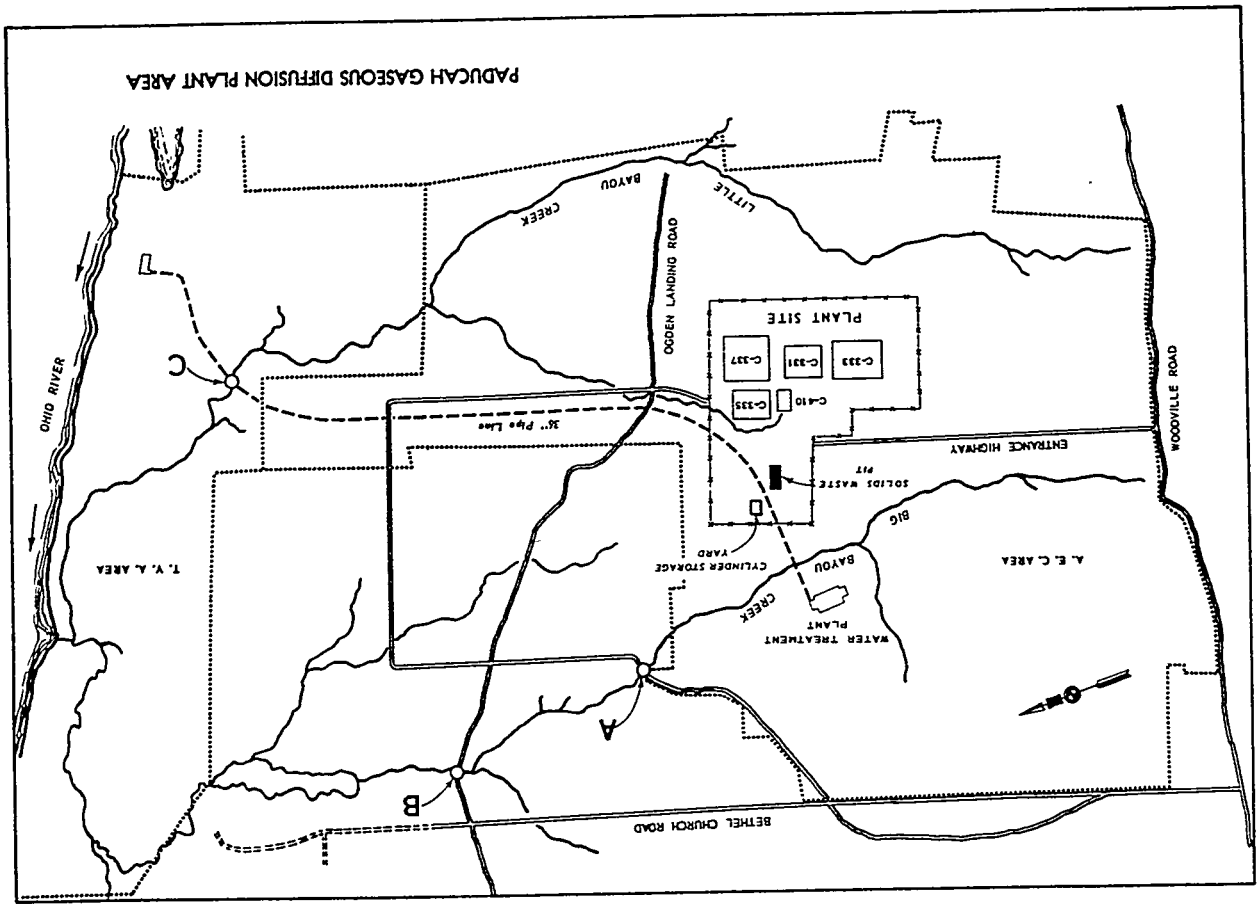
COLLECTION POINT FOR COMPOSITE WATER SAMPLE
DASHED LINE INDICATES OVERFLOW FROM K-1420 TO K-1407-B SETTLING BASIN TO POPLAR CREEK.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A. E. C. AREA
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WOODVILLE ROAD
ENTRANCE HIGHWAY
OGDEN LANDING ROAD
LITTLE BAYOU CREEK
BIG BAYOU CREEK
WATER TREATMENT PLANT
CYLINDER STORAGE YARD
SOLIDS WASTE PIT
36" Pipe Line
PLANT SITE
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C-410
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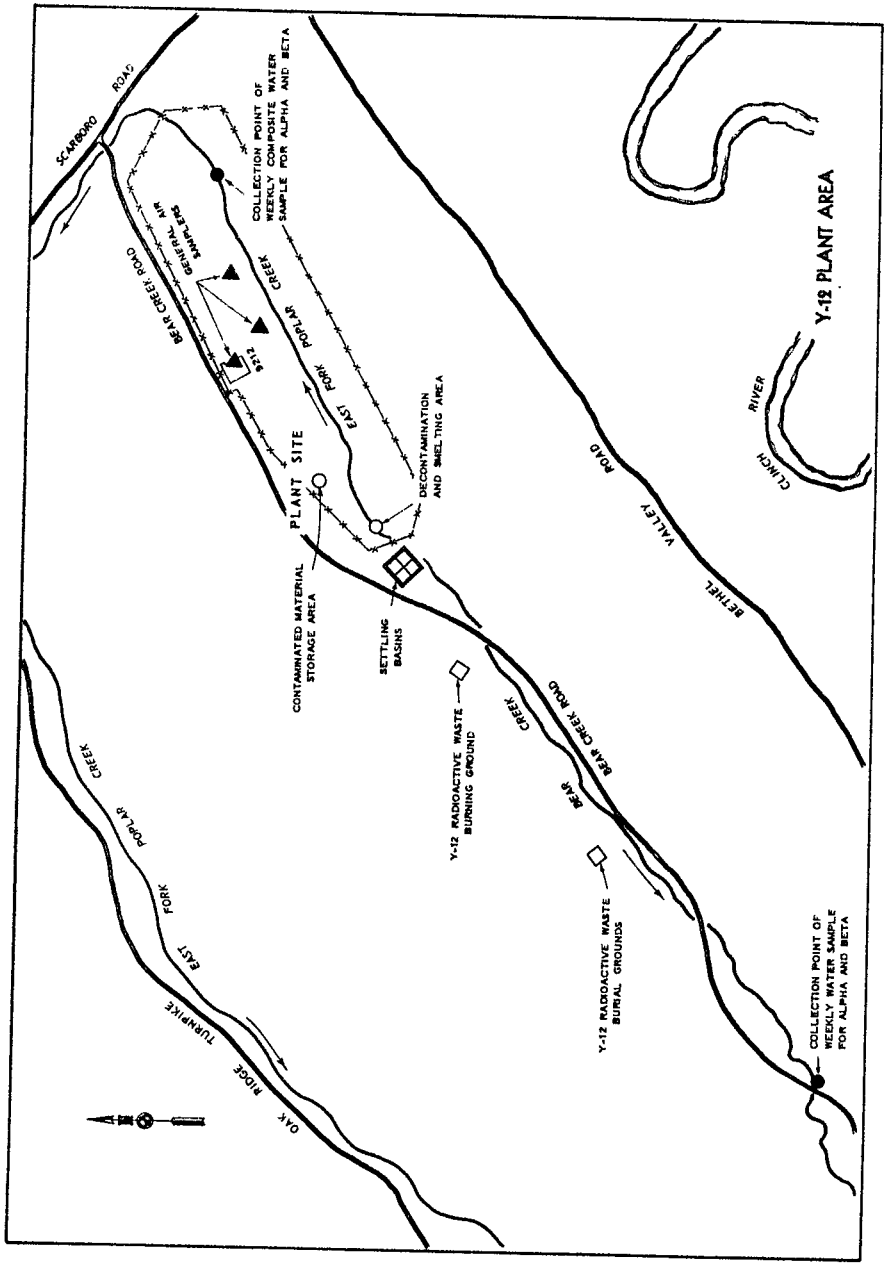

Part I of Two Companion Papers

under the general heading --

"TREATMENT PLANT FOR REMOVAL OF RADIOACTIVE CONTAMINANTS FROM PROCESS WASTE WATER"

Part I "Engineering Design Features"

Mark C. Culbreath, m. ASCE, Principal Engineer, Burns and McDonnell Engineering Company, Kansas City, Missouri.

So far as is known this plant, located at Oak Ridge National Laboratory, is the first full scale unit of this type adapted for treatment of low level radioactive wastes, particularly for the removal of strontium.

Design Criteria

It is required to reduce the radiation activity to a level that will not exceed the acceptable standards for discharge into White Oak Creek and the Clinch River.

1. Treatment Requirements:

The treatment plant conforms very closely to that of a standard water softening plant, having the usual water softening equipment and using the usual water softening chemicals. The plant was designed with the requirement that it would be possible to reduce the calcium carbonate content to 30 to 35 ppm with a maximum of 50 ppm. Provision is made for feeding hydrated lime, soda ash, calcium chloride, clay and tri-sodium phosphate.

The plant influent will have a wide fluctuation in the pH value with a possible low of 2 and a possible high of 10.

The plant was designed with one treatment line capable of treating

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* Paper presented at the annual meeting of the American Society of Civil Engineers, October 13-17, 1958, New York, New York. Published in Journal of the Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 85, 1959.