ENVIRONMENTAL ASSESSMENT FOR THE REMOVAL OF CONTAMINATED SOIL AT THE ROCKY FLATS PLANT OF THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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ABSTRACT

The plan for the removal of plutonium-239 contaminated soil from an area of about 2,000 m^2 to a depth of 15 cm is described.

This action will provide an opportunity for coordinated study of soil removal techniques and their effectiveness in preventing resuspension of plutonium contaminated particles. Backfilling and seeding should establish good grass cover in approximately two years.

No significant adverse impact on the environment is expected, and the USERDA recommends that no environmental statement be prepared.

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I. GENERAL STATEMENT

This environmental assessment has been prepared in compliance with the National Environmental Policy Act of 1969. The purpose of this assessment is to describe the planned ERDA action of removing contaminated soil at the Rocky Flats Plant and to assess the potential impacts of this action on the surrounding environment. The area of soil to be removed is located within the security fenced area which surrounds the Rocky Flats Plant as shown in Figure 1. A closer view indicating the areas of excavation is shown in Figure 2.

Careful assessment of this planned action indicates that little, if any, adverse environmental impact would result if the plan were implemented. In fact, there would be an environmental benefit since soil containing significant concentrations of plutonium would be removed, and potential resuspension from the excavated areas would be prevented.

Since this action is not expected to have any significant adverse impact on the environment, USERDA recommends that no environmental statement be prepared.

II. BACKGROUND

A. Existing Situation

Prior to 1951 when the Rocky Flats Plant was established, the area was used for grazing, which caused a significant impact on the plant and animal populations of Rocky Flats. The natural succession of the vegetative cover has been only partially successful and the area still contains significant populations of European weeds. In the intervening years, the contaminated area has seen limited human intrusion. Since the discovery of the hot spots, no vehicles have been allowed in the area. Therefore, the present principal intrusion into the area is by pedestrian researchers.

During the time period between 1959 and 1967 approximately 5240 drums of plutonium and uranium contaminated machining oil and lathe coolant were stored in the 903 Area, also known as the Oil Drum Storage Field. The approximate location of the drums was near the center of the presently existing asphalt pad shown in Figure 2. The first drums were placed in the 903 Area in July 1959 and the first drums were removed in January 1967. During the 8 years of outdoor storage, several drums were damaged by corrosion and oil leakage occurred. It has since been estimated by Rocky Flats personnel that approximately 5,000 gallons of

oil containing an estimated 86 grams of plutonium-239 leaked from approximately 100 corroded drums into the soil.[1]

During the period between the initiation of the drum removal project and October 1969, when an asphalt pad was placed over the old drum storage area to contain the plutonium in the soil, approximately one curie* of plutonium-239 was redistributed away from the pad area by natural forces and spread over an area of more than 2,000 acres. Krey[2] has calculated a slightly different inventory. His current estimates include 1.4 curies beyond the 3 mCi/hm^2 contour and 10 curies inside the 3 mCi/hm^2 contour. The latter value includes 1.4 curies off site and 8.6 curies on Rocky Flats land. The total estimated plutonium released by Rocky Flats, according to Krey, was 11.4 curies, which is about twice that estimated by Dow.[1] Krey's explanation for this difference is related to sampling depth. The HASL data were based on samples collected to a depth of 20 cm while Dow and others took either the top one or five centimeters. The major concentrations were spread to the east and south of the asphalt pad, and it is now estimated that approximately 1/2 curie of that plutonium is within the contours shown in Figure 3.

*One curie of plutonium-239 represents about 16 grams of that element.

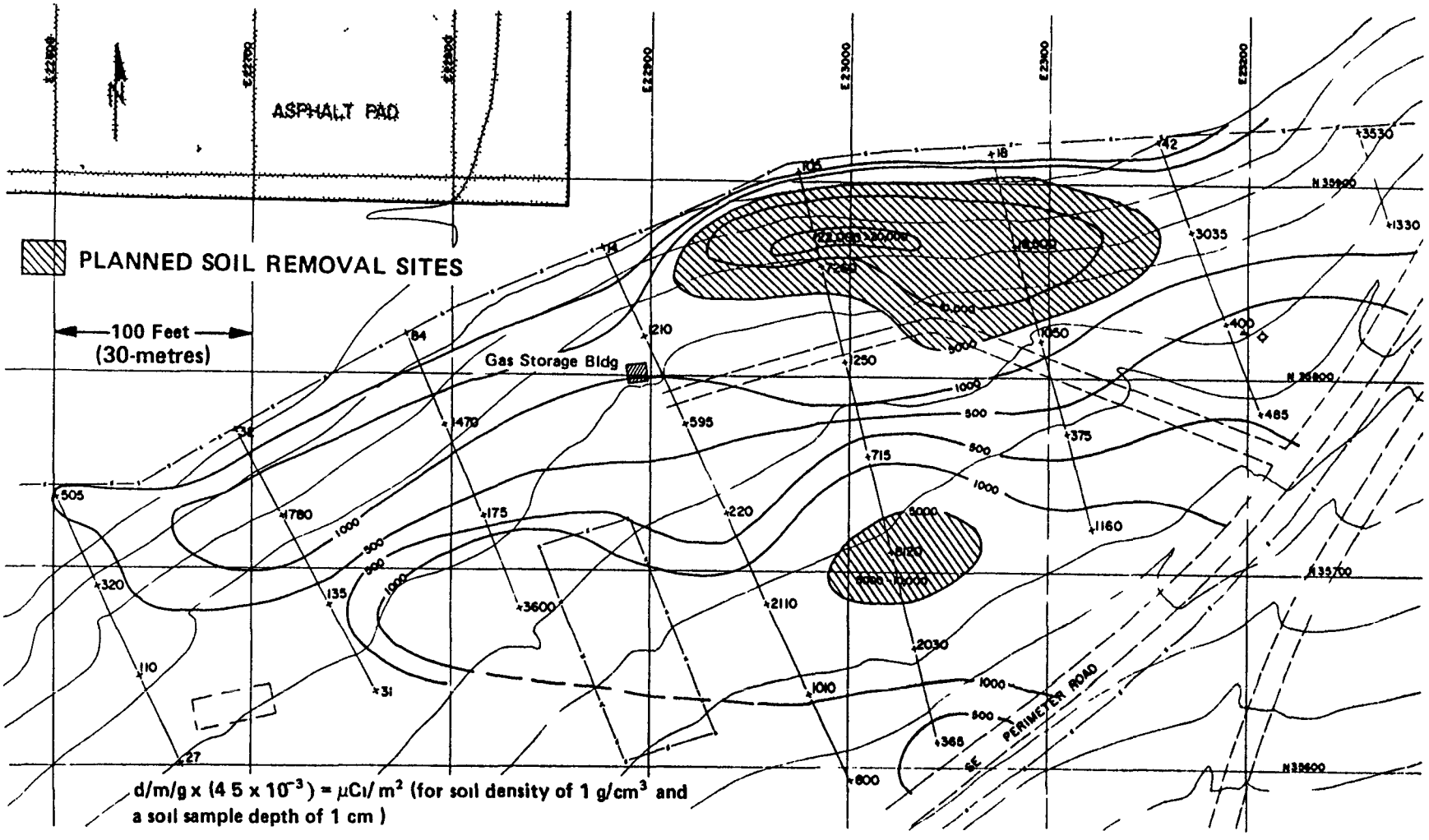

Figure 3 Plutonium Concentrations (d/m/g) Determined by Radiochemical Analysis of Soil Samples Collected in March, 1974

The contaminated soil is situated on the side of a small ancient erosional valley which has cut through the old Rocky Flats pediment surface. At the present time, limited erosion of the slope occurs only during exceptionally wet weather by sloughing of the surface layers. The area was vegetated with mixed prairie grasses. There were also abundant tall growing mullein plants, scattered small forbs and sedge and sparce shrubs like rabbitbrush, pincushion cactus and plains pricklypear. Vegetation covered about 70% of the ground surface until May 1975 at which time a herbicide was applied to the area planned for excavation. Subsequently the area was irrigated with an equivalent of 20 inches of rainfall and a sacrificial crop of millet was planted. Recovery of vegetation in the area is expected by the fall of 1976.

Surveys at the time of the drum removal project and subsequent annual soil sampling detected a maximum plutonium-239 concentration of 5,680 d/m/g in the top 5 cm of soil in the general area southeast of the Oil Drum Storage Field. In June 1973 an aerial radiological monitoring survey (ARMS) by EG&G, Inc., of Las Vegas, Nevada, detected radioactive concentrations similar to the contours shown in Figure 3.[3] This was the first indication of a contaminated area rather than isolated plutonium in soil anomalies. In July 1973 personnel from the USAEC Health and Safety

Laboratory (HASL) conducted simultaneous soil sampling and direct reading surveys of the area using a field instrument for detecting low energy radiation (a FIDLER) which confirmed the ARMS survey.

On the basis of these preliminary surveys, it was decided to do a more extensive study, including soil profile analyses. The purpose of the study was to obtain an accurate assessment which would permit removing the contaminated soil. Figure 3 is a summary of the results of the soil analyses. Thirty-seven soil samples were collected at 50 foot intervals along eight parallel transverses 100 feet apart. Samples were taken to a depth of 5 cm in a 10 by 10 cm square. The samples were air dried, sieved through a 35 mesh screen and analyzed for plutonium by the method of Talvitie.[4] Soil profile data were obtained from 19 samples collected at 15 cm intervals down to a maximum of 45 cm at seven selected sites. Samples were collected using a 3 inch diameter orchard auger. Each 15 cm interval was treated as one sample, i.e., air dried, sieved to pass 35 mesh and analyzed for plutonium on a d/m/g basis. The results are shown in Table I. The two shaded areas shown on Figure 3 describe the planned excavation sites and encompass a total area of approximately 2,000 square meters contaminated with plutonium-239 in excess of 5,000 d/m/g.

TABLE I

SOIL PROFILE DATA

Sample No.	Depth Zone (cm)	Plutonium (d/m/g)
4B-1	0-15	980
4B-2	15-30	150
4B-3	30-45	93
4D-1	0-15	150
4D-2	15-30	27
4D-3	30-45	16
5B-1	0-15	1140
5B-2	15-30	905
5D-1	0-15	48
5D-2	15-30	16
5D-3	30-45	16
5E-1	0-15	155
5E-2	15-30	105
5E-3	30-45	28
6B-1	0-15	1980
6B-2	15-30	1820
6D-1	0-15	420
6D-2	15-30	1820
6D-3	30-45	960

In January 1974 a public briefing was held at the Rocky Flats Plant for the Governor of the State of Colorado and other state officials. In that briefing the contaminated zone was described as an area of concern. During the briefing and in releases to the press which followed, the ERDA made a commitment to examine techniques to further stabilize or remove the contaminated soil. Although there is no known public health hazard at the present time, there is a potential environmental problem. The concentrations of plutonium in the soil are of concern and are significant enough to warrant prompt action to insure that no off site releases occur. It is in the best interests of health and safety and public relations with surrounding communities to remove the contaminated soil and by so doing eliminate a potential hazard.

Personnel from the Colorado State Department of Health have been advised of the plan to remove some of the contaminated soil and agree that the potential for future environmental problems warrants the safe removal of the soil as soon as practical.

Stability of the area is based on Dow air monitoring results from instruments located east (the prevailing downwind direction) of the area. Air sample results have not shown higher than 11% of the Radioactivity Concentration Guide

(RCG_a) for soluble plutonium-239 in a controlled area which is 2.0 pCi/m^3.* Additional air monitors maintained by the Colorado Department of Health (CDH) likewise have not shown excessive amounts of airborne plutonium. Figure 4 shows the relative locations of the Dow and CDH air monitors. Air monitoring instrumentation consists of a vacuum pump and filter paper collector which samples about two cubic feet of air per minute on a continuous basis. The filters are analyzed weekly for total alpha activity and composited for monthly plutonium analysis.

The average alpha radioactivity concentrations from eight stations are shown in Table II. Stations D-4 and AF-83 are located immediately downwind from the contaminated area. The other stations are located east and northeast of the area at a maximum distance of 800 feet. The results are for total long-lived alpha activity except for the 1974 Dow results which are concentrations of plutonium-239. It should be noted that all of the annual averages are significantly below the recommended Radioactivity Concentration Guide.

Calculations of dose commitments from these air concentrations have been made. The results for the same eight

*Standards for Radiation Protection, U.S. Atomic Energy Commission, AEC Manual Chapter 0524.

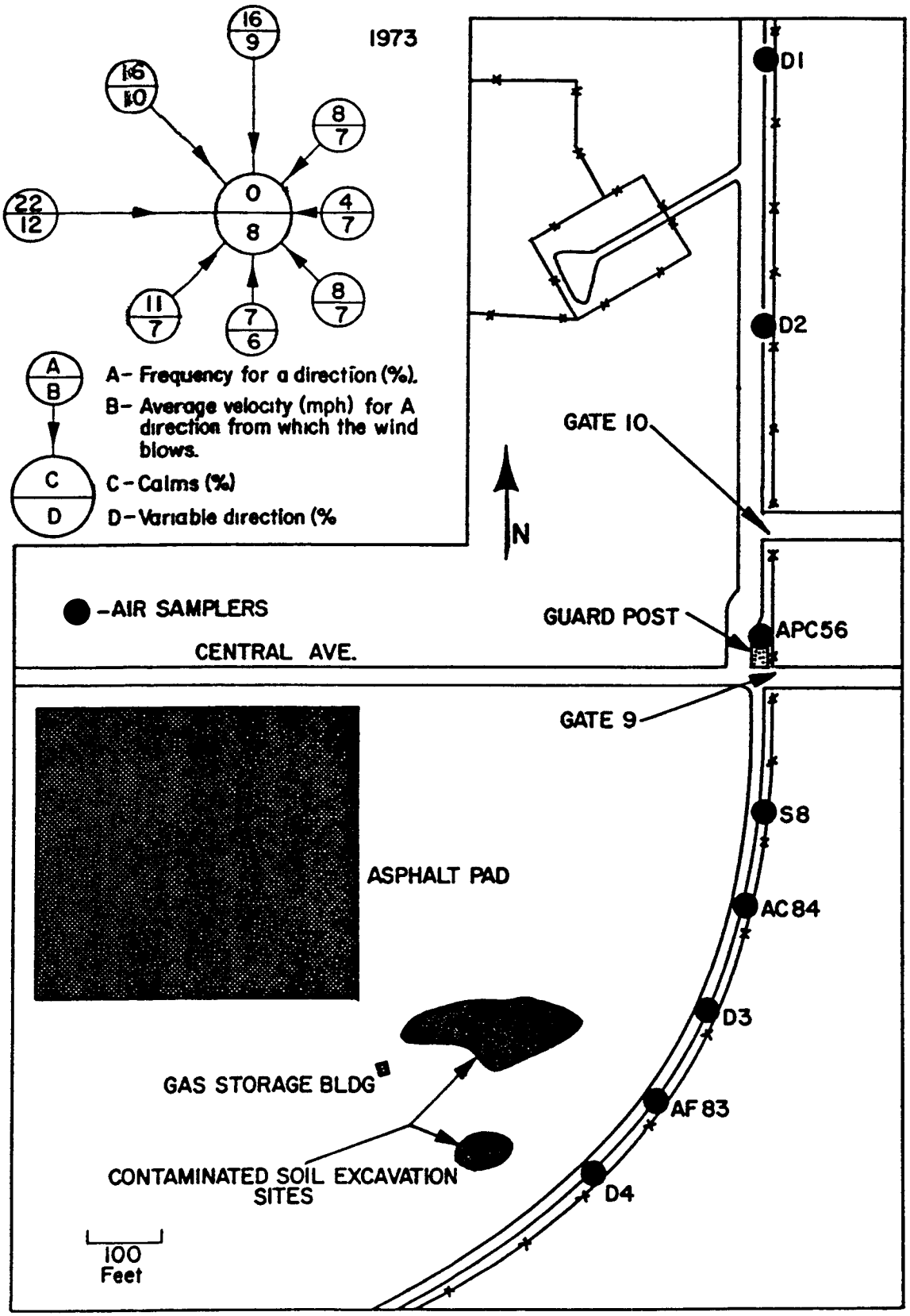

Figure 4 Location of the Dow and CDH Air Samplers east of the contaminated soil excavation sites.

TABLE II

AVERAGE ANNUAL ALPHA RADIOACTIVITY*
IN AIR AT EAST EDGE OF ROCKY FLATS

Colorado Health Department Stations

Station Code	1973	1974
D-1	0.008**	0.008
D-2	0.008	0.007
APC56	0.010	0.010
D-3	0.008	0.007
D-4	0.006	0.006

Dow Stations

Station Code	1973	1974
S-8	0.005	0.003
AC-84	--	0.001
AF-83	--	0.001

*RCG_a for soluble plutonium-239 in a controlled area is 2.0 pCi/m^3.

**Results are for the average of daily samples collected during indicated year.

stations are shown in Table III. It was assumed that a person would be standing near the station for eight hours per day, 260 working days per year, without the use of a respirator or other protective devices. A typical calculation of dose is as follows:

$$\text{DOSE} = \text{STANDARD} \times \frac{C_{avg}}{RCG_a}$$

where the STANDARD = 15 Rem/year, the RCG_a = 2.0 pCi/m^3 and using the maximum average annual concentration from Table I (i.e. station APC56) so that C_{avg} = 0.01 pCi/m^3. Then,

$$\text{DOSE} = 15 \text{ Rem/yr} \times \frac{0.1 \text{ pCi/m}^3}{2.0 \text{ pCi/m}^3}$$

$$= 0.075 \text{ Rem/yr}$$

Thus, the maximum occupational dose received by a worker who was employed continuously in this area would be less than 0.08 Rem. This calculation is based on the most restrictive standard by assuming the plutonium-239 involved in the exposure is in a soluble form. This is a commonly accepted conservative approach and the values in Table III were calculated in this manner. If the assumption had been made that the plutonium is in an insoluble form then the RCG_a would be 40.0 pCi/m^3 and the calculated DOSE near station APC56 would be less than 0.004 Rem/year, i.e., approximately 20 times lower.

TABLE III

CALCULATED INTERNAL DOSAGE*

FROM AIR IN REM/YEAR

Colorado Health Department Stations

Station Code	1973	1974
D-1	0.06**	0.06
D-2	0.06	0.05
APC56	0.08	0.08
D-3	0.06	0.05
D-4	0.05	0.05

Dow Stations

Station Code	1973	1974
S-8	0.04	0.02
AC-84	--	0.01
AF-83	--	0.01

*Note that the maximum recommended lung dose for occupational workers is 15 Rem/year and for an individual in the general population is 1.5 Rem/year, as per the Standards for Radiation Protection, U.S. Atomic Energy Commission, AEC Manual Chapter 0524.

**Calculated Rem/hear from data in Table I.

Excavation of the contaminated soil is not expected to change the plutonium in air concentrations downwind from the site. Since the current air concentrations are less than the RCG_a reduction of the air concentration is not a reason for the cleanup. Removal of the contaminated soil simply eliminates the potential hazard if the plutonium were exposed to resuspension forces following a major natural or manmade disturbance.

In addition to the air sample data of record, dust collection pots have recently been installed immediately downwind from the contaminated area. Four of these are buried in the ground surface and three are mounted on posts about one meter above the ground. Data on plutonium movement should be available before excavation of the contaminated soil is initiated.

B. Proposed Action

The proposed action is to remove a layer of plutonium contaminated soil from the shaded area shown in Figure 3. The contamination level in these areas exceeds 5,000 d/m/g (2.3×10^{-9} Ci/g) in the top five centimeters of soil. The objective is to remove the soil until the plutonium concentration is below the limit of detection of the FIDLER instrument set up to measure the 60 keV gammas from ^{241}Am. The limit of detection for the FIDLER corresponds to

approximately 250 d/m/g of soil, which is below the proposed standard of 500 d/m/g for plutonium in soil in uncontrolled areas.[5]

Soil profile analyses (Table I) indicates that the objective of removing the plutonium contaminated soil to a level less than detectable by the FIDLER instrument can probably be accomplished by removing an average of 15 cm of soil throughout the approximately 2,000 square meter area. The excavation will generate approximately 10,500 cubic feet of contaminated soil requireing approximately 1500 55-gallon waste drums for shipment to a waste disposal facility in Idaho.

Since the contaminated soil near the asphalt pad is within the plant security fence and access to the area is restricted to authorized personnel only, it is planned to remove soil only in areas contaminated above 5,000 d/m/g. Although this level is a factor of ten greater than the proposed standard, the area has limited access and is not open to the general population. When USERDA or USEPA adopts soil standards for plutonium contamination, the question of soil contamination at Rocky Flats will be reassessed.

The removal is expected to take approximately 30 man-months and will begin in the spring of 1976. The excavation will

be performed by closely supervised laborers who will be trained in excavating and health physics procedures in a non-contaminated analog area. The training excavation will also provide an opportunity to refine the techniques for dust suppression and to determine the degree of soil resuspension that can be expected.

Rocky Flats Health Physics personnel will provide protective clothing and respiratory protective equipment to all personnel participating in the project which will be worn during excavation and handling of the soil. They will also insure compliance with all appropriate health physics precautions. In addition, all individuals participating in the soil excavation project will be required to shower at the end of each shift, and as a further protection, these personnel will be provided with all of the Rocky Flats radiation dosimetry techniques, including urine assay, whole body counting, and radiation exposure badges.

Dust palliatives will be used to control resuspension during and after the operation. Examples of these control measures are spraying the area with water periodically and using soil stabilizers. To assure that the palliatives are effective, continuous alarmed particulate air monitors will be operated in the immediate area of the excavation. It is planned to modify or cease excavation when the air concen-

trations detected by the air monitors exceeds the AECM 0524 Radioactivity Concentration Guides (RCG's).

To assure that significant transport of the plutonium is not occurring at air concentrations below the RCG's, fallout pots of the type used by the USERDA Health and Safety Laboratory will be placed around the excavation site. The dustfall in the pots will be analyzed weekly for plutonium-239. The results of the analysis will be compared with preoperational data from the fallout pots and routine air sampling. Excavation will be modified or cease when the deposition in the fallout pots exceeds ten times the pre-excavation rates. In addition, various air and dust samplers and measuring instruments have been proposed for installation by Dow, Lawrence Livermore Laboratory (LLL) and Pacific Northwest Laboratory (PNL).

Weather observation and prediction will be an important part of this project. Rocky Flats weather observations are made at a station located about 4600 feet from the area of concern. A temporary wind direction and velocity measurement system will be installed immediately adjacent to the area of excavation. Precipitation at Rocky Flats is light with an annual average of 16 inches. The maximum yearly total recorded over a 21 year period was 25 inches

in 1969. The minimum for the same period was 8 inches in 1954. The greatest amount for one day was 3.4 inches in May 1969.

High force winds gusting to velocities of approximately 105 miles per hour have been recorded at Rocky Flats on four occasions in 17 years: March 1956, January 1959, January 1972 and November 1972. The 21 year average of the mean wind velocity was eight miles per hour. The highest velocity and most sustained high force winds have occurred during the period October through May. The winds at Rocky Flats, although variable, are predominantly from western quadrants. Over a 17-year period (1953 to 1970), west winds occurred 25% of the time and more than 50% of the winds had a westerly component.

Since the soil excavation is planned for the summer months, the major weather concerns are rain storms and high winds. Summer forecasts of these two conditions are not feasible on a day-to-day basis for this local area. There are available, however, climatological frequency charts of periods of wind velocity equal to or greater than 20 miles per hour for periods greater than two hours. These charts were prepared by L. W. Crow, a consultant meterologist, from historical data from the Rocky Flats weather station. Crow recommends June as a typical low-wind month (Appendix

I). Thunderstorms at Rocky Flats usually occur in the afternoon and are preceeded by the buildup of cloud formations which should provide adequate warning. Each cessation of excavation will be immediately followed by appropriate soil stabilization measures.

Contaminated soil will be excavated from one small area at a time and an area resurveyed using a FIDLER to determine if detectable contamination levels remain in the soil. A floorless metal building, about 8 by 16 feet, equipped with a door, window, HEPA filter and air mover will serve as a shelter over the immediate digging area. This building was used successfully for the excavation of two trenches in the contaminated area by personnel from USERDA-HASL in order to obtain samples for depth profile analysis.

A plywood walkway will be installed between the digging site and the non-contaminated roadway. The walkway will be used to move soil, equipment and personnel into the area. It will be checked daily for spread of contamination.

Excavation will continue until the contamination levels are below detectable and then the area will be filled with clean topsoil, fertilized, seeded, and irrigated. An estimate of the cost for the planned operation is as follows:

Personnel	$ 69,000
Materials	37,200
Shipping	16,800
Support	12,000
Contingency	15,000
	$150,000

Immediately outside the security fence in a direction southeast of the excavation sites, and at a distance of approximately 150 feet, lies the nearest edge of an area under intensive study by the Colorado State University Department of Radiology and Radiation Biology. This area is valued as a site for the study of plutonium-239 in the environment. The studies are funded by the ERDA's Division of Biomedical and Environmental Research (DBER) and include such aspects of plutonium in the environment as mechanical transport, uptake in biological systems, solubilization, and movement among tropic levels in the food web.

Since the area is providing valuable information on plutonium in the environment, with approximately four years work completed in a projected six-year study, there is concern that during the excavation some contaminated soil will be blown into the study area. Present plans call for excavation of the contaminated soil during calm periods inside a metal building. These plans will be carried out

under careful supervision and should assure minimal adverse impact to the study area.

C. Anticipated Benefits

To date there has not been any evidence of danger to the environment as a result of the contamination in the area southeast of the asphalt pad. This evaluation is based on air and water sample data collected by both the Rocky Flats contractor and the Colorado Department of Health. However, only removal of the contaminated soil can absolutely insure agains the further potential redistribution of the plutonium by severe weather action.

Even though there seems to be oral agreement between Rocky Flats and the Colorado State Department of Health that the area is stabilized, the area is viewed by the public as a potential health hazard and only removal of the most elevated levels of contaminated soil will alleviate this concern. In addition, removal would be in keeping with the "as low as practicable" philosophy.

In addition to the anticipated benefit of removing soil that could be considered a potential health hazard if redistributed, the experience gained by Rocky Flats personnel in soil removal along with the environmental affects information gathered before, during, and after that

operation would be of value. Little is known in this area and the experience gained will be useful in evaluating the removal of other contaminated soil areas at Rocky Flats and elsewhere.

Through the process of reclamation, an uncontaminated area of soil will be surrounded by contaminated soil. One benefit of this process will be the opportunity to study the transport, if it occurs, of plutonium from the contaminated area to the uncontaminated area.

III. ENVIRONMENTAL IMPACT

The movement of personnel and equipment onto the mixed prairie grassland will temporarily disrupt the succession of vegetation in the immediate area. In addition, once disturbed, the soil becomes more susceptible to wind and water erosion. This condition is anticipated in both the planned excavation area and any access routes used for movement of personnel and equipment. However, care will be taken to keep the movement to the minimum required for successful contaminated soil removal.

The liberal and widespread application of dust palliatives is expected to effectively control soil resuspension. It is anticipated that Coherex will be the primary soil stabilizer used. Coherex is manufactured by the Golden Bear Division of Witco Chemical Company. It is a non-volatile emulsion consisting of 60% semi-liquid natural petroleum products and 40% wetting agents. A water solution (1 part Coherex to 4 parts water) is applied at a concentration of 0.5 gallon per square yard. Coherex has been successfully used in a variety of soil stabilization projects in Colorado[7] and elsewhere.[8] It does not affect the growth of vegetation and is non-toxic.[9] The solution is applied with a spray nozzle at low pressures from a mixing tank. A second stabilizer, J-197, will be available for use if needed. J-197 is produced by the Dowell Division of Dow Chemical U.S.A. It is poly-acrylamide, which

is a plastic product similar to surfactant chemicals and thickening agents. It is mixed with water and applied at a rate of about 40 pounds per acre from a mist spray nozzle. The anticipated results from the use of one or both dust palliatives will be the absence of any soil resuspension during and after excavation and rehabilitation operations.

Additional soil control measures will include revegetating the area with native grasses. This operation will consist of adding four inches of clean topsoil, hydroseeding with a water slurry of grass seed, fertilizer and mulch, and applying a chemical soil stabilizer to prevent erosion during grass germination and initial growth.

As each excavated area is backfilled with topsoil and seeded it will be necessary to irrigate that area. It is now known exactly what effect irrigation will have on the adjacent areas. However, the adjacent areas have some grass cover and irrigation will most likely enhance the growth. Careful controls will be used to prevent erosion of the soil from occurring. Several years exposure of the present area to natural weather conditions, including a 25-year storm in May 1969 has shown no visible signs of detrimental erosion. The plant geologist considers the slope stable, since it has been rebuilt and compacted. Therefore, it is not expected to slump in the event of a 100-year storm which could yield as much as 3.7 inches of rainfall in

6 hours.[10] Whether or not a 100-year storm would result in visible signs of erosion is not known. However, the stability of the site precludes severe erosion from occurring during normal storm situations.

Careful irrigation of the newly seeded area should not have significant environmental impact. According to C. L. Williams (Appendix II), "grass can be established if the proper procedures are followed. This has been demonstrated with seedings made in prior years. It would probably be necessary to use top-soil and irrigation water during the establishment period. Other less expensive items requiring consideration would be proper selection of grass species, fertilizer, equipment, time of seeding, and management." Approximately two years after the excavation, the area should have recovered to a self maintaining state and require no further irrigation or treatment.

"If climax species are seeded at the proper rate, they will continue to grow indefinitely. There is no danger of their dying out and a future plant succession having to occur." After many years, perhaps 50, the area will approach the climax community and there would be little change for undesirable plant encroachment and establishment.

IV. UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The major unavoidable effect from the removal of the contaminated soil that could be considered adverse will be the temporary disruption of this presently stable site. With the protections planned, no health hazards or effects to the surrounding environment are anticipated during the excavation period. Approximately two years after the soil removal, the area should have returned to a self-maintaining state.

A minor adverse effect is the loss of the contaminated soil in its present undisturbed state. The Colorado State University researchers have expressed insterest in the preservation of the area as a resource on which to study plutonium in the environment. At the invitation of Rocky Flats personnel, DBER funded CSU researchers have samples the soil and vegetation prior to project initiation.[6] It is planned to retain at the Rocky Flats Plant approximately 100 cubic feet of the contaminated soil stored in drums for future research purposes. Laboratory research on the retained soil will supplement research conducted at the undistributed site. The less contaminated soil remaining after the excavation, will provide opportunity for research.

V. ALTERNATIVES

The alternatives to the removal of plutonium contaminated soil southeast of the asphalt pad are: (1) take no action and leave the contaminated soil in its present state, (2) cover the contaminated soil areas with asphalt, concrete, or other material, or (3) postpone the planned removal until further studies can be made.

In the case of the first alternative of taking no action, the plutonium in the soil could be redistributed by severe weather conditions such as heavy rainfall during an abnormally wet spring. Such conditions are considered to have a very remote probability. Taking no action will not alleviate public concern nor will it fulfill the Rocky Flats assurance to the Governor of the State of Colorado that the stability of the soil would be insured. It is felt that the methods available will allow safe removal at this time. Leaving the contaminated soil in place does not appear to be a viable alternative, since the potential hazard will continue to exist.

For the second alternative, covering the area with impervious material, would provide temporary assurance of stability. The cost of covering the contaminated soil with Gunite sprayed concrete is estimated to be about one-fifth of the cost of soil removal. Asphalt covering is not practical on this sloping

terraine without extensive base preparation which could cause resuspension of the plutonium contamination into the air. Neither of these methods of covering will eliminate the potential hazard of plutonium or allow the soil to be returned to a state of potential usefulness by the Rocky Flats Plant. Furthermore, leaving the contaminated soil in place, is not in keeping with the "as low as practicable" philosophy. Covering the contaminated areas would only add to the material that would eventually have to be removed. Therefore, this procedure does not appear to be a satisfactory alternative.

The third alternative of further delaying so that more studies can be made has been considered but is adjudged unsuitable. The current "state of the art" for soil removal will allow safe excavation and will not endanger workers or the general public. The coordinated studies that will be done before, during and after the soil removal operation will provide considerable information that should have practical value with regard to handling soil contamination problems. In addition, the remaining contaminated soil, which it is not practical to remove at this time provides adequate opportunities for future studies.

The "as low as practicable" philosophy necessitates the removal of the designated areas of highest contamination, because it is not possible to absolutely insure the stability of this soil from any natural disaster.

VI. RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The long-term effect of removing the contaminated soil southeast of the asphalt pad is the return of that area to a condition of potential usefulness to the Rocky Flats Plant. If USERDA operations were to one day cease, the area could be safety returned to agricultural use. The short-term effect of this plan would be the temporary disruption of the vegetation by the excavation process. This would be overcome in approximately two years with seeding, fertilizing, and careful irrigation.

VII. RELATIONSHIP OF PROPOSED ACTION TO LAND USE PLANS, POLICIES AND CONTROLS

The proposed action of removing contaminated soil southeast of the asphalt pad is not in conflict with any known Federal, State or Local land use plans, policies or controls.

VIII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The only commitment of resources that could be considered irretrievable by this planned action is the loss of the contaminated soil in its original environment for study purposes. Research by USERDA supported programs and university researchers would be partially precluded by the soil removal. However, approximately three cubic meters of soil is planned to be retained in drums at the Rocky Flats Plant for research purposes, and a significant area of contaminated soil will remain surrounding the excavation site available for research studies. In addition, minor amounts of resources used in the removal operation that could also be considered irretrievable are transportation fuel, drums for storage of soil, and USERDA storage capacity at the waste disposal facility in Idaho

IX. COST BENEFIT ANALYSIS

The primary benefit resulting from the removal of contaminated soil southeast of the asphalt pad is the assurance that the redistribution of plutonium under severe weather conditions will be minimized. In addition, practical excavating experience will be gained, which will be useful in evaluating other contaminated soil areas having removal potential.

Another benefit is the assurance to the citizens of Colorado that positive actions are being taken to prevent the potential spread of contamination from this particular area.

The primary costs resulting from this action are estimated to be $150,000 for soil removal plus the cost of additional cleanup resulting from resuspension of plutonium during the removal operations. If the contaminated soil is not removed, subsequent plutonium redistribution over a larger surface area could increase the eventual removal cost by factors of ten. The plutonium concentrations per unit of soil might be lower but probably would not be reduced to a safe level by soil dilution.

A comparison of the costs versus benefits indicates the Rocky Flats Plant should proceed with the proposed plan to remove the indicated contaminated soil southeast of the asphalt pad.

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APPENDIX I

Loren W. Crow
CERTIFIED
CONSULTING METEOROLOGIST

Phone (303) 722-8665 or 756-3971
2422 South Downing Street
Denver, Colorado 80210

April 2, 1975

Mr. Skip Allen
Dow Chemical-Rocky Flats Division
P. O. Box 888
Golden, Colorado 80401

Dear Skip:

I have reviewed the frequency of strong winds and recommend June as a typical low-wind month.

Sincerely yours,

Loren W. Crow CCM

LWC:dd

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. Box 17107, Denver, Colorado

February 5, 1975

Mr. Chuck Illsley
Dow Chemical Company
P. O. Box 888
Golden, Colorado 80401

Dear Mr. Illsley:

This letter is in answer to your inquiry concerning revegetating disturbed sites at Rocky Flats.

Grass can be established if the proper procedures are followed. This has been demonstrated with seedings made in prior years. It would probably be necessary to use topsoil, and irrigation water during the establishment period. Other less expensive items requiring consideration would be proper selection of grass species, fertilizer, equipment, time of seeding, and management.

If climax species are seeded at the proper rate, they will continue to grow indefinitely. There is no danger of their dying out and a future plant succession having to occur.

Please contact our field office in Golden (279-1632) if you desire assistance relative to problems associated with revegetating disturbed areas or other conservation problems.

Sincerely,

Clifford L. Williams
Acting State Resource Conservationist