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SUBJECT Uranium Authorized Limits For the DuPont Site

FROM Johnson, A TO Kirk COMM DATE 3/27/97

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United States Government **Department of Energ**

memorandum

DATE: MAR 27 1997

REPLY TO ATTN OF: EM-42 (W. A. Williams, 301-903-8149)

SUBJECT: Uranium Authorized Limits for the DuPont site, Deepwater, New Jersey

TO: R. Kirk, OR

This is in response to the request for approval of uranium guidelines for the DuPont Site of the Formerly Utilized Sites Remedial Action Program (FUSRAP), pursuant to Department of Energy (DOE) Order 5400.5. This site is located in Deepwater, New Jersey, and was used by DOE's predecessor for production and recycling of uranium compounds. Your staff requested approval of a residual uranium authorized limit of a 500 pCi/g authorized limit for the central drainage ditch, with a 100 picoCuries per gram (pCi/g) of total uranium for the remainder of the site. This recommendation was made based on a draft supporting analysis by Argonne National Laboratory (ANL) and a brief rationale for the recommendation.

Basic Dose Requirement:

The DuPont Site is located in an industrial area near Deepwater, New Jersey. The site is an enormous tract used for chemical production and processing, and known as the "Chambers Works." The site is immediately adjacent to the Delaware River; it extends northward from the Delaware River Bridge and Interstate Route 295 approximately one mile. Only a small portion of the site was affected by the activities of the Department's predecessors.

The draft ANL analysis calculated a maximum residual concentration of total uranium in soil of 1100 pCi/g for the current industrial use (Scenario A). This concentration is equivalent to 30 millirem per year, the dose constraint for current or likely use of land proposed in 10 CFR 834.

A similar calculation for future residential use of the property (Scenario B) yields a maximum uranium concentration of 1300 pCi/g. Based on the unlikely nature of this exposure scenario, the 100 millirem per year limit in DOE Order 5400.5 and in proposed 10 CFR 834 is used.

The possible agricultural use of the site in the future must be also considered. Scenario C examines this use, and assumes a resident farmer will:

(1) reside at the site after cleanup;
(2) drink water from an on-site well;
(3) eat plant foods grown in the decontaminated area;
(4) drink milk and eat meat from cattle grown on the site;
(5) eat seafood from an on-site pond; and
(6) ingest 100 milligrams per day of soil at the site.

These assumptions are very unlikely but may be plausible in the distant future. The calculated maximum uranium concentration, using these assumptions, is 580 pCi/g. This calculation is also based on a 100 millirem per year dose limit, as required in DOE Order 5400.5 and proposed 10 CFR 834.

The recommended 100 pCi/g guideline is about 3 millirem per year for an industrial worker (Scenario A in the draft ANL Report). For residential and subsistence agricultural use, the recommended guideline is approximately 8 and 17 millirem per year (Scenarios B and C, respectively).

Based on the draft ANL analysis, the recommended value of 100 pCi/g of total uranium is within DOE's dose guideline of 100 millirem per year, which must be met under all worst case, plausible scenarios, including the assumed subsistence residential use. The recommended level of 100 pCi/g also meets the constraint of 30 millirem per year for current or likely land use, as proposed in 10 CFR 834.

The recommended level of 500 pCi/g also meets the basic dose limit of both DOE Order 5400.5, Chapter IV and proposed 10 CFR 834. In this case, the areal extent of the residual uranium is limited and the higher limit can be justified by the background levels in the adjacent areas.

As Low as Reasonably Achievable (ALARA) Analysis:

In addition to meeting the basic radiation protection guideline, any cleanup guideline must be analyzed to keep exposures ALARA. The ALARA analysis in the request stated that reducing the soil guideline to the recommended level of 100 pCi/g would increase the volume of soil and other costs relating to the remediation effort. Further reductions in the uranium guideline will significantly increase post remedial survey and verification costs. These costs include detailed sample preparation, a much larger number of soil samples, smaller grids for soil sampling, use of more sophisticated equipment, longer counting times on detectors, slower sample turnaround, and significant increases in time and cost. Further reductions in the guideline would increase costs substantially.

The separate authorized limit for the central drainage ditch requires special comment. This area has chemical contamination, and its remediation is being conducted by DuPont using a movable enclosure. The nature and extent of the chemical contamination justify a separate limit for uranium to minimize chemical exposures to DOE personnel. The alternative to this limit is to participate in DuPont's excavation with personnel in fully encapsulated personal protective equipment, at costs well above any conceivable benefit. As pointed out in the recommendation, the advantage of the higher authorized limit is that hand held instruments can detect uranium at this level and this advantage facilitates remediation of the chemical contaminants. It is also expected that much of the uranium would be removed during the course of the remediation for chemicals.

In the application of ALARA, practical considerations are also taken into account. For practical considerations, it is likely that the contaminated areas will be cleaned up to a level below whatever guideline is established. This is likely for two reasons. First, in order to remove all material above the guideline, some soil contaminated below the guideline will be removed. This will have the practical effect of lowering the guideline as it is applied during cleanup operations. Second, during cleanup operations, it is difficult to precisely delineate the point at which contamination above the guideline ends. As a result, remedial personnel will remove suspect materials to avoid repeated cleanup operations in the same area. For these reasons, it is likely that cleanup will be accomplished at some level lower than the approved cleanup guideline.

A final practical consideration is the use of clean fill material to replace excavated materials. This will cause a shielding and covering effect on the remaining soils, reducing gamma ray and dust. Further, the clean fill would reduce the projected doses by diluting any residual contamination. The draft ANL analysis does not assume that there is any clean fill or cover placed over the site after cleanup. For this reason, the doses calculated in the draft ANL report are clearly a worst case scenario. In the actual application of a cleanup guideline, it is very likely that a cleanup level substantially below the established guideline will be achieved.

A review of the draft ANL report indicates that one significant pathway for all scenarios is via inhalation of contaminated dust. The mass loading factor used for airborne dust in the calculations (100 micrograms per cubic meter) is higher than would be expected for respirable particles at the site under ambient conditions. This estimate reflects the level of airborne dust expected from plowing or digging in the soil. Such a high dust load is unlikely on a continual basis, and it very unlikely that all of the soil at this level would be of a respirable particle size. There are a number of other sources of uncertainty and conservatism in the dose calculations; these are briefly summarized on pages 14 and 16 of the draft ANL report.

Summary and Approval:

Based on the above considerations, a site-wide authorized limit of 100 pCi/g for total uranium above background levels is approved for use in the cleanup of the DuPont Site, pursuant to DOE Order 5400.5, Chapter IV, Section 5a. A separate authorized limit of 500 pCi/g is approved for the central drainage ditch. The authorized limits are to be the average concentration of residual on a 10 meter by 10 meter gridblock. "Hot spots" shall use the applicable criteria set forth on page 18 of the draft ANL report.

We will provide comments on the draft ANL report separately. Please provide ANL with post-remedial action data to permit the preparation of another dose estimate report to reflect the actual doses after completion of the cleanup. We also recommend that your staff discuss the site characterization data and the approved guidelines with the DuPont staff, regulatory agencies and other stakeholders at an appropriate time.

Albert S. Johnson
Team Leader
FUSRAP Team
Office of Eastern Area Programs
Office of Environmental Restoration

cc: R. Atkin, DOE/OR
A. Wallo III, EH-232
C. Yu, ANL
D. Dunning, ANL
R. Foley, Oak Ridge National Laboratory (ORNL)
M. Murray, ORNL

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1.0 EXECUTIVE SUMMARY

This remediation plan (RP) presents the conceptual plan to meet the requirements of the Administrative Consent Order (ACO) with the New Jersey Department of Environmental Protection and Energy (NJDEPE) for the Process Water Ditch System (PWDS) and is being submitted to the NJDEPE for review and approval.

The PWDS is a system of ditches distributed throughout the plant with a total length of 25,500 feet (approximately 4.8 miles). In the past, the PWDS conveyed the following streams to the plant basin and later to the Chambers Works Wastewater Treatment Plant (WWTP):

- Process wastewater
- Noncontact cooling water
- Stormwater runoff
- Recovered groundwater from the interceptor well system (IWS)

In the present configuration, the ditch conveys noncontact cooling water and storm-water runoff to the WWTP, and storm-water runoff surges are rerouted to B Basin via a spillway.

The sludge that has accumulated in the PWDS and the soil surrounding the ditches are contaminated with a variety of volatile organic compounds (VOCs),

semivolatile organic compounds (SVOCs), and metals. The predominant compounds are

- Chlorobenzene (CB).
- 1,2-dichlorobenzene (ODCB).
- Lead.

Nitronaphthalene (NN)- and dinitrobenzene (DNB)-impacted areas were identified in the closure plan. These impacted areas have been investigated and characterized.

Treatability studies were conducted to evaluate potential remedial technologies for PWDS sludge and soil. Section 4.0 summarizes the findings and conclusions of treatability studies which were performed to evaluate the following areas:

- Sludge
- DNB-impacted sludge
- NN-impacted sludge
- Soil

The PWDS remediation will consist of the following four components:

- Nonhazardous ditch section remediation
- Hazardous ditch section remediation
- NN- and DNB-impacted area remediation
- Ditch replacement

The following sections describe the conceptual approach for each component and several miscellaneous components.

The sludge contained within the nonhazardous sections have been removed (see Section 2.2.3). Soil samples have been collected and the results indicate that sidewall and bottom soil need to be excavated to complete the closure of these ditch sections. The sidewall soil will be excavated up to a maximum of 1 foot from the edge of the ditch, and 3 inches of bottom soil will be removed.

The sludge and subsoil (approximately 3 inches underlying the sludge) in the hazardous ditch sections (including the NN-impacted area) will be remediated by carbon addition and in situ bulk dewatering followed by excavation and placement in the A and B Basin Vault. Carbon addition will consist of adding and mixing a 5 percent dosage of carbon with the sludge and subsoil. The dosage is based on the carbon treatability results as discussed in Section 4.0.

In situ bulk dewatering will consist of adding and mixing portland cement with the sludge and subsoil using the same process as used for the A and B Basin sludge. The purpose of bulk dewatering is to produce a material with sufficient geotechnical properties to facilitate vault construction. The dosage of portland cement will range from 5 to 15 percent, depending on the water content of the sludge and subsoil.

Carbon addition and bulk dewatering of the sludge and subsoil in selected ditch sections will be conducted in place. Sludge and subsoil from other ditch sections will be excavated and consolidated prior to carbon addition and bulk dewatering. Consolidation is required due to the inaccessibility of the carbon addition and bulk-dewatering equipment to these ditch sections. Inaccessibility is due to the presence of pipe supports, overhead obstacles (e.g., process piping, electrical lines), and buildings in or adjacent to the ditch.

A consolidation area will be constructed to facilitate consolidation, carbon addition, and bulk dewatering. The dewatered sludge and subsoil will be placed in the A and B Basin Vault.

Soil samples of the ditch sidewall soil will be collected and analyzed to delineate sidewall soil that exceeds the target compound action levels (TCALs). The sidewall soil that exceeds the TCALs will be excavated up to maximum of 1 foot from the edge of the ditch. The excavated soil will be transported to and placed in the A and B Basin Vault.

Based on the results of previous investigations, the DNB-impacted area is segregated into the following categories:

- High DNB concentration sludge (greater than 3 percent)
- Low DNB concentration sludge (less than 3 percent)

The high DNB concentration sludge has an average concentration of 40 percent DNB. Reclamation technologies are being evaluated for recovering DNB from the sludge and include physical and chemical separation processes. Alternative methods will be considered if a reclamation method is determined not to be feasible. Treatability work is currently being conducted. Based on the results of previous investigations, CB was found to be the primary constituent of concern. As referenced above, the area will be remediated in the same manner as the sludge in the hazardous ditch sections.

The low DNB concentration sludge will be handled and treated in the same manner as the sludge and subsoil from the hazardous ditch sections except that a 10 percent wet weight dosage of carbon will be added. The dosage is based on the carbon treatability results as discussed in Section 4.0.

The PWDS has been replaced by the Overhead Transfer System (OTS). The existing ditches are currently used to convey noncontact cooling water and stormwater runoff. These ditches will be replaced after remediation is complete. The ditch replacement system will most likely consist of a system of enclosed pipes or culverts. An open swale will be constructed where appropriate. The design for the ditch replacement system will not be presented in the RP.

At the time of closure plan preparation, limited information was available on the characterization of the PWDS sludge. A great deal is now known about the nature of the sludge as a result of the extensive characterization and treatability programs conducted by Du Pont. As a result of this new information, minor modifications to the closure plan and permit are required. These minor changes are discussed in detail in Section 6.0 of this report.

The Environmental Protection Agency (EPA) Region II letter dated October 16, 1991, states that the A and B Basins and the A Ditch are considered one hazardous waste management unit (HWMU). As a result, consolidation of the wastes from the A Ditch to the basins and between the A and B Basins does not trigger land disposal restrictions (LDRs).

The EPA has also stated in their letter dated March 6, 1992 that bulk dewatering by the addition of cement does not trigger LDRs. Since the proposed remediation of the A Ditch sludge will use in situ carbon addition and bulk dewatering, LDRs will not apply to this operation.

Du Pont requests a one year extension to the current schedule, which moves the PWDS closure deadline from December 31, 1994, to December 31, 1995. The PWDS closure schedule must be in line and compatible with the A and B Basin remediation schedule. The consolidation of the dewatered sludge from

the PWDS must occur at appropriate junctures during vault construction. To minimize delays for the A and B Basin closure, the two project schedules must allow flexibility to incorporate the required interactions during the remediation process.

2.0 INTRODUCTION

2.1 PURPOSE

The PWDS, otherwise known as the A Ditch, located at the Du Pont Chambers Works plant is required to be closed through an ACO between the NJDEPE and Du Pont (issued in 1984 and revised in 1988) and a New Jersey Pollutant Discharge Elimination System—Discharge to Groundwater Permit (NJPDES-DGW) permit No. 0083429 (issued in 1988). This RP presents the conceptual remediation plan for the PWDS to meet the requirements of the ACO and NJPDES-DGW Permit and is being submitted to the NJDEPE for review and approval.

2.2 BACKGROUND

2.2.1 Site Background

The Du Pont Chambers Works plant is located along the eastern bank of the Delaware River adjacent to the Delaware Memorial Bridge in Deepwater, New Jersey (see Figures 1 and 2). The plant has been in operation since 1917, producing many different chemical products and intermediates. Prior to the mid-1970s, the following streams were discharged into the Plant Basin via the PWDS:

- Process wastewater
- Noncontact cooling water
- Storm-water runoff
- Recovered groundwater from the Inceptor Well System (IWS)

In the mid-1970s, the Plant Basin was segregated into the A, B, and C Basins, and the PWDS discharged the above streams to the A Basin. In 1975, the Chambers Works WWTP began operation, and the A Basin served as an

overflow basin for the PWDS. In 1988, as per the ACO requirements, the OTS was installed and began operation. The OTS replaced the PWDS and A Basin in conveying process wastewater and recovered groundwater from the IWS streams to the WWTP. The OTS consists of a series of overhead pipelines throughout the plant and three 4.7-million-gallon equalization tanks. In the present configuration, the A Basin is no longer in operation, and only the PWDS conveys noncontact cooling water and storm-water runoff to the WWTP. The PWDS was not designed to handle storm-water surges, and as a result of taking A Basin out of service, a spillway was constructed in May 1992 to route storm-water surges to the B Basin. The B Basin operates as a cooling and settling basin for noncontact cooling water and storm-water runoff.

2.2.2 Regulatory Background

On August 31, 1984, an ACO was agreed to by the NJDEPE and Du Pont. The ACO was later amended and signed by the NJDEPE and Du Pont in 1988. The ACO required

- Eliminating the discharge of process wastewater and recovered groundwater from the IWS to the PWDS by June 1991 (completed).
- Remediating the PWDS.

In 1984, the Recovery Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) became effective. The HSWA mandated that Du Pont discontinue the use of the existing A and B Basins or retrofit them by November 8, 1988. On August 15, 1988, EPA issued a letter to Du Pont that provided a waiver to the provisions of RCRA Section 3005 (j). This waiver allows Du Pont to continue the closure of the PWDS in accordance with the time schedule specified in the ACO.

In October 1986, Du Pont submitted the *Process Water Ditch Closure Plan* for

the PWDS to the NJDEPE. On November 7, 1988, a NJPDES-DGW Permit was issued and became effective. The PWDS closure plan was incorporated by reference in the permit.

In addition to the NJPDES-DGW Permit, a HSWA Permit was issued and became effective on November 7, 1988. In this permit, the PWDS was listed as a solid waste management unit (SWMU), but the EPA is allowing the NJDEPE to assume the lead with respect to enforcing the closure of the PWDS.

2.2.3 Previous Remedial Activities

In March 1990, the PWDS was segregated into regulatory nonhazardous and hazardous sections. It has been determined that the nonhazardous ditch sections never received any listed hazardous wastes. Therefore, no F, K, P, or U wastes are contained in these ditch sections. The sludge contained in the nonhazardous ditch sections did not exhibit any characteristics of a hazardous waste. Based on this information, the sludge contained in these ditch sections was classified as regulatory nonhazardous.

The hazardous ditch sections contained sludge that exhibited the toxic characteristic, and this determination was based on the sludge failing the extraction procedure toxicity test for lead. Du Pont presented the results of these investigations in a *Characterization of the Process Water Ditch Sludge* report dated March 30, 1990. Approval of the classification was given by the EPA in a letter dated August 14, 1990. The sludge in the nonhazardous ditch sections were subsequently excavated, dewatered, and placed into the C Landfill (on-site secure landfill). These activities were completed in December 1990.

Soil samples were collected and analyzed following the completion of the sludge removal operation to delineate areas that may require further remedial action. Du Pont submitted the sampling and analytical procedures in the *Chambers Works Process Water Ditch System Subsoil Sampling Program Description* dated October 19, 1990, and revised in March 1991 to implement the comments in a letter from the NJDEPE dated January 29, 1991. In the program description, it was stated (and agreed to by the NJDEPE in Item 6 of the above letter) that any vadose zone soil containing concentrations of the three target parameters greater than concentration levels mutually agreed on would be remediated. The target compounds are

- CB.
- ODCB.
- Lead.

The mutually agreed concentration levels or TCALs are presented in Table 1. The results identified and delineated seven locations where the TCALs were exceeded, and the areal extent of soil that requires further remedial action was defined. The results are presented in Du Pont's *Process Water Ditch System Subsoil Sampling Program Report* dated November 20, 1992.

2.3 OVERVIEW

This RP will summarize the

- PWDS description.
- Treatability studies.
- RP.
- Regulatory compliance.
- Schedule.

A description of the PWDS is presented in Section 3.0 and covers the locations of the PWDS, including the NN- and DNB-impacted areas and sludge and soil characterization summaries. Summaries of the treatability studies completed to date are presented in Section 4.0. Section 5.0 describes the components of the conceptual remediation plan. Section 6.0 presents a discussion of Du Pont's plans for compliance with regulatory requirements, and Section 7.0 presents the proposed schedule.

3.0 PROCESS WATER DITCH SYSTEM DESCRIPTION

3.1 DESCRIPTION

The PWDS is a system of ditches distributed throughout the plant having a total length of 25,500 feet (approximately 4.8 miles). In the present configuration, the ditch conveys noncontact cooling water and storm-water runoff to the WWTP. Storm-water runoff surges are routed to the B Basin via a spillway. The construction of the ditch varies throughout the plant and consists of the following types:

- Earthen
- Bituminous
- Wooden box (covered, uncovered, underground)
- Concrete box (covered, uncovered, underground)
- Pipe

Maps of the plant showing the location and construction of PWDS are included with this document in Appendix A. The individual ditch sections are identified by the ditch and corresponding section number (i.e., D1S1, Ditch No. 1—Section No. 1). The PWDS Location Map in Appendix A further segregates the ditch sections that were classified as nonhazardous and hazardous. The classification was based on 1990 regulations (see Section 2.2.3) and is deemed inappropriate now due to changes in the RCRA definition of a hazardous waste. The nonhazardous ditch sections are D1S3, D1S4, D2S7, D2S8, D2S9, D2S10, and D2S11. The hazardous ditch sections are D1S1, D1S2, D1S5, D2S1, D2S2, and D2S3. The purpose of maintaining the segregation is to distinguish which ditch sections previously had sludge removed from them.

3.2 PROCESS WATER DITCH SYSTEM SLUDGE AND SOIL CHARACTERIZATION

3.2.1 Sludge Characterization Data Summary

Several investigations have been conducted to characterize the sludge associated with the PWDS. Several reports were submitted by Du Pont to the NJDEPE presenting the results of these investigations, including the following:

- *Characterization of the Process Water Ditch Sludge* dated March 30, 1990
- *Process Water Ditch System Summary* dated October 19, 1990

Based on sludge sampling and analytical data, the following three target compounds have been identified to be representative of the PWDS sludge:

- CB
- ODCB
- Lead

These compounds comprised at least 86 percent of the total constituent concentrations in the ditch sludge. The concentration of CB in the sludge ranged from not detected (ND) to 30,000 milligrams per kilogram (mg/kg) dry weight with an average of 2,582 mg/kg dry weight. The concentration of ODCB in the sludge ranged from ND to 65,000 mg/kg dry weight, with an average of 6,319 mg/kg dry weight. The concentration of lead in the sludge ranged from 9 to 176,000 mg/kg dry weight with an average of 9,914 mg/kg dry weight. Table 2 presents the range and average concentrations for the RCRA Appendix IX VOCs, SVOCs, and metals detected in the sludge.

3.2.2 Soil Characterization Data Summary

Several investigations have been conducted to characterize the soil associated with the PWDS. Several reports were submitted by Du Pont to the NJDEPE presenting the results of these investigations and include the

- *Process Water Ditch System—A Sludge and Soil Sampling Report* dated October 19, 1990.
- *Process Water Ditch System Subsoil Sampling Program Report* dated November 20, 1992.

The target compounds identified for the PWDS sludge also apply to the soil associated with PWDS. The concentration of CB in the soil ranged from ND to 3,000 mg/kg dry weight with an average of 137 mg/kg dry weight. The concentration of ODCB in the soil ranged from ND to 36,000 mg/kg dry weight, with an average of 1,255 mg/kg dry weight. The concentration of lead in the soil ranged from ND to 73,600 mg/kg dry weight, with an average of 1,793 mg/kg dry weight. Table 3 presents the range and average concentrations for the RCRA Appendix IX VOCs, SVOCs, and metals detected in the soil.

3.3 NITRONAPHTHALENE- AND DINITROBENZENE-IMPACTED AREA DELINEATION SUMMARY

The NN- and DNB-impacted areas were investigated and characterized in June and August 1991 and again in January and August 1992. The objective of the investigations were to obtain the following information:

- Chemical and physical data to determine the presence of NN and DNB in designated areas of the PWDS as described in the PWDS closure plan
- The extent of contamination, if present, of NN and DNB in the designated areas, including impacted sludge volumes

The results of the investigations are presented in Du Pont's *Delineation and Characterization of Nitronaphthalene and Dinitrobenzene in the Process Water Ditch System* report dated December 19, 1992 (see Appendix B). Based on the information presented, the following conclusions were made:

- The area originally designated as the NN-impacted area does not appear to be significantly different from the remainder of the ditch sludge. The average NN concentration is 3,838 mg/kg, with a range from 49 to 18,300 mg/kg.

- The total estimated volume of DNB-impacted sludge (i.e., the sludge in the vicinity of the DNB storage tank indicated in the closure plan as sediments and associated DNB) is 2,000 cubic yards (yd^3). Additional DNB-impacted sludge was identified in ditch section D2S2, and the estimated volume is 2,900 yd^3.

- The presence of DNB in concentrations greater than 3 percent is localized to the area designated as the DNB hot spot [i.e., the ditch area immediately adjacent to the DNB storage tank (see Figure 3)]. The volume of sludge containing high concentrations of DNB is approximately 1,000 yd^3. The average DNB concentration in this area is 43 percent, with a maximum of 87 percent.

- The volume of sludge containing low concentrations of DNB (less than 3 percent) is approximately 3,900 yd^3. The average DNB concentration in this area is 2,753 mg/kg, with a maximum of 13,400 mg/kg.

4.0 TREATABILITY STUDIES

Treatability studies have been conducted to evaluate potential remedial technologies for PWDS sludge and soil. Additional studies are presently being conducted to evaluate alternate carbon sources and DNB reclamation processes further. The following sections summarize the findings, conclusions, and status of these treatability studies for the

- Sludge.
- NN-impacted sludge.
- DNB-impacted sludge.
- Soil.

4.1 SLUDGE

The recommended remediation for the majority of the sludge is in situ carbon addition, bulk dewatering, and consolidation in the A Basin vault. This will consist of adding carbon to obtain similar chemical and physical properties as the A and B Basin sludge, followed by a bulk-dewatering process similar to that approved for the A and B Basin project. The material will then be consolidated in the A and B Basin vault.

Treatability studies were conducted to evaluate carbon addition based on the following observations:

- CB toxicity characteristic leaching procedure (TCLP) concentrations, while below RCRA hazardous levels, are slightly higher in the PWDS sludge than in the A and B Basin sludge.
- Carbon has been shown to chemically and physically bond organic compounds in A and B Basin sludge.
- Carbon is not present in the PWDS sludge.

wastewaters to the WWTP. Storm-water runoff surges that are conveyed by the PWDS will be routed to the B Basin via a spillway constructed in May 1992.

6.2.3.2 Proposed Revisions to Phase 3

Use a system of enclosed pipes and swales to collect and convey noncontact cooling water, storm-water runoff, and emergency releases.

6.2.4 Phase 4—Shallow Interface and Vadose Zone Sampling and Analysis

6.2.4.1 Description

During this phase, Du Pont was to sample and analyze the shallow interface zone and the vadose zone soil underlying the ditch sections that contain earthen or wooden bottoms. As a result of the delineation of the water table and ditch bottom elevations, it has been determined that the bottom of the ditches are below the water table. Hence, there is no vadose zone beneath the ditches to be sampled. Vadose zone soil is limited to sidewalls above the groundwater table.

6.2.4.2 Proposed Revision to Phase 4

Sidewall soil samples will be collected in accordance with the *PWDS Soil Sampling Work Plan* (see Appendix E).

6.2.5 Phase 5—Process Water Ditch System Structural Integrity Evaluation

This phase would require Du Pont to conduct a detailed evaluation of the structural integrity of the ditches. The purpose of this evaluation was to determine whether the PWDS was capable of conveying noncontact cooling water, storm-water runoff, and emergency containment and collection for the plant. This requirement is no longer applicable since the PWDS will be replaced

5.0 REMEDIATION PLAN

The PWDS remediation will consist of the following four components:

- Nonhazardous ditch section remediation
- Hazardous ditch section remediation
- NN- and DNB-impacted area remediation
- Ditch replacement

The following sections describe the conceptual approach for each component and several miscellaneous components.

5.1 NONHAZARDOUS DITCH SECTION REMEDIATION

The majority of the sludge contained within the nonhazardous sections has been removed as discussed in Section 2.2.3 of this RP. The sludge remaining in those ditch sections not removed during the previous remedial activities due to accessibility will be removed and managed in the same manner as described in Section 5.2 for the hazardous ditch sections. Soil samples have been collected, and the results indicate that sidewall and bottom soil needs to be excavated to complete the closure of these ditch sections (see Figure 7). The sidewall soil will be excavated up to a maximum of 1 foot from the edge of the ditch. Excavation will consist of a combination of methods, including hydraulic and manual excavation. The excavated sidewall soil will then be consolidated in the vault.

5.2 HAZARDOUS DITCH SECTION REMEDIATION

The sludge and subsoil (approximately 3 inches of the underlying soil) in the hazardous ditch sections will be remediated by in situ carbon addition and bulk dewatering, followed by excavation and consolidation in the vault. Carbon

addition will consist of adding and mixing carbon with the sludge and shallow interface zone soil. The purpose of carbon addition is to obtain similar chemical and physical characteristics between the PWDS sludge and the A and B Basin sludge. A 5 percent wet weight dosage of carbon was selected based on the following reasons:

- The results of the carbon treatability studies indicated that the leaching of CB, the controlling compound, was significantly reduced (greater than 75 percent) with the addition of a 5 percent wet weight dosage of carbon (see Section 4.1).
- The A and B Basin sludge contains a 5 percent concentration of carbon on a wet weight basis; therefore, adding a 5 percent carbon dosage on a wet weight basis to the PWDS sludge would result in sludge with chemical and physical properties similar to the A and B Basin sludge.

In situ bulk dewatering will consist of adding and mixing portland cement with the sludge and shallow interface zone soil using the same process as that for the A and B Basin sludge. The purpose of bulk dewatering is to produce a material with sufficient geotechnical properties to facilitate vault construction. The dosage of portland cement will range from 5 to 15 percent depending on the moisture content of the sludge.

Carbon addition and bulk dewatering of the sludge and shallow interface zone soil in some ditch sections may be conducted in place. Sludge and subsoil from the other ditch sections will be excavated and consolidated prior to carbon addition and bulk dewatering. Excavation will be conducted with a combination of methods, including hydraulic and manual excavation. Consolidation is required due to the inaccessibility of the carbon addition and bulk dewatering equipment to these ditch sections. Inaccessibility is due to the presence of pipe supports, overhead obstacles (e.g., process piping, electrical lines), and buildings in or adjacent to the ditch. A consolidation area will be constructed to facilitate consolidation, carbon addition, and bulk dewatering.

Sludge contained in underground ditch sections and pipes that previously discharged into the ditch will be removed by flushing. Flushing consists of a combination of conventional sewer cleaning methods such as jet rodding and water flushing. The sludge will be collected in a sediment trap at the discharge end of the ditch. Sludge collected in the sediment trap will be excavated and transported to the consolidation area. Sludge contained in smaller sections of ditch that extend into the production areas will be removed and managed in the same manner as the rest of the sludge.

Soil samples of the ditch sidewall soil will be collected and analyzed prior to the sludge removal to delineate sidewall soil that exceeds the TCALs. The sidewall soil that exceeds the TCALs will be excavated up to maximum of 1 foot from the edge of the ditch. The excavated soil will be transported to and placed in the vault.

The dewatered material must meet the following performance criteria:

- Must contain 5 percent carbon
- Must be able to be excavated using conventional soil excavation equipment
- Must possess the minimum geotechnical properties necessary for vault construction

The 5 percent carbon dosage will be checked using a mass balance to ensure that a sufficient quantity of carbon is added to the sludge and soil. The total mass of material being treated at one time and mass feed rate of carbon being added will be known. Therefore, the quantity of carbon required can be calculated and controlled. Standard field geotechnical testing will be conducted to determine if the dewatered material meets design criteria.

5.3 NITRONAPHTHALENE- AND DINITROBENZENE-IMPACTED AREA REMEDIATION

5.3.1 Nitronaphthalene-Impacted Area

Delineation and characterization of the NN-impacted area was summarized in Section 3.3. As a result of the investigation and treatability studies, it has been determined that the NN-impacted sludge is not significantly different from the rest of the PWDS sludge. Therefore, Du Pont proposes to remediate this area in the same manner described in Section 5.2 for the hazardous ditch sections.

5.3.2 Dinitrobenzene-Impacted Area

Delineation and characterization of the DNB-impacted area was summarized in Section 3.3. Based on the results of these investigations and treatability studies, the DNB-impacted area was segregated into the following categories:

- High DNB concentration sludge (greater than 3 percent)
- Low DNB concentration sludge (less than 3 percent)

Reclamation technologies are being evaluated for recovering DNB from the sludge and include physical and chemical separation processes. Alternative methods will be considered if a reclamation method is determined not to be feasible. Treatability work is currently being conducted.

The low DNB concentration sludge will be handled and treated in the same manner as the sludge and subsoil from the hazardous ditch sections, except that a 10 percent wet weight dosage of carbon will be added. This dosage is based on the Phase II carbon treatability study results discussed in Section 4.3.

5.4 DITCH REPLACEMENT

The PWDS has been replaced by the OTS as discussed in Section 2.2.1. The existing ditches are currently used to convey noncontact cooling water and stormwater runoff. These ditches will be replaced after remediation is complete. The ditch replacement will most likely consist of a system of enclosed pipes or culverts. The pipes or culverts will be constructed of one of the following impervious materials:

- Polyethylene
- Corrugated steel
- Concrete
- Fiberglass reinforced plastic

An open swale will be constructed where appropriate. It will consist of bituminous or concrete sides and bottom. The design for the ditch replacement system will not be presented in this RP.

5.5 MISCELLANEOUS COMPONENTS

5.5.1 Site Preparation

Site preparation for the remediation activities will consist of

- Constructing a consolidation area.
- Preparing work zones at each ditch section.

Constructing the consolidation area will consist of excavating a portion of dewatered sludge from ditch section D2S1 or D2S2, from the A or B Basin. The consolidation area will be constructed within the excavation to prevent slope failure and water infiltration. Other alternative construction methods, such as sheet piling, will be considered. The addition of compacted fill material

or gravel may be required to support and provide accessibility to the consolidation area for unloading, carbon addition, bulk dewatering, and excavating equipment.

Work zone preparation will be important due to the many safety issues associated with sludge and shallow interface zone soil excavation in the production areas. It may consist of temporary supports for ditch sidewalls, overhead pipes, and/or buildings. Ditch water flow and noncontact cooling water discharges will have to be temporarily routed around the work zone. Barricades will have to be installed temporarily to route traffic away from the remedial activities. Safety is a critical part of the remediation and construction activities associated with this project, so work zone preparation will be a major part of the operation.

5.5.2 Water Management

Ditch water will be controlled by the installation of temporary dams upstream and downstream from the work zone. A pump will be used to convey the water around the work zone. The optimal pump will be selected based on the PWDS flow rate information and possible storm water surges. In the event of storm water surges to prevent flooding in the plant, the storm water will be allowed to overflow the temporary dams.

Since the majority of the ditch bottoms are below the groundwater table, groundwater is expected to flow into the ditch during construction activities. If the flow inhibits construction activities, the groundwater will be pumped to a nearby process sump or temporary storage containers for conveyance to the WWTP for treatment.

5.5.3 Ditch Soil Sampling

Soil samples will be collected from alternating sides every 1,000 feet along the ditches prior to removal of the sludge and shallow interface zone soil. It is necessary to collect these samples ahead of time due to the following reasons:

- Removing sidewall soil exceeding TCALs will be accomplished at the same time as removal of sludge and shallow interface zone soil.
- Leaving open excavations while waiting for analytical data and further delineation that may be required do not pose safety concerns.
- Installing replacement system as soon as possible following the removal of sludge will be necessary.

All of the samples will be analyzed for the following target parameters:

- CB
- ODCB
- Lead

Ten percent of these samples will also be analyzed for the complete Appendix IX list of compounds. Sample locations that exceed the TCALs will be delineated further to determine the extent of sidewall soil that needs to be excavated. The sampling and analytical procedures are presented in the *PWDS Soil Sampling Work Plan* included in Appendix E. Delineation will be accomplished by collecting addition samples at 25-foot increments on both sides of the initial sample until the analytical results are less than the TCALs. The soil that requires further remedial action is the soil up to a maximum of 1 foot from the ditch and between the sample locations that exceed the TCALs.

5.5.4 Air Monitoring

Air monitoring will be conducted throughout the remediation activities to ensure that air emissions that present a potential risk to the health of the plant workers and the surrounding community are not migrating from the exclusion zone. Air monitoring will not be conducted during ditch placement activities unless determined to be necessary by health and safety personnel. The air monitoring will be conducted per the plan entitled *A and B Basin and A Ditch Remediation Air-Monitoring Plan* dated July 30, 1992. A copy of the plan is included with this document in Appendix F.

5.5.5 Postclosure Monitoring and Maintenance

In Du Pont's November 3, 1992, letter Du Pont requested an extension until the first quarter of 1994 to submit a postclosure monitoring plan for the PWDS. The NJDEPE approved this request in a letter dated December 7, 1992.

6.0 REGULATORY COMPLIANCE

6.1 PWDS CLOSURE REQUIREMENT CHANGES

Based on information currently available, minor modifications to the closure plan are required. Presented in this section are the minor changes requested for the PWDS closure requirements stipulated in the NJPDES-DGW Permit No. NJ0083429 (formerly No. NJ005100) and the PWDS closure plan. The changes are required due to the limited information known at the time that the original closure plans were submitted in October 1986. Du Pont believes that these changes fulfill the requirements for the closure. The following sections address each existing requirement, the desired change, and the reason for the request.

6.2 CONDITION C.1—CLOSURE ACTIVITIES

6.2.1 Phase 1—Overhead Transfer System Installation

Phase 1 of the permit and closure plan required the installation of an OTS for the conveyance of wastewater from the various manufacturing and research facilities on the plant to the WWTP. This requirement has been fulfilled. The OTS has been completed and is currently in use.

6.2.2 Phase 2—Collection, Transportation, and Disposal of Dinitrobenzene- and Nitronaphthalene-Impacted Sludge

6.2.2.1 Description

Phase 2 of the permit and closure plan required the collection, transport, and disposal of approximately 2,000 yd^3 of DNB-impacted sludge and 25 yd^3 of NN-impacted sludge from the PWDS. The proposed remedial method was treatment at the on-site WWTP and disposal in the on-site secure landfill.

To comply with this requirement, the areal extent of the NN- and DNB-impacted areas was delineated. The results of this delineation are discussed in Section 3.3 of this report. As a result of the investigations, it has been determined, via the sludge analyses, that the area originally designated as NN-impacted sludge is not significantly different than the remainder of the PWDS sludge. The maximum NN concentration detected was less than 2 percent. Based on the chemical characteristics and treatability study results, Du Pont believes that the NN-impacted sludge can be managed in the same manner as the remainder of the ditch sludge (e.g., in situ carbon addition and bulk dewatering and consolidation in the vault).

The delineation and investigation of the NN- and DNB-impacted sludge has revealed the following:

- The area originally designated as the NN-impacted area does not appear to be significantly different from the remainder of the ditch sludge. The average NN concentration is 3,838 mg/kg, with a range from 49 to 18,300 mg/kg.

- The total estimated volume of DNB-impacted sludge (i.e., the sludge in the vicinity of the DNB storage tank indicated in the closure plan as sediments and associated DNB) is 2,000 yd^3. Additional DNB-impacted sludge was identified in ditch section D2S2, and the estimated volume is 2,900 yd^3.

- The presence of DNB in concentrations greater than 3 percent is localized to the area designated as the DNB hot spot [i.e., the ditch area immediately adjacent to the DNB storage tank (see Figure 3)]. The volume of sludge containing high concentrations of DNB is approximately 1,000 yd^3. The average DNB concentration in this area is 43 percent, with a maximum of 87 percent.

- The volume of sludge containing low concentrations of DNB (less than 3 percent) is approximately 3,900 yd^3. The average DNB concentration in this area is 2,753 mg/kg, with a maximum of 13,400 mg/kg.

As a means of managing the high concentration DNB-impacted sludge, Du Pont is currently evaluating the reclamation of the DNB. The regulatory requirements for the reclamation process will be determined once the unit operations have been identified and proven feasible. If reclamation of the DNB is not feasible, alternate treatment and disposal methods including consolidation in the vault, will be evaluated. Based on chemical characteristics and results of treatability studies of the low concentration DNB impacted sludge, Du Pont believes that this sludge it can be managed in the same manner as the remainder of the PWDS sludge, except that 10 percent carbon will be added versus 5 percent for typical sludge.

6.2.2.2 Proposed Revisions to Phase 2

The following are the proposed revisions to the Phase 2 activities:

- Manage the PWDS sludge in the NN-impacted area and the low concentration DNB area in the same manner as the remainder of the sludge in the PWDS. This consists of in situ carbon addition and bulk dewatering of the sludge, followed by consolidation in the vault.

- Reclaim the DNB from the area adjacent to the DNB storage tank, if feasible. Alternate disposal methods will only be evaluated if reclamation is not feasible. The reclaimed DNB will be used for commercial purposes. The residues may be consolidated with the rest of the PWDS sludge and managed in the same manner as the remainder of the sludge based on NJDEPE and EPA approval.

6.2.3 Phase 3—Continued Use of the PWDS

6.2.3.1 Description

This phase notes that the PWDS will continue to be used for the conveyance of noncontact cooling water, storm-water runoff, and emergency conveyance of wastewater. Du Pont is in the process of designing a collection and conveyance system for the above wastewater that will replace the PWDS. This system will consist of enclosed pipes and swales for conveying these

7.0 SCHEDULE

Du Pont requests a one year extension to the current schedule that will move the PWDS closure deadline from December 31, 1994, to December 31, 1995. The PWDS closure schedule must be in line and compatible with the A and B Basin remediation schedule. The consolidation of the dewatered sludge from the PWDS must occur at appropriate junctures during the vault construction. To minimize delays for the A and B Basin closure, the two project schedules must allow flexibility to incorporate the required interactions during the remediation process.

A schedule for this project, including the one year extension, has been prepared on the basis of the current status (see Figure 8). This schedule represents the current knowledge of the anticipated design requirements, future agency submittals and reviews, and the estimated construction durations for the project. The schedule is subject to change and will be modified based on the professional judgement of engineering and construction personnel. However, the completion date of December 31, 1995, will not change without prior approval from the NJDEPE.

The schedule's tasks and durations represent an aggressive and demanding timetable. Adherence to the schedule presumes the following NJDEPE review and response times:

- Review and approval of the RP within 30 calendar days
- Timely review and approval of all applicable permit submittals

FUSRAP

108-G0A-GAM-00004
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SUBJECT Uranium Authorized Limits For the DuPont Site

FROM Johnson, A TO Kirk COMM DATE 3/27/97

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RESPONSE TRACKING INFORMATION

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108 DUP			138 MIS		
112 PNV			139 CIS		
116 SLD			140 HIS		
118 MSP			144 NBS		
127 VEN			153 SLP		
129 LIN			158 NFS		
134 SVP			PIC-MIS		
137 WIS			PIC-TON		
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H. Sothran					/
C. Dirabanc					/
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BNI	W/A	W/O
PROGRAM MANAGER: A. Boos		
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United States Government | Department of Energ

memorandum

DATE: MAR 27 1997

REPLY TO ATTN OF: EM-42 (W. A. Williams, 301-903-8149)

SUBJECT: Uranium Authorized Limits for the DuPont site, Deepwater, New Jersey

TO: R. Kirk, OR

This is in response to the request for approval of uranium guidelines for the DuPont Site of the Formerly Utilized Sites Remedial Action Program (FUSRAP), pursuant to Department of Energy (DOE) Order 5400.5. This site is located in Deepwater, New Jersey, and was used by DOE's predecessor for production and recycling of uranium compounds. Your staff requested approval of a residual uranium authorized limit of a 500 pCi/g authorized limit for the central drainage ditch, with a 100 picoCuries per gram (pCi/g) of total uranium for the remainder of the site. This recommendation was made based on a draft supporting analysis by Argonne National Laboratory (ANL) and a brief rationale for the recommendation.

Basic Dose Requirement:

The DuPont Site is located in an industrial area near Deepwater, New Jersey. The site is an enormous tract used for chemical production and processing, and known as the "Chambers Works." The site is immediately adjacent to the Delaware River; it extends northward from the Delaware River Bridge and Interstate Route 295 approximately one mile. Only a small portion of the site was affected by the activities of the Department's predecessors.

The draft ANL analysis calculated a maximum residual concentration of total uranium in soil of 1100 pCi/g for the current industrial use (Scenario A). This concentration is equivalent to 30 millirem per year, the dose constraint for current or likely use of land proposed in 10 CFR 834.

A similar calculation for future residential use of the property (Scenario B) yields a maximum uranium concentration of 1300 pCi/g. Based on the unlikely nature of this exposure scenario, the 100 millirem per year limit in DOE Order 5400.5 and in proposed 10 CFR 834 is used.

The possible agricultural use of the site in the future must be also considered. Scenario C examines this use, and assumes a resident farmer will:

(1) reside at the site after cleanup;
(2) drink water from an on-site well;
(3) eat plant foods grown in the decontaminated area;
(4) drink milk and eat meat from cattle grown on the site;
(5) eat seafood from an on-site pond; and
(6) ingest 100 milligrams per day of soil at the site.

These assumptions are very unlikely but may be plausible in the distant future. The calculated maximum uranium concentration, using these assumptions, is 580 pCi/g. This calculation is also based on a 100 millirem per year dose limit, as required in DOE Order 5400.5 and proposed 10 CFR 834.

The recommended 100 pCi/g guideline is about 3 millirem per year for an industrial worker (Scenario A in the draft ANL Report). For residential and subsistence agricultural use, the recommended guideline is approximately 8 and 17 millirem per year (Scenarios B and C, respectively).

Based on the draft ANL analysis, the recommended value of 100 pCi/g of total uranium is within DOE's dose guideline of 100 millirem per year, which must be met under all worst case, plausible scenarios, including the assumed subsistence residential use. The recommended level of 100 pCi/g also meets the constraint of 30 millirem per year for current or likely land use, as proposed in 10 CFR 834.

The recommended level of 500 pCi/g also meets the basic dose limit of both DOE Order 5400.5, Chapter IV and proposed 10 CFR 834. In this case, the areal extent of the residual uranium is limited and the higher limit can be justified by the background levels in the adjacent areas.

As Low as Reasonably Achievable (ALARA) Analysis:

In addition to meeting the basic radiation protection guideline, any cleanup guideline must be analyzed to keep exposures ALARA. The ALARA analysis in the request stated that reducing the soil guideline to the recommended level of 100 pCi/g would increase the volume of soil and other costs relating to the remediation effort. Further reductions in the uranium guideline will significantly increase post remedial survey and verification costs. These costs include detailed sample preparation, a much larger number of soil samples, smaller grids for soil sampling, use of more sophisticated equipment, longer counting times on detectors, slower sample turnaround, and significant increases in time and cost. Further reductions in the guideline would increase costs substantially.

The separate authorized limit for the central drainage ditch requires special comment. This area has chemical contamination, and its remediation is being conducted by DuPont using a movable enclosure. The nature and extent of the chemical contamination justify a separate limit for uranium to minimize chemical exposures to DOE personnel. The alternative to this limit is to participate in DuPont's excavation with personnel in fully encapsulated personal protective equipment, at costs well above any conceivable benefit. As pointed out in the recommendation, the advantage of the higher authorized limit is that hand held instruments can detect uranium at this level and this advantage facilitates remediation of the chemical contaminants. It is also expected that much of the uranium would be removed during the course of the remediation for chemicals.

In the application of ALARA, practical considerations are also taken into account. For practical considerations, it is likely that the contaminated areas will be cleaned up to a level below whatever guideline is established. This is likely for two reasons. First, in order to remove all material above the guideline, some soil contaminated below the guideline will be removed. This will have the practical effect of lowering the guideline as it is applied during cleanup operations. Second, during cleanup operations, it is difficult to precisely delineate the point at which contamination above the guideline ends. As a result, remedial personnel will remove suspect materials to avoid repeated cleanup operations in the same area. For these reasons, it is likely that cleanup will be accomplished at some level lower than the approved cleanup guideline.

A final practical consideration is the use of clean fill material to replace excavated materials. This will cause a shielding and covering effect on the remaining soils, reducing gamma ray and dust. Further, the clean fill would reduce the projected doses by diluting any residual contamination. The draft ANL analysis does not assume that there is any clean fill or cover placed over the site after cleanup. For this reason, the doses calculated in the draft ANL report are clearly a worst case scenario. In the actual application of a cleanup guideline, it is very likely that a cleanup level substantially below the established guideline will be achieved.

A review of the draft ANL report indicates that one significant pathway for all scenarios is via inhalation of contaminated dust. The mass loading factor used for airborne dust in the calculations (100 micrograms per cubic meter) is higher than would be expected for respirable particles at the site under ambient conditions. This estimate reflects the level of airborne dust expected from plowing or digging in the soil. Such a high dust load is unlikely on a continual basis, and it very unlikely that all of the soil at this level would be of a respirable particle size. There are a number of other sources of uncertainty and conservatism in the dose calculations; these are briefly summarized on pages 14 and 16 of the draft ANL report.

Summary and Approval:

Based on the above considerations, a site-wide authorized limit of 100 pCi/g for total uranium above background levels is approved for use in the cleanup of the DuPont Site, pursuant to DOE Order 5400.5, Chapter IV, Section 5a. A separate authorized limit of 500 pCi/g is approved for the central drainage ditch. The authorized limits are to be the average concentration of residual on a 10 meter by 10 meter gridblock. "Hot spots" shall use the applicable criteria set forth on page 18 of the draft ANL report.

We will provide comments on the draft ANL report separately. Please provide ANL with post-remedial action data to permit the preparation of another dose estimate report to reflect the actual doses after completion of the cleanup. We also recommend that your staff discuss the site characterization data and the approved guidelines with the DuPont staff, regulatory agencies and other stakeholders at an appropriate time.

Albert S. Johnson
Team Leader
FUSRAP Team
Office of Eastern Area Programs
Office of Environmental Restoration

cc: R. Atkin, DOE/OR
A. Wallo III, EH-232
C. Yu, ANL
D. Dunning, ANL
R. Foley, Oak Ridge National Laboratory (ORNL)
M. Murray, ORNL

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This document consists of 2 pages.
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WAR DEPARTMENT
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NEW YORK, N. Y.

IN REPLY
REFER TO

A-6

November 17, 1942

DEC 9 1942

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Gentlemen:

There are forwarded herewith for execution by you three (3) numbers of Letter Contract No. W-7412 eng-2, dated November 17, 1942.

It will be noted that in the letter contract a symbol is used in place of the name or formula of the material contracted for. The code for this symbol is as follows: C716 means C_7F_{16}.

The tentative specifications for C_7F_{16} shall be as follows:

For Use as Sealing Gas:

Molecular Weight not less than 385
Boiling Point 81-83°C
Product must be totally inert to Process Gas
Product must be neutral when shaken with water

For Use as a Coolant:

Initial b.p.	>30°C	(>86°F.)
End point	<100°C	(<212°F.)
Melting point	< 20°C	(< 68°F.)

Product must be totally inert to Process Gas
Product must be neutral when shaken with water

It is understood that disclosure of information contained in this letter or in the contract relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the contractor or any person under his control in connection with the work under this contract, may subject the contractor, his agents, employees, and subcontractors to criminal liability under the laws of the United States. (See Title I of an Act approved June 15, 1917, 40 Stat. 217; 50 U.S.C. 30-42), as amended by an Act approved March 23, 1940 (54 Stat., Chap. 72); and the provisions of an Act

SECRET

approved January 12, 1938, (52 Stat. 3; 50 U.S.C., Supp. V 45-45d), as supplemented by Executive Order No. 8351, dated March 22, 1940, 5 F.R. 1147, D.I.)

It is understood and agreed that this letter is to become a part of Letter Contract No. W-7412 eng-2 in the same manner as if fully set forth therein. A copy of this letter shall be kept on file in the Manhattan District Office.

It is requested that three copies of this letter be executed by you and the original and one copy of this letter be returned to this office with the original and one copy of Letter Contract No. W-7412 eng-2.

Very truly yours,

THE UNITED STATES OF AMERICA

By _____
J. C. MARSHALL,
Colonel, Corps of Engineers,
Contracting Officer.

This is to certify that this letter has been received and the contents thereof read, fully understood and agreed to.

E. I. du Pont de Nemours & Company

By _____

E. G. ROBINSON

ORGANIC CHEMICALS DEPT.

Dec 8, 1942

Methods of Inspection

A. Distillation

The A.S.T.M. method D86-40 is to be used, except that a 50 cc sample is charged instead of the 100 cc sample regularly specified. This method is described in pp. 36-42 of the Federal Standard Stock Catalogue, Section IV (Part 5), code number VV-L-791b.

B. Acidity

Place 10 cc of the product to be tested in a test tube. Add 30 cc of water. Shake thoroughly and allow to settle. Decant 10 cc of acqueous layer into a clean test tube. Add 1 drop of 0.1% methyl orange. No pink or red color shall be formed.

C. Inertness to Process Gas

1. Apparatus

The reactors shall be of from 125 to 150 cc capacity, constructed of nickel or monel metal.

A valve of nickel, monel or brass packed with polytetrafluoroethylene preferably silver soldered to the reactor body shall seal the reactor. An additional cap is to seal the valve in case of failure.

In place of a valve a nickel or monel nipple of 1/8 in.pipe may be sealed into the reactor and the reactor be sealed with a nickel or monel cap. The reactor is to be of such a weight that an accuracy of one milligram can be obtained on the balance used, any metal joints on the reactor shall be silver soldered, or metal welded. After evacuation, the leak into the metal system containing the reactors shall be less than 0.1 mm. per hour with the pumps shut off.

The process gas charging system shall consist of a copper or brass vessel, in which TF_6 is stored over anhydrous KF. The TF_6 is to be charged as gas at its vapor pressure at same temperature into a 2-3 liter measuring pipette constructed of copper or brass. Gas shall be

mean by more than four times the average deviation, it shall be discarded. The average value of at least three acceptable determinations shall satisfy specifications.

D. Cloud Point

The A.S.T.M. method D97-39 is to be used. This method is described on pages 10-13 of the Federal Standard Stock Catalogue, Section IV (Part 5), code number VV-L-791b.

It is understood that disclosure of information contained in this letter, or in the contract, relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved June 15, 1917 (40 Stat. 217; 50 U.S.C. 31-42), as amended by an Act approved March 28, 1940 (54 Stat. 79); and the provisions of an Act approved January 12, 1938 (52 Stat. 3; 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F.R. 1147.

It is understood and agreed that this letter is to become a part of Letter Contract No. W-7412 eng-2 in the same manner as if fully set forth therein. A copy of this letter shall be kept on file in the Manhattan District Office.

Very truly yours,

UNITED STATES OF AMERICA

BY _____
J. C. MARSHALL
Colonel, Corps of Engineers,
Contracting Officer.

This is to certify that this letter has been received and the contents thereof read, fully understood and agreed to as of 8-23-43.

E. I. DU PONT DE NEMOURS & COMPANY

BY _____
Wilmington, Delaware

SECRET

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

This document consists of 3 pages
No. 1 of 8 copies, Series A

1 October 1943
Supplement No. 2 to
Letter of Specifications dated
November 17, 1942

E. I. du Pont de Nemours & Co.
Wilmington, Delaware

Attention: S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 17 November 1942 and Supplement No. 1 thereto under date of 7 July 1943, relating to code symbols and specifications concerning Contract No. W-7412 eng-2.

You will please note that certain specifications apply to the initial quantity of Twenty Thousand (20,000) pounds of Product C-716 which were contained in the above mentioned Supplement No. 1 dated 7 July 1943.

It is the desire of this office to modify the aforesaid specifications with respect to any additional quantities in excess of the initial quantity of Twenty Thousand (20,000) pounds of Product C-716. The modified specifications as well as detailed methods of inspection to determine conformance thereto, including code symbols, are mentioned below:

Specifications

Acidity	Nil
Inertness residue (3 hrs. at 212° F)	Less than 0.15% by weight.
Cloud point	Less than 68° F
Mol percent C_7F_{14} (as tetradecafluoromethylcyclohexane plus tetradecafluoroethylcyclopentane)	Less than 2% above primary standard.

SECRET

tion

5% Above 174° F.
95% Not above 185° F.
Dry point. Less than 182° F. ± 6° F.

The methods of inspection are attached to this letter and made a part thereof. The meanings of code symbols used in the methods of inspection are as follows:

C-616: Uranium hexafluoride.
T: Uranium.
C-715H: $C_7F_{15}H$
K-416: Tetrafluoroethylene polymer.
C-714: C_7F_{14}
FM-33: Cobalt trifluoride.
C-216: Fluorine.

Detailed procedure covering methods of inspection as well as drawing number JLS-191 are set forth in the annexed specifications, in triplicate, which are made a part hereof in the same manner as though fully set forth at length herein.

It is understood that disclosure of information relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved June 15, 1917 (40 Stat. 217; 50 U.S.C. 30-42), as amended by an Act approved March 28, 1940 (54 Stat. 79); and the provisions of an Act approved January 12, 1938 (52 Stat. 3; 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F.R. 1147.

If this modification is acceptable to your company, it is requested that acceptance thereof be indicated hereon and on the two (2) copies of this letter, and return the original together with a copy thereof to this office without delay. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-2, and subject to all of the terms thereof.

Very truly yours,
UNITED STATES OF AMERICA

By E A Brinkman

E. A. BRINKMAN SEP 20 1944
CORPS OF ENGINEERS
CONTRACTING OFFICER AUG 15 1944

1 Incl.:
Mthds of Insp C-716
(in trip.)

SECRET

This is to certify that this letter has been received and the contents appearing on pages 1 and 2 thereof were read, are fully understood and agreed to as of October 1, 1943.

E. I. du PONT de NEMOURS & COMPANY

By _____

Wilmington, Delaware
(Address)

SECRET

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

EIDH A-43 MS

18 May 1944

Supplement No. 3 to Secret Letter
dated 17 November 1942 to
Contract No. W-7412 eng-2

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Att: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to Secret Letter dated 17 November 1942, as supplemented, to Contract No. W-7412 eng-2. It is desired by this office to modify said secret letter by adding the following code symbols:

Product P-46 - is a polyfluoropolychloroheptene mixture having the approximate average formula $n\text{-}C_7H_2F_{9.5}Cl_{2.5}$. The exact amounts of hydrogen, fluorine and chlorine in this material may be expected to vary somewhat from the amounts indicated by the formula $n\text{-}C_7H_2F_{9.5}Cl_{2.5}$.

Product C-715-CL - is a mixture of the compounds $n\text{-}C_7F_{15}Cl$, $n\text{-}C_7F_{14}Cl_2$, and $n\text{-}C_7F_{16}$ produced by fluorination of P-46 using a suitable fluorinating agent.

Product PCT - is a liquid mixture of compounds produced by treatment of a mixture of ortho and meta-polychloroterphenyls with a suitable fluorinating agent.

Specifications for Products P-46, C-715-CL and PCT shall be such as are mutually agreed upon in writing between the Contractor and the Contracting Officer.

It is understood that disclosure of information contained in this letter or in the contract relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any

person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved June 15, 1917 (40 Stat. 217; 50 U.S.C. 31-42), as amended by an Act approved March 28, 1940 (54 Stat. 79); and the provisions of an Act approved Jan. 12, 1938 (52 Stat. 3; 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F.R. 1147.

If the foregoing is acceptable to you, will you kindly so indicate hereon and on the inclosed copieshereof and return the original and one copy to this office as soon as practicable. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-2.

Very truly yours,

THE UNITED STATES OF AMERICA

BY E A Brinkman
E. A. BRINKMAN
MAJOR, CORPS OF ENGINEERS
CONTRACTING OFFICER

Accepted this 10 day
of June, 1944.

E. I. DU PONT DE NEMOURS & COMPANY

BY E G Robinson
E. G. Robinson
Wilmington, Delaware

JMC

THIS DOCUMENT CONSISTS OF 2 PAGES
NO. 1 OF 8 COPIES SERIES A

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

SECRET

6 October 1944

Supplement No. 4 to Secret Letter
dated 17 November 1942 to
Contract No W-7412 eng-2

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to Secret Letter dated 17 November 1942, as supplemented, to Contract No. W-7412 eng-2. It is desired by this office to modify said secret letter by adding the following code symbols:

P-45:	Hexafluoroxylene
P-45CL:	Monochlorohexafluoroxylene, containing small amounts of P-45 and dichlorohexafluoroxylene.
C-816-CLX:	Crude product produced by treatment of P-45CL with a fluorinating agent and consisting principally of hexadecafluorodimethylcyclohexane and monochloro-pentadecafluorodimethylcyclohexane.
C-816X:	Crude product produced by treatment of P-45 with a fluorinating agent and consisting principally of hexadecafluorodimethylcyclohexane.
C-715CLX:	Crude product produced by treatment of P-46 with a fluorinating agent and consisting principally of $n\text{-}C_7F_{15}Cl$, $n\text{-}C_7F_{14}Cl_2$, and $n\text{-}C_7F_{16}$.

It is understood that disclosure of information contained in this letter or in the contract relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an

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Act approved 15 June 1917 (40 Stat. 217; 50 U.S.C. 31-42), as amended by an Act approved 28 March 1940 (54 Stat. 79); and the provisions of an Act approved 12 Jan. 1938 (52 Stat. 3: 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated 22 March 1940, 5 F.R. 1147.

If the foregoing is acceptable to you, will you kindly so indicate hereon and on the inclosed copies hereof and return the original and one copy to this office as soon as practicable. Such acceptance will constitute this letter a part of Letter Contract No. W-7412 eng-2.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelley, Maj. CE

W. E. KELLEY,
Major, Corps of Engineers
Contracting Officer

Accepted this 17 day

of January ,1945.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson

E. G. Robinson
Wilmington, Delaware

SECRET

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THIS DOCUMENT CONSISTS OF 2 PAGE(S)
NO. 1 OF 9 COPIES SERIES A

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

Cont. No. W-7412 eng-2

SECRET

23 December 1944

Supplement No. 5 to
Secret Letter dated
17 November 1942 to
Contract No. W-7412 eng-2

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 17 November 1942, together with Supplements Nos. 1, 2, 3 and 4 thereto, relating to code symbols and specifications concerning Contract No. W-7412 eng-2.

It is the desire of this office to effect certain further modifications to the said secret letter as indicated below:

1. Add the following code symbol:

Product C-816-CL - Product produced by the fluorination of P-45-CL with suitable fluorinating agent, followed by distillation, and meeting the following specifications:

Mol % C-714 as tetradecafluoromethylcyclohexane and tetradecafluoroethylcyclopentane - Less than o.5% above standard sample number GD 1207A or an equivalent middle cut C-816.

Acidity - Nil.
Inertness residue, 24 hours at 212° F. - Less than 0.30%
Cloud point-Less than 68° F.
ASTM Distillation:
Initial boiling point - Not less than 172° F.
Dry Point - Not greater than 266° F.

In addition to the foregoing modification, the following specifications are to be incorporated relative to Product P-45-CL, which was defined in Supplement No. 4 to the secret letter dated 6 October 1944:

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t P-45-CL:

1.- It shall be water-white in color.

2.- It shall be free of visible moisture and sediment

3.- It shall contain not more than 14.5% chlorine (by the Parr Bomb method).

4.- It shall have a distillation range (by the Barrett method) as follows:

5% - Not lower than 140° C.
95% - Not greater than 157.5° C.

It is understood that disclosure of information contained in this letter or in the contract relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved 15 June 1917 (40 Stat. 217; 50 U.S.C. 31-42), as amended by an Act approved 28 March 1940 (54 Stat. 79); and the provisions of an Act approved 12 January 1938 (52 Stat. 3; 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated 22 March 1940. 5 F. R. 1147.

If the foregoing is acceptable to your company, it is requested that acceptance be indicated on the lower left portion of this letter as well as on the accompanying two copies, and that the original together with a copy be returned to this office without delay. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-2.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelley, Maj. CE

W. E. KELLEY,
Major, Corps of Engineers
Contracting Officer

Accepted this 20 day of

April, 1945.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson

E. G. Robinson, Gen'l Mgr.
Organic Chemicals Dept.

SECRET

[redacted] DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

EIDM A-43 MS

COPY

31 December 1942

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Gentlemen:

Reference is made to Contract No. W-7412 eng-22 dated 31 December 1942.

It will be noted that throughout the contract symbols are used in place of the names or formulae of the materials contracted for. The code for these symbols is as follows:

C-103 - UO_2
C-105 - Uranium metal.
C-116 - Slag resulting from the reaction of UF_4 and magnesium metal. This material will consist largely of magnesium fluoride but will contain some quantities of UF_4, UO_2, CaO and possibly uranium metal.
C-114 - Slag resulting from the reaction of calcium and UF_4. This material will consist largely of CaF_2 but will contain small amounts of UF_4, UO_2, uranium metal, CaO, etc.
C-117 - Dross resulting from the recasting of metal made by the reaction of magnesium with UF_4. This dross will be largely MgF_2 and UO_2 but will contain appreciable quantities of uranium metal.
C-115 - Dross resulting from the recasting of metal made by the reaction of calcium with UF_4. This dross will be largely CaF_2 and UO_2 but will contain appreciable quantities of uranium metal.
C-130 - Sludge resulting from the electrolytic metal process. This sludge is a mixture of UO_2 and uranium metal - approximately 80% or 90% UO_2.

[redacted]

C-131 - Dross resulting from the casting of metal of electrolytic process. This is a mixture of uranium metal and UO_2.
C-112 - Uranium peroxide dihydrate - $UO_4 \cdot 2H_2O$.
Product A - C-116 having an assay of not less than 25% C-105.
Product B - C-117 having an assay of not less than 83% C-105.

It is understood that disclosure of information contained in this letter, or in the contract, relating to the work contracted for hereunder, to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved June 15, 1917 (40 Stat. 217; 50 U. S. C. 31-42), as amended by an Act approved March 28, 1940 (54 Stat. 79); and the provisions of an Act approved January 12, 1938 (52 Stat. 3; 50 U. S. C. 45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F. R. 1147.

If the foregoing is acceptable to you, will you kindly so indicate hereon and on the inclosed copies hereof and return the original and one copy to this office. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

BY K. D. Nichols

K. D. NICHOLS
COL. CORPS OF ENGINEERS
CONTRACTING OFFICER

Accepted ~~this day~~ as of the 31st day
of December, 1942.

E. I. DU PONT DE NEMOURS AND COMPANY

BY E. K. Bannister

Wilmington, Delaware

EIDM A-43 MS

SECRET

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

December 30, 1942

E. I. du Pont de Nemours & Co.
Wilmington, Delaware

Gentlemen:

Reference is made to Letter Contract No. W-7412 eng-22 dated December 30, 1942.

It will be noted that throughout the letter contract symbols are used in place of the names or formulae of the materials contracted for. The code for these symbols is as follows:

C103 - UO_2

C110 - Slag resulting from the reaction of UF_4 and magnesium metal. This material will consist largely of magnesium fluoride but will contain some quantities of UF_4, UO_2, CaO and possibly uranium metal.

C111 - Slag resulting from the reaction of calcium and UF_4. This material will consist largely of CaF_2 but will contain small amounts of UF_4, UO_2, uranium metal, CaO, etc.

C112 - Dross resulting from the recasting of metal made by the reaction of magnesium with UF_4. This dross will be largely MgF_2 and UO_2 but will contain appreciable quantities of uranium metal.

C113 - Dross resulting from the recasting of metal made by the reaction of calcium with UF_4. This dross will be largely CaF_2 and UO_2 but will contain appreciable quantities of uranium metal.

C114 - Sludge resulting from the electrolytic metal process. This sludge is a mixture of UO_2 and uranium metal - approximately 80% to 90% UO_2.

C115 - Dross resulting from the casting of metal of electrolytic process. This is a mixture of uranium metal and UO_2.

SECRET

[redacted]

It is understood that disclosure of information contained in this letter or in the letter contract relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. (See Title 1 of an Act approved June 15, 1917, 40 Stat. 217; 50 U.S.C. 30-42), as amended by an Act approved March 23, 1940 (54 Stat. Chap. 72); and the provisions of an Act approved January 12, 1938, (52 Stat. 3; 50 U.S.C., Supp. V45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F.R. 1147, D.I.).

It is understood and agreed that this letter is to become a part of Letter Contract No. W-7412 eng-22 in the same manner as if fully set forth therein. A copy of this letter shall be kept on file in the Manhattan District Office.

Very truly yours,

E. A. Brinkman

E. A. BRINKMAN
MAJOR, CORPS OF ENGINEERS
CONTRACTING OFFICER

Accepted as of the ~~this~~ 30 day of December, ~~1944~~ 1942.

E. I. DU PONT DE NEMOURS & COMPANY

BY E. G. Robinson

E. G. Robinson
Wilmington, Delaware

[redacted]

SECRET

WAR DEPARTMENT This document consists of 2 pages
UNITED STATES ENGINEER OFFICE [illegible] copies, Series A

MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

EIDM A-46-a MS

18 May 1944
Supplement No. 1 to
Code Letter Dated
31 December 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942 which described the meaning of certain code symbols that were used in the subject contract, and in connection therewith it is proposed to supplement the aforesaid secret letter to include the definitions of Product C and Product D, as follows:

Product C - C-116 having an average assay of 5.5% C-105 and containing no more than 35% fluorine.

Product D - C-117 having an average assay of 70% C-105 and containing no more than 10% fluorine.

It is understood that disclosure of information contained in this letter, or in the contract, relating to the work contracted for hereunder to any person not entitled to receive it, or failure to safeguard all secret, confidential and restricted matter that may come to the Contractor or any person under his control in connection with the work under this contract, may subject the Contractor, his agents, employees and subcontractors to criminal liability under the laws of the United States. See Title 1 of an Act approved June 15, 1917 (40 Stat. 217; 50 U.S.C. 31-42), as amended by an Act approved March 28, 1940 (54 Stat. 79); and the provisions of an Act approved January 12, 1938 (52 Stat. 3; 50 U.S.C. 45-45d), as supplemented by Executive Order No. 8381, dated March 22, 1940, 5 F.R. 1147.

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JUN 12 1944

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If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date.

Very truly yours,

THE UNITED STATES OF AMERICA

BY E. A. Brinkman

E. A. BRINKMAN
Major, Corps of Engineers
Contracting Officer

Accepted this 10 day of

June, 1944

E. I. DU PONT DE NEMOURS & COMPANY

BY E. G. Robinson

Wilmington, Delaware

E. G. Robinson

SECRET

 M-3

Cont.No.W-7412 eng-22

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

SECRET

23 December 1944
Supplement No. 2 to
Code Letter dated
31 December 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to modify said secret letter by adding thereto the following code symbol and its meaning:

Product E - A mixture of C-116 and C-117 containing an average of 8.7% C-105.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By William G. Akeley

WILLIAM G. AKELEY
Major, Corps of Engineers
Contracting Officer

Accepted as of this 23 day of December 1944.

SECRET

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson

E.G.Robinson, Gen'l Mgr. Organic Chemicals Dept.
Wilmington, Delaware

RGC

SECRET

This document consists of / pages
No. / of ___ Copies, Series A

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

Contract No.
W-7412 eng-22

25 June 1945
Supplement No. 3 to
Code Letter dated
31 December 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McClure, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to modify said secret letter by adding thereto the following code symbol and its meaning:

Product F - A mixture of C-116 and C-117 containing an average of 5.7% C-105.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelley, Maj. CE

W. E. KELLEY,
Major, Corps of Engineers
Contracting Officer

Accepted this 9 day of
July, 1945.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson
E. G. Robinson
General Manager, Organic Chemicals Dept.

SECRET

WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK 16, N. Y.

Cont.No. W-7412 eng-22.

25 June 1945
Supplement No. 4 to
Code Letter dated
31 December 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said secret letter by adding thereto the following code symbol and its meaning:

Product G - A mixture of uranium-containing residues and by-products having an average content of 8.3% uranium.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelly, Lt Col

Lt. Col. Corps of Engineers,
Contracting Officer

Accepted this 30 day of
October, 1945.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson
E. G. Robinson
General Manager
Organic Chemicals Department

UNCLASSIFIED

ARMY SERVICE FORCES
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK, N. Y.

IN REPLY REFER TO EIDM A-42 MS
Cont.No. W-7412 eng-22

11 December 1945
Supplement No. 5 to Code Letter
dated 31 December 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said secret letter by adding thereto the following code symbol and its meaning:

Product H - A mixture of uranium-containing residues and by-products having an average content of 5.5% uranium.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelly

W. E. KELLY,
Lt. Col., Corps of Engineers
Contracting Officer

Accepted this 1st. day of
February, 1946.

E. I. DU PONT DE NEMOURS & COMPANY

By _____
General Manager
Organic Chemicals Department

SECRET

ARMY SERVICE FORCES
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK, N. Y.

IN REPLY REFER TO EIDM A-42 MS
W-7412 eng-22

12 March 1946
Supplement No. 6 to
Code Letter dated
31 December 1942 to
Contract No. W-7412
eng-22.

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said secret letter by adding thereto the following code symbol and its meaning:

Product I - A mixture of uranium-containing residues and by-products having an average content of 27.3% uranium.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By W. E. Kelley, Lt. Col. C.E.

W. E. KELLEY,
Lt. Col., Corps of Engineers
Contracting Officer

Accepted this 16th day of
April, 1946.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson

E. G. Robinson
General Manager
Organic Chemicals Department

SECRET

This document consists of [illegible] pages A
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ARMY SERVICE FORCES
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK, N. Y.

IN REPLY REFER TO EIDM A-42 MS
W-7412 eng-22

17 June 1946
Supplement No. 7 to
Code Letter dated
31 December 1942 to
Contract No. W-7412
eng-22.

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said secret letter by adding thereto the following code symbol and its meaning:

Product J - A mixture of uranium-containing residues and by-products having an average content of 28.3% uranium.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By G. W. Beeler

G. W. Beeler,
Colonel, Corps of Engineers,
Contracting Officer.

Accepted this 27th day of
August, 1946.

E. I. DU PONT DE NEMOURS & COMPANY

By E. G. Robinson

E. G. Robinson
General Manager
Organic Chemicals Department

ARMY SERVICE FORCES
UNITED STATES ENGINEER OFFICE
MADISON SQUARE AREA
P. O. BOX 42
STATION F
NEW YORK, N. Y.

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IN REPLY REFER TO: EIDM A-42 MS
W-7412 eng-22

11 September 1946
Supplement No. 8 to
Code Letter dated
31 December 1942 to
Contract No. W-7412
eng-22.

E. I. Du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to secret letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said secret letter by adding thereto the following code symbol and its meaning:

Product K -- A mixture of uranium - containing residues and by-products having an average content of 23.3% uranium.

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

THE UNITED STATES OF AMERICA

By G. W. Baehr

G. W. Baehr,
Colonel, Corps of Engineers,
Contracting Officer.

Accepted this 27 day of
September, 1946.

E. I. DU PONT DE NEMOURS & COMPANY

By Ely Robinson

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WAR DEPARTMENT
CORPS OF ENGINEERS
OFFICE OF THE AREA ENGINEER
MANHATTAN DISTRICT
MADISON SQUARE AREA
NEW YORK, NEW YORK

REPLY TO
AREA ENGINEER
MADISON SQUARE AREA
CORPS OF ENGINEERS
P.O. BOX 42, STATION F
NEW YORK 16, NEW YORK

REFER TO FILE NO. EIDMA-42 MS
W-7412 eng-22

23 December 1946
Supplement No. 9 to
Code Letter dated
31 December 1942 to
Contract No. W-7412 eng-22.

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to Secret Letter from this office dated 31 December 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said Secret Letter by adding thereto the following code symbol and its meaning:

Product L - A mixture of uranium-containing residue and by-products having an average content of 29.6% uranium.

OK
RGC

If the foregoing is acceptable to your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

UNITED STATES OF AMERICA

By GW Beetler

G. W. Beetler,
Colonel, Corps of Engineers,
Commanding Officer.

Accepted this 9th day of
January, 1947.

E. I. DU PONT DE NEMOURS & COMPANY

By Ed Robie
General Manager
Organic Chemicals Department

UNCLASSIFIED

UNITED STATES
ATOMIC ENERGY COMMISSION
Madison Square Area
P. O. Box 42, Station F
New York, N. Y.

EIDMA-42 MS
W-7412 eng-22

March 3, 1947
Supplement No. 10 to
Code Letter dated
December 31, 1942 to
Contract No. W-7412 eng-22

E. I. du Pont de Nemours & Company
Wilmington, Delaware

Attention: Mr. S. W. McCune, Jr.

Gentlemen:

Reference is made to Secret Letter from this office dated December 31, 1942, as modified, to Contract No. W-7412 eng-22.

It is the desire of this office to further modify said Secret Letter by adding thereto the following code symbol and its meaning:

Product M - Feed material suitable for the use of the Recovery Plant, having an average assay of 30.3% calculated as Product C-105.

If the foregoing is suitable tc your company, it is requested that the original and a copy hereof be signed and returned to this office at the earliest practicable date. Such acceptance will constitute this letter a part of Contract No. W-7412 eng-22.

Very truly yours,

UNITED STATES OF AMERICA

Accepted this 21 day of

May, 1947.

By W. E. Kelly
Contracting Officer

E. I. DU PONT DE NEMOURS & COMPANY

By Ed Robinson
E. G. Robinson, General Manager
Organic Chemicals Department

FUSRAP

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168-EDA-GEN-000007

US Army Corps of Engineers.

DATE PROCESSED BY PDCC NOV 13 1997

COMM REF _____

SUBJECT DUP: ERDA News Release that Radiological Survey Will be Performed at DuPont

FROM RUDEK TO FILE COMM DATE 3/11/77

ADDR CODE | | | | CLOSES CCN _____

WBS 108 7315

RESPONSE TRACKING INFORMATION

ACTION DESCRIPTION: _____

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(ORG) _____ TARGET DATE _____

PARENT:
OWED BY: _____ (ORG) _____
CLOSING CCN _____ COMP. DATE / / CLOSING REF _____

01:
OWED TO: _____ / /
(ORG) _____ TARGET DATE _____

01:
OWED BY: _____ (ORG) _____
CLOSING CCN _____ COMP. DATE / / CLOSING REF _____

MESSAGE:

168K

USACE	W/A	W/O	SITES:	W/A	W/O	BNI	W/A	W/O
Commander, USACE:			166 DUP	/		139 MIS		
			112 PNY			136 CIS		
Buffalo District			116 SLD			140 HIG		
			118 MSP			144 NBS		
			127 VEN			163 SLP		
New York District			128 LIN			166 NFS		
			134 SVP			PIC-NEW		
			137 WIS			PIC-TON		
St. Louis District			ORNL:			ENGINEERING		
			ORISE:			QUALITY ASSURANCE		
			SEC:			HEALTH & SAFETY		
New England District			DPRA:			ENVIR. COMPLIANCE		
			OTHER:			WASTE MANAGEMENT/TREATMENT		
						PROCUREMENT		
Philadelphia District			R. Howard	✓		ADMINISTRATION / INFORMATION		
GARY BOHN	!					PROJECT CONTROLS		
						TECHNICAL REPORTS		
Baltimore District								
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SAIC								
PROGRAM MANAGER J. Waddell								
DEPUTY PROGRAM MGR: G. Stephens								
MGMT. SYSTEMS: K. Renfro								
SECRETARY: S. Hopkinson								

PROGRAM MANAGER:	A. Boos		
PROJECT SUPPORT MGR.:	R. Barber		
PROGRAM INT. MGR.:	G. Dover		
PROJ. MGRS.:	S. Wilkinson		
	K. Albin		
	P. Griffin		
COMMUNITY RELATIONS			
CONSTRUCTION			

R/F: ☐ CHRON FILE DLG

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PLEASE RETURN TO PDCC FOR CORRECTIONS

NEWS

OAK RIDGE OPERATIONS
UNITED STATES
ENERGY RESEARCH
& DEVELOPMENT ADMINISTRATION
Oak Ridge, TN 37830

FOR IMMEDIATE RELEASE

Telephone No. - Area Code 615
483-8611 - Extension 3-4231

ERDA PLANS SURVEY
OF DUPONT BUILDING

DEEPWATER, New Jersey -- The Energy Research and Development Administration (ERDA) will conduct a radiological survey at the E. I. DuPont DeNemours and Company's Chambers Works here beginning Monday, March 14.

The survey will be conducted on portions of DuPont's Chambers Works that were used during the 1940's in the processing of uranium, initially for the World War II Manhattan Project and later for the former Atomic Energy Commission.

The survey is part of a national program by ERDA to resurvey certain sites formerly used for research and production in the Nation's early atomic energy program. The Deepwater site is one of some 50 sites where ERDA has conducted or is considering surveys, as announced by ERDA in September of 1976.

The ERDA surveys are being made where radiological records are considered insufficient by ERDA to document the location and quantity of any residual radioactive material which may remain at the sites.

The survey in Deepwater will be conducted by a team of four specialists from ERDA's Oak Ridge (Tennessee) National Laboratory which is providing technical assistance in the National survey program. The survey will involve

(more)

taking measurements within and around one DuPont building that was involved in the early uranium production project. ERDA estimates the survey will take approximately two weeks to complete.

During the period 1942 through 1948 the DuPont facility was used for the production of uranium compounds and metal from uranium ore concentrates and scrap material.

# # #

March 11, 1977