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SILOS 1 AND 2 (K-65 SILOS) REMOVAL ACTION WORK PLAN NOVEMBER 1990

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REPORT

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SILOS 1 AND 2

(K-65 Silos)

REMOVAL ACTION

WORK PLAN

FEED MATERIALS PRODUCTION CENTER

NOVEMBER 1990

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For:

The United States Department of Energy
Oak Ridge Operations Office

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I. INTRODUCTION

One of the Remedial Investigation/Feasibility Study (RI/FS) identified operable units, Operable Unit 4, at the Feed Materials Production Center (FMPC) includes the two K-65 silos (Silos 1 and 2), the metal oxide silo (Silo 3), Silo 4 and the potentially contaminated soils surrounding the waste storage silos. A Removal Site Evaluation (RSE) has been generated by the Department of Energy (DOE) consistent with 40 CFR 300.410 and it was determined by the DOE, as the lead agency at the FMPC, that a non-time critical removal action is necessary. The scope of this removal action can be broadly defined as the reducing the chronic radon emissions and the control of potential releases of residues from Silos 1 and 2.

This removal action will contribute to the efficient performance of the long term remedial action for Operable Unit 4 to the extent practicable. The removal action is being conducted pursuant to the Consent Agreement Under CERCLA 120 and 106(a) between the DOE and the United States Environmental Protection Agency (U.S.EPA) as *Removal Number 4: Silos 1 and 2*. An Engineering Evaluation/Cost Analysis (EE/CA) for the K-65 Silos Removal Action has been prepared to evaluate the removal action alternatives, using the preliminary RI/FS data, to support the selection of a preferred alternative. The objectives of this removal action as stated in the EE/CA are as follows:

- To reduce routine emissions of radon from the K-65 Silos to the maximum extent practical within the context of the removal action
- To decrease, mitigate, or otherwise control the radon gas inventory in the head of the K-65 Silos so that a failure of the dome(s) will not result in a release of significant quantities of radon gas, which would pose a threat to the public
- To decrease, mitigate, or otherwise control the threat of K-65 residues released in significant quantities as a result of dome failure caused by a tornado.

The Consent Agreement requires that a work plan be submitted to the U. S. EPA for review and comment prior to implementation of this removal action. This work plan satisfies this commitment in the Consent Agreement and is consistent with the requirements of 29 CFR 1910.120. All activities performed under this work plan will be in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and consistent with the OSWER Directive 9360.0-03B, SUPERFUND REMOVAL PROCEDURES, Rev.3.

II. BACKGROUND

1.0 Summary of the Potential Threat

During the early 1950's, FMPC processed pitchblende (high grade uranium/radium ore) from the Belgian Congo. This ore was processed to remove uranium at Mallinckrodt Chemical Works at St. Louis and later at the 4

FMPC. The residue of this processing contained significant amounts of radium, which at that time had significant economic value. This residue was considered valuable and, as a part of the purchase agreement, the residue was to be retained by the mining company, African Metals. Ownership was assumed by the DOE from African Metals in the early 1980's. 1875

Silos 1 and 2 were constructed in 1951 and 1952 for the purpose of storing this residue, which was called K-65 material. These silos received residues during the years between 1952 and 1958. The silos contain approximately 9600 tons of residue. The radioactive constituents of concern are uranium-238 and 234, radium-226 and thorium-230. The radium bearing residues emit radiation in the form of alpha, beta, and gamma rays, as well as emitting radon gas.

Most of the radon that is generated in the K-65 residues are contained within the silos. Currently, approximately 12 curies of radon are released to the head space of each silo per day. Radon in the head space will build up until an equilibrium concentration is reached. The time required to obtain this equilibrium concentration is dependent on two factors: radioactive decay of the radon (half-life is 3.84 days), and the head space ventilation rate (due to diffusion through intact concrete and leakage through cracks, both of which are affected by the daily heating cycle). Once the equilibrium condition has been reached, the head space radon concentration will be affected only by changes in the ventilation rate. The concentration of radon in the head space has been measured to be as high 3×10^7 pCi/liter. Using the concentration and the volume of the head space of each silo, it has been calculated that approximately 33 curies of radon-222 exist in the head space.

Two independent studies have been completed on the structural integrity of the silos (Camargo, 1986, and Bechtel, 1990). These two structural analyses concluded that the silos had lost over half of their design strength and that no life expectancy could be predicted for the silo domes.

The result of silo dome failure would be an immediate release of radon gas from the head space of the silos to the environment. There is also the potential for the K-65 residues to become airborne under tornado loading conditions.

2.0 Related Actions

There are various ongoing activities and projects concerning the K-65 Silos area. Many of these activities are not in the field implementation stage at this time. These include the K-65 Decant Sump Tank Removal Action and sampling of the K-65 Silos embankment and subsoils.

The K-65 Decant Sump Tank Removal Action will consist of removing the water from the K-65 decant sump tank, performing the Hazardous Substance List (HSL) analysis and disposition of the removed liquid . Any HSL or hazardous waste treatment will occur prior to transferring the water to existing FMPC water treatment facilities for treatment of uranium and radium. The principle isotopes of uranium, radium 226, and thorium 230 are considered to be the primary contaminants of concern. Management and control of the liquid 5

will be performed as if it is a potentially hazardous waste until the HSL analysis results are complete. Suspect contaminants, especially non-radiological contaminants, such as lead, will be addressed once the liquid is removed and stored for HSL analysis. 1875

Also, the K-65 Silos embankment and subsoils will be sampled utilizing five low-angle borings and analyzed to determine and verify the extent of contamination in the soils surrounding the K-65 Silos. The K-65 Silos embankment and below-silo soils will be analyzed for geotechnical, chemical and radiological parameters. This sampling will be conducted as part of the RI/FS in support of the final remedial action for Operable Unit 4.

Other ongoing activities and projects concerning the K-65 Silos area include resampling the K-65 residues, treatability testing and maintenance activities to the radon treatment system to support resampling the K-65 residues.

3.0 Roles of the Participants

The DOE is the lead agency for this removal action and will coordinate and execute this removal action. The U.S. EPA and the Ohio Environmental Protection Agency (Ohio EPA) roles have been one of providing guidance and participation in the preparation of the CERCLA 120 Consent Agreement and technical information exchanges.

ASI, as a contractor to DOE, is conducting the RI/FS program including activities such as sampling the K-65 Silos embankment and subsoils, resampling the contents of the K-65 Silos, and treatability testing.

Westinghouse Materials Company of Ohio (WMCO), as the FMPC Management and Operating contractor, is responsible for implementing this removal action in a manner consistent with DOE and regulatory guidance.

Parsons, as the FMPC full service remedial architectural engineering contractor, is preparing the design packages, including the operating manuals, necessary to implement this removal action. Parsons will also direct the application demonstration program, identified in Section III, 2.0, and provide some field supervision during construction/installation.

4.0 Removal Action

As selected by the K-65 Silos EE/CA, the preferred alternative for this removal action consists of covering the K-65 residues with a gas barrier material that will retard the emanation of radon gas into the space between the residues and the silos domes. The barrier material will be bentonite due to bentonite's plasticity and the relative ease by which it can be placed into the silos. The plasticity of bentonite enhances its ability to withstand and minimize the effect of potentially falling debris on the layer covering the K-65 residues. The flexibility of the bentonite slurry will also facilitate in sealing the cracks near 6 the wall to reduce the radon emissions from the side walls of the silos. The

application of the bentonite to cover the K-65 residues offers the immediate protection from the effects of a tornado-induced or spontaneous dome failures as well as a significant reduction in the chronic radon released from the Silos 1 and 2.

The dry bentonite bulk material will be delivered by a pneumatic tanker to a receiving/unloading area near the FMPC K-65 Area. Figure 1 illustrates a schematic diagram of the bentonite installation system. The dry feed material will be pneumatically removed and transferred from this tanker into a hopper and then into the bentonite mixing unit via a pair of screw conveyors. Air, vented from the hopper, will be discharged into the atmosphere through a dust collector in order minimize dust emissions. The bentonite mixing unit will provide the bentonite slurry mix suitable for covering the K-65 residues in Silos 1 and 2. This mixing unit will consist of two mixer tanks, each equipped with one side mounted blender driven by an electric motor, and one transfer pump serving the two mixing tanks. The bentonite slurry will be discharged from the mixing unit by the transfer pump. The entire bentonite mixing unit will be assembled on a movable skid.

From the mixing unit, the bentonite slurry will be pumped into the manways of Silos 1 and 2 utilizing a bentonite slurry supply system and a distributor/sprayhead assembly supported by a crane. The bentonite slurry supply system will include the transport supply header from the discharge of the transfer pump and flexible hose which supplies the bentonite slurry to the distributor/sprayhead assembly unit. The distributor/sprayhead assembly unit will have an adjustable angle discharge sprayhead which will be remotely controlled and a distribution system which will also be controlled. The distributor/sprayhead assembly unit will be supported by a crane equipped with properly designed strong bars. The distributor/sprayhead assembly will be lowered into the appropriate silo through one of the four manways by use of the crane. Use of the crane will avoid any additional structural load on Silo 1 and 2.

The bentonite slurry will be pumped from the mixing unit through the transport supply header into the distributer/sprayhead which will spray the slurry over the K-65 residue surface. The radon treatment system will be operated per FMPC standard operating procedures prior to opening the manways. This will reduce the radon emissions to the environment during installation of the bentonite through the manways. The manways in use will also be covered by a glove bag during installation of the bentonite to minimize the radon emissions.

Minimization of the radon emissions will be achieved by use of the radon treatment system (after mechanical repairs/replacements) and by use of glove bags over the manyways during installation of the bentonite. Also, it has been determined that a minimum of one (1) foot of bentonite will be installed to cover the K-65 residues as opposed to the four (4) feet of bentonite as stated in the EE/CA. One (1) foot of bentonite was chosen over the four (4) feet of bentonite as stated in the EE/CA for the following reasons:

- Decreasing the amount of bentonite installed will minimize the waste that will be required to be dealt with during final remediation. 875

- Through the use of a computer model and calculations one (1) foot of bentonite will obtain the optimum radon attenuation.

The volume of the silo atmospheres displaced will be reduced considerably by placement of one (1) foot instead of four (4) feet of bentonite. Therefore, an air tight enclosure will not be constructed over Silos 1 and 2 to contain the volume of the silo atmospheres displaced by the installation of the bentonite. Also, the implementation of this removal action will be facilitated by not constructing an air tight enclosure over Silos 1 and 2.

During installation of the bentonite, a closed circuit television (CCTV) camera will be strategically located to view operations of the sprayhead. The CCTV will be installed in a manway not in use and will have a 270 degree range of view. Also, during installation of the bentonite, depth indicators and monitors will be installed to verify the depth of the bentonite installed in the silos. During detailed design it will be determined how to install one (1) foot of bentonite to cover the irregular surface in Silo 1 and how to verify that a minimum of one (1) foot of bentonite was installed.

5.0 Integration with the Remedial Action

This removal action will be completed prior to initiating the final remedial action for Operable Unit 4. While the bentonite increases the volume of residues within the silos it provides significant reduction in worker exposures during future remedial actions and minimizes potential releases as a consequence of accident scenarios during final actions. Residue transfer system currently being examined under remedial alternatives, including residue removal, are compatible with the bentonite covering material.

III. SUPPORT ACTIVITIES

1.0 Planning Activities

Activities to be undertaken prior to the actual site work are planning, training, design, and defining the detailed operating procedures. Included in these activities will be the preparation of detailed task listings and delineation of responsibilities to support the schedule given in Attachment I.

2.0 Additional Data/Studies Required

An application demonstration program will be developed and carried out to demonstrate the applicability of the alternative as selected by the EE/CA. The purpose of this program will be to provide the basis for detailed design. Specific objectives of the application demonstration program are:

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a. To determine the optimum mixing formula for the adequate flow capability and sealing characteristics.

b. To determine the chemical and physical characteristics of the optimum bentonite slurry mix.

c. To compare the flow capability verses the sealing characteristics of the bentonite slurry and to determine the stability of the bentonite slurry mix to maintain the optimum moisture content.

d. To determine a mixing formula which will produce a suitable slurry to be used to cover the irregular surfaces in Silo 1 and Silo 2 to the acceptable uniformity, thickness and sealing properties.

At this time, it is planned to use the bentonite product, Bento-Grout, sold commercially by American Colloid Company for this demonstration program. The equipment, labor, and facility will be provided by the company which will perform this application demonstration program. Initial investigations determined that the Chem-Grout Company is capable of performing the above defined application demonstration program. A report will be prepared to summarize the results of this demonstration program. The report will also include, if it can be determined, the specific slurry mix formula with the proper viscosity which would enable operations to cover the irregular surfaces in Silo 1 and Silo 2.

3.0 Specific Design Activities

After approval of this work plan design efforts will be finalized for this removal action. The design phase of this removal action will include; detailed design for the bentonite installation system which includes the receiving/unloading system, the mixing unit and the transport supply system; preparation of the installation, testing, start-up, and operational manuals; instructions for the dismantling and removal of the receiving/unloading system, the mixing unit and the transport supply system; and preparation of safety assessments and other relevant safety documentation. The majority of the bentonite installation system will be located east of the K-65 Silos adjacent to the access road outside the fenced area.

The scope of the design activities will include development of:

- Process flow diagram showing material balances and utility requirements.
- Piping and instrumentation diagrams.
- Plan layout, sections, and detailed drawings.

- The operational scenario with control philosophy to provide support for the instrumentation design and the basis for future health and safety documentation.

- Performance Specifications for the system to include the following subsystems:

  1. Bentonite Receiving/Unloading System

  2. Bentonite Mixing Unit

  3. Bentonite Slurry Supply System

  4. Distributor/Sprayhead Assembly

  5. Crane

  6. Utility/Support Systems (i.e., process water, the CCTV, instrument air, the control room and associated instruments and equipment, and the radon treatment system)

- Test and Inspection Plan

- The Installation Manual and the Construction Acceptance Test Instructions

- Operational Procedures which will include:

  - startup
  - normal operations
  - normal shutdown
  - restart after normal operations shutdown
  - routine maintenance
  - preventive maintenance
  - emergency shutdown
  - restart after emergency shutdown
  - dismantling and removal
  - equipment decontamination and removal

- Bentonite Installation Process Waste Management Plan

The documents developed during the design phase of this removal action will be provided to the U.S. EPA and the Ohio EPA, on a request basis, for information purposes only.

4.0 Training Requirements

All personnel involved will be trained in accordance with the Occupational Safety and Health Administration (OSHA) standards found in 29 CFR 1910.120. In addition to this training, all personnel involved will be trained on; 1) how to handle emergency situations in the K-65 Silos area according to 10

the FMPC K-65 Silo Numbers 1 and 2 Area Emergency Standard Operating Procedure (SOP) 65-C-201 dated March 1, 1990, and 2) the applicable procedures, mentioned in section III 3.0, relevant to the activities to be performed. 1875

IV. FIELD ACTIONS

Coordination of this removal action will be performed by FMPC personnel. Supplying the equipment, maintenance, installation, operation, maintenance, dismantling and removal of the equipment/system will be performed by subcontractor per the requirements of the specification package under management of FMPC personnel. Commercially available equipment and/or systems will be utilized to the extent practical. Monitoring of the system's operation will be performed by FMPC personnel.

During construction/installation of the bentonite system and prior to initiating the system operability testing/startup, construction acceptance tests will be performed by the subcontractor. The requirements for the construction acceptance tests will be incorporated into the subcontractor's specification packages. Inspection services and quality assurance will be provided by FMPC personnel.

The following discussion is based upon preliminary engineering and is subject to change based upon completion of detailed design.

1.0 Construction/Installation of the Bentonite System

1.0.1 Bentonite Receiving/Unloading System

Construction of the bentonite receiving/unloading area will be located on the east side of the K-65 Silo Area between Silos 1 and 2 (See Figure 2). In addition to the truck receiving/unloading pad, this system will include a hopper, two screw conveyors and a dust collector for the venting of the hopper.

The dry bentonite bulk material will be delivered by a pneumatic tanker to the receiving/unloading pad. Feed will be pneumatically removed and transferred from this tank into a hopper. From the hopper, a pair of screw conveyors will transfer the dry material to the bentonite mixing unit. Air vented from the hopper will be discharged into the atmosphere through a dust collector, to minimize particle emissions from the receiving/unloading operations.

1.0.2 Bentonite Mixing Unit

The bentonite mixing unit will be assembled on a movable skid and then installed on the east side of the K-65 Silo Area (See Figure 2). This mixing unit will consist of two mixing tanks, each equipped with one side mounted blender driven by an electric motor, and one transfer 11

pump serving the two mixing tanks.

1.0.3 Bentonite Slurry Transport Supply System

Construction of the bentonite slurry supply system will include the bentonite slurry supply header attached to the discharge of the mixing unit transfer pump and the flexible hose which supplies the bentonite slurry to the distributor/sprayhead assembly unit.

1.0.4 Distributor/Sprayhead Assembly

Installation of the distributor/sprayhead assembly unit will consist of an adjustable angle discharge sprayhead which will be remotely controlled and a distribution system which will also be remotely controlled.

1.0.5 Crane

The distributor/sprayhead assembly unit will be supported by a crane and will be lowered into the appropriate silo through one of the four manways by use of the crane. Utilizing the crane will avoid any additional structural load on Silos 1 and 2.

The crane will be delivered to the FMPC in sections and then assembled and positioned near Silo 1. After the completion of bentonite installations operations in Silo 1, the crane will be moved near Silo 2. The crane will be equipped with a 220 foot long boom.

1.0.6 Utility/Support Systems

Utility/Support Systems include process water supply system, the CCTV, instrument air supply system, radon treatment system mechanical replacements/repairs, and the data logging system. The FMPC existing process water system will have to be extended to the bentonite mixing unit located on the east side of the K-65 Silo Area. A CCTV camera system will be installed within the K-65 Area to enable remote viewing of the operations of the sprayhead. At this time, it is planned that the instrument air will be used to facilitate control of the distributor/sprayhead assembly unit. The FMPC existing instrument air will have to be extended to the K-65 Area. The mechanical replacements/repairs to the radon treatment system will include replacement of the piping, the manway valves, and the blower. The data logging system will include process control parameters, radon concentration data from the K-65 Area, temperature and pressure data from the silos.

1.0.7 Instrumentation and Controls

The instrumentation and controls associated with this removal action will be installed for the field instruments to a pre-fabricated control room that will be located adjacent to the K-65 Area north of the bentonite mixing unit. This control room will house the bentonite installation instruments and process control equipment, as well as the instrumentation installed for monitoring the temperature and pressure instruments on Silos 1, 2 and 3 and the radon concentration monitors. The video monitors necessary for remote monitoring of the distributor/sprayhead assembly unit will also be located in this control room. Moisture analyzers will be installed inside the silos to monitor the moisture content of the bentonite cover from the control room.

2.0 System Operability Testing/Startup

System Operability Testing/Startup will begin after review and approval of the construction acceptance test results. Operation of the bentonite process systems, including; the Bentonite Receiving/Unloading System, the Bentonite Mixing Unit, the Bentonite Slurry Supply System, the Distributor/Sprayhead Assembly, and the Crane, will require operability testing prior to and during startup operations. The Utility/Support Systems, including; process water, the CCTV, instrument air, and the control room and associated instruments and equipment, will be operationally tested during the testing of the bentonite process systems. This will verify the required integrated operation of all the systems. System operability test procedures, including startup requirements, will be prepared during completion of the detailed design.

Operation of the radon treatment system will require that a pressurization and leak test be performed along with an acceptance test after the mechanical upgrades are completed. The existing FMPC Standard Operating Procedures for the radon treatment system.

3.0 Operations and Maintenance

Bentonite installation operations will begin after testing/startup has proven the bentonite process systems and the Utility/Support Systems, including the radon treatment system, operate according to the design specifications and operating manuals.

Bentonite installation general operational steps will include:

a. Operating the radon treatment system until the acceptable level of radon has been achieved within the head space of the respective silo.

b. Installing a glove bag over the appropriate manway.

c. Removing the manway that the sprayhead will be used to install the bentonite slurry.

d. Installing and positioning the sprayhead into the appropriate manway.

e. Installing a glove bag over the appropriate manway.

f. Removing the last manway to be used to install the bentonite slurry. This manway will be used to install the CCTV.

g. Install the CCTV in the manway. The CCTV in this manway will be used to monitor bentonite installation through the other three manways. Prior to installation of the bentonite through the manway where the CCTV is installed, the CCTV will have to be removed and the sprayhead will have to be installed.

h. Placing the bentonite slurry into the silo to cover one quarter of the residue surface. Relative to the mixing of the bentonite slurry, a flow measurement will be made and from it a ratio control will be used to control addition of the process water to the mixing unit. A representative sample of slurry will be collected from the mixing unit for each batch to be analyzed for physical and chemical characteristics.

i. Shutting down the bentonite installation processes and flushing the bentonite slurry supply headers with process water.

j. Reinstalling the manway cover on the silo.

k. Removing the glove bag and the sprayhead from the manway in use.

l. Operating the radon treatment system as previously stated prior to moving to the second manway.

m. Repeat of steps g. through k. for the second and third manway.

n. Removing the CCTV from the fourth manway, installing the sprayhead, and placing a glove bag over this manway.

o. Removing the cover of a previously used manway, installing the CCTV in this manway, and placing a glove bag over this manway.

p. Repeat of steps h. through k. for the last manway to be used.

q. Removing the CCTV, reinstalling the manway cover on the silo, and removing the glove bag.

4.0 Dismantling and Removal of Equipment

After residue in each silo is covered with the bentonite slurry, the radon concentration within the head space and the ambient air will be monitored for a specific time period to determine if the performance goal of .015 pCi/l above background has been achieved. The equipment associated with this removal action will be dismantled and removed when the performance goal has been achieved. The pre-fabricated control room will remain in place to allow monitoring of the radon monitoring systems. After the bentonite process systems (including; the Bentonite Receiving/Unloading System, the Bentonite Mixing Unit, the Bentonite Slurry Supply System, the Distributor/Sprayhead Assembly, and the Crane) are dismantled, the equipment will be decontaminated prior to removal from the FMPC site.

V. SAMPLING AND MONITORING PLAN

The K-65 residues generate radon on a constant basis. The resulting radon concentration have been monitored as a part of the FMPC Environmental Monitoring Program in support of this removal action and the remedial action for Operable Unit 4. Also, in support of this removal action, additional radon monitoring will be undertaken. Figure 3 and Figure 4 include the current radon monitors that are part of the FMPC Environmental Monitoring Program and the additional radon monitors necessary to support this removal action. The following efforts will be included in the additional monitoring for this removal action:

1. The atmospheric volume within Silos 1 and 2 will be measured for pressure and temperature and then compared to the pressure and temperature of the surrounding ambient air. The instrumentation to support these measurements will be installed by November 30, 1990. FMPC personnel will be responsible for installation of these instruments.

2. Additional radon concentration monitoring will be performed at the FMPC site boundary fence at air monitoring station #5 (AMS-5), at air monitoring station #6 (AMS-6), and within the FMPC production area near Building 54 (the Pilot Plant). Monitoring will be accomplished by using a specific type of radon monitor, Pylon AB-5, at each location. Installation of the Pylon AB-5s at AMS-5 and AMS-6 has been completed. The Pylon AB-5 at Building 54 will be completed by November 30, 1990. FMPC personnel will be responsible for the installation of these instruments.

3. A continuous radon concentration monitor has been installed at AMS-BK1 in Westwood, Ohio to measure background radon concentrations. The instrument installed to accomplish this was a Pylon AB-5 equipped with CPRD (continuous passive radon detector) rather than a Pylon kettle. FMPC personnel were responsible for the installation of these instruments.

Note: Collecting data from the instruments in Items 1, 2 and 3 will be initiated as soon as each of these instruments is installed.

4. The effectiveness of installing the one (1) foot of bentonite to cover the K-65 residues will be determined by utilizing grab samples from the head space of each silo prior to installing the bentonite and comparing this data with data collected from the head space of each silo after the installation of the bentonite. The data in the head space after installation of the bentonite will be completed by the installation of sampling tubing from the head space to a remote Pylon AB-5. The radon concentration monitoring data from this Pylon AB-5 will be recorded on a data logger in the Silos 1 and 2 Removal Action control room.

The above mentioned radon concentration monitors, temperature sensors and pressure sensors in Items 1, 2, and 3 have the capability to monitor on a one hour time increment. This hourly data will be collected on a weekly basis from the chart recorders on each of the instruments. FMPC personnel will be responsible for collecting the data associated with the above items, in addition to the data currently collected as a part of the FMPC Environmental Monitoring Program. The data collected from the instruments identified in Figure 3 and Figure 4 will be used to generate a radon emissions report, as part of the FFCA Quarterly Report, that will be issued to the U.S. EPA.

A performance goal has been established for this removal action following the addition of the bentonite slurry. This goal is .015 pCi/l of radon concentration above background for the area, calculated at the nearest resident. Measurements taken from instruments located near the railings on the silo domes will be used in the calculations. Data from the sampling and monitoring outlined above will be used by DOE and the U.S.EPA to determine the effectiveness of the bentonite layer. Based on review of the monitoring data and the Operable Unit 4 final remediation schedule, DOE and U.S.EPA will determine if additional measures are required.

VI. HEALTH AND SAFETY PLAN

The work to be performed will be consistent with the Health and Safety Plan prepared for this removal action. A copy of this plan is provided as Attachment V of this work plan. The plan identifies, evaluates, and controls all safety and health hazards. In addition, it provides for emergency response for hazardous operations. The plan is consistent with 29 CFR 1910.120 and the FMPC Site Health and Safety Plan. Safety documentation will be prepared according to FMPC-2116 Topical Manual "Implementating FMPC Policies and Procedures for System Safety Analysis and Review System" and DOE/OR-901 Guidance for Preparation of Safety Analysis Reports.

VII. QUALITY ASSURANCE

The Silos 1 and 2 (K-65 Silos) Removal Action will be conducted according to the requirements of the overall quality assurance program at the FMPC which is described in the site Quality Assurance Plan, FMPC 2139. The Quality Assurance Plan is based on the criteria specified in ASME NQA-1, Federal EPA Guideline QAMS-005/80 and DOE Orders 5700.6 and 5400.1. Specific quality assurance requirements will be incorporated into written and approved procedures and into personnel training.

Periodic surveillances will be completed to verify compliance with established procedures.

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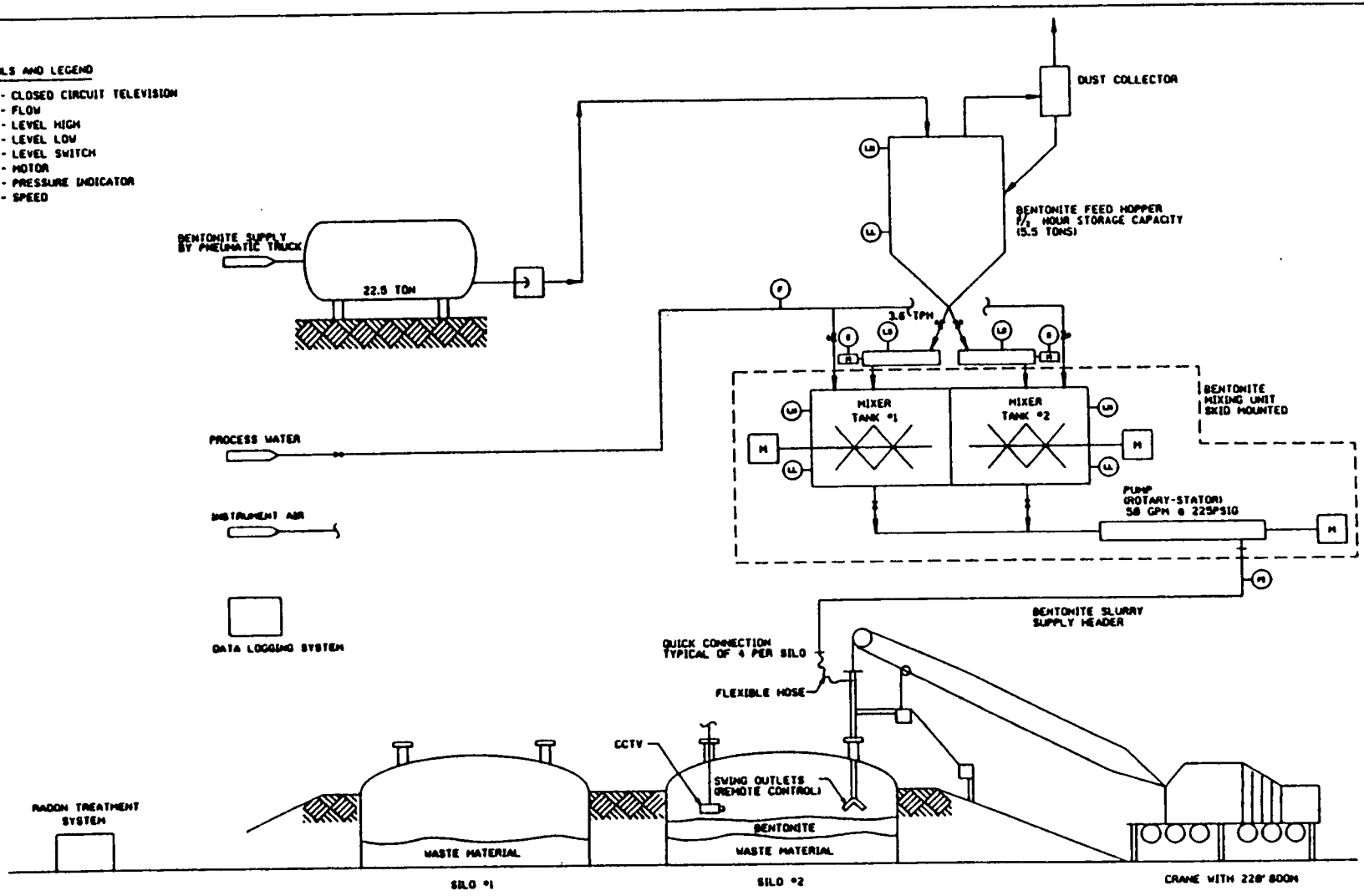
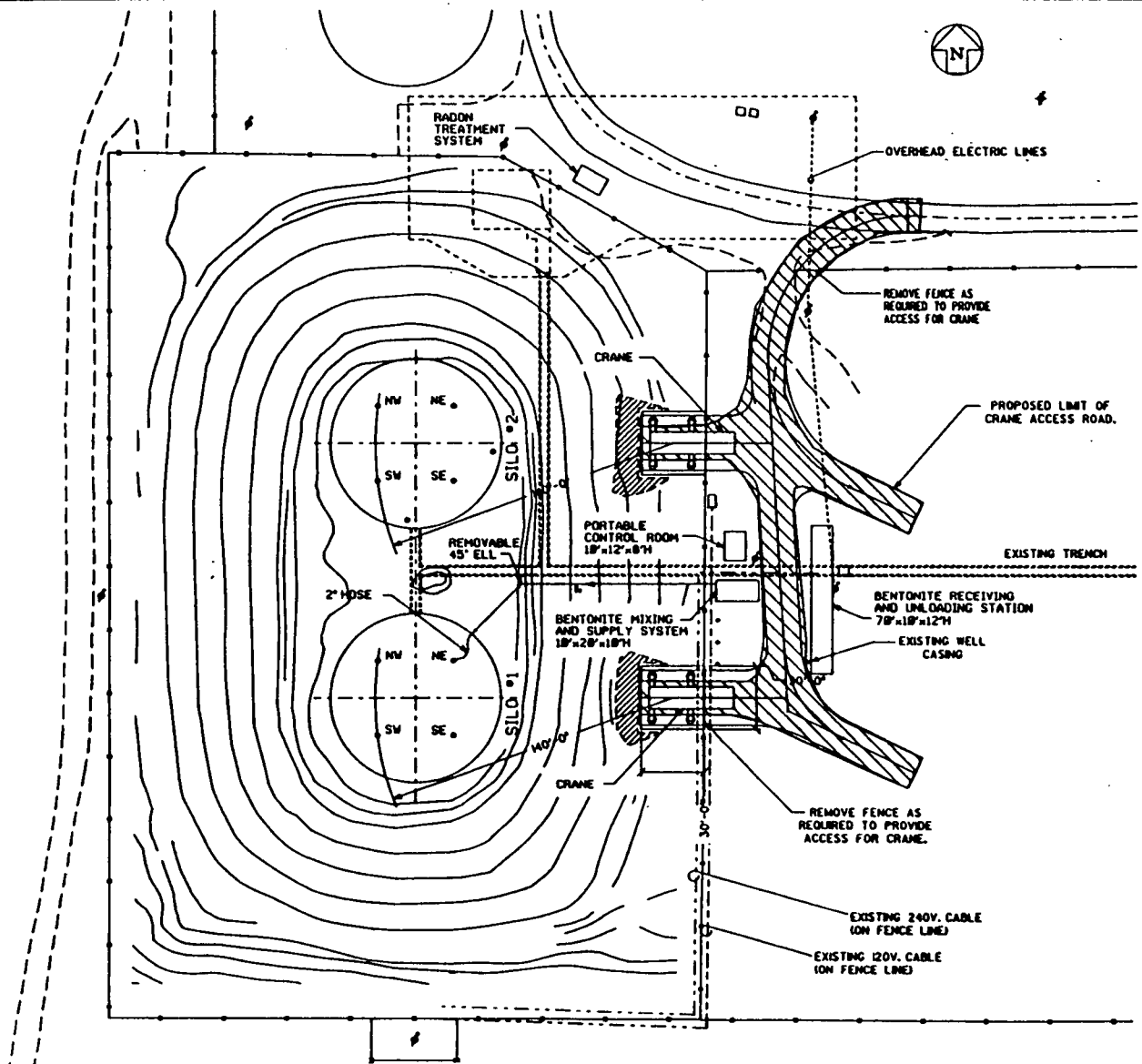
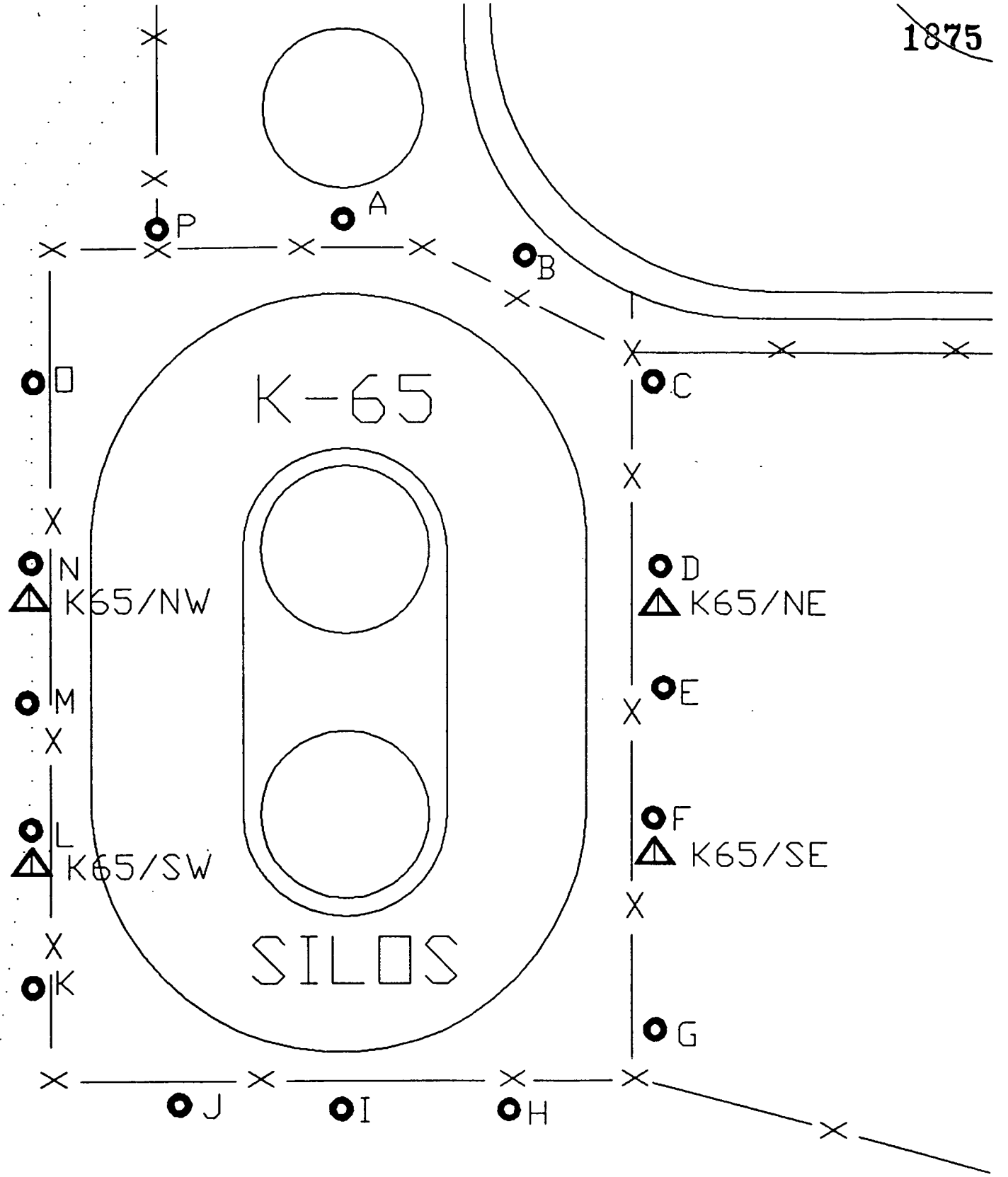


KGS RESIDUE - BENTONITE COVERING SYSTEM
PROCESS FLOW DIAGRAM
SKETCH NUMBER 454-001
FIGURE 1



K65 RESIDUE - BENTONITE COVERING SYSTEM
PLOT PLAN
SKETCH NUMBER 4SK-002
FIGURE 2



Terradex Track Etch Detector

Radon Gas Monitors (RGM-3)

FIGURE 3

RADON CONCENTRATION MONITORS
K-65 AREA

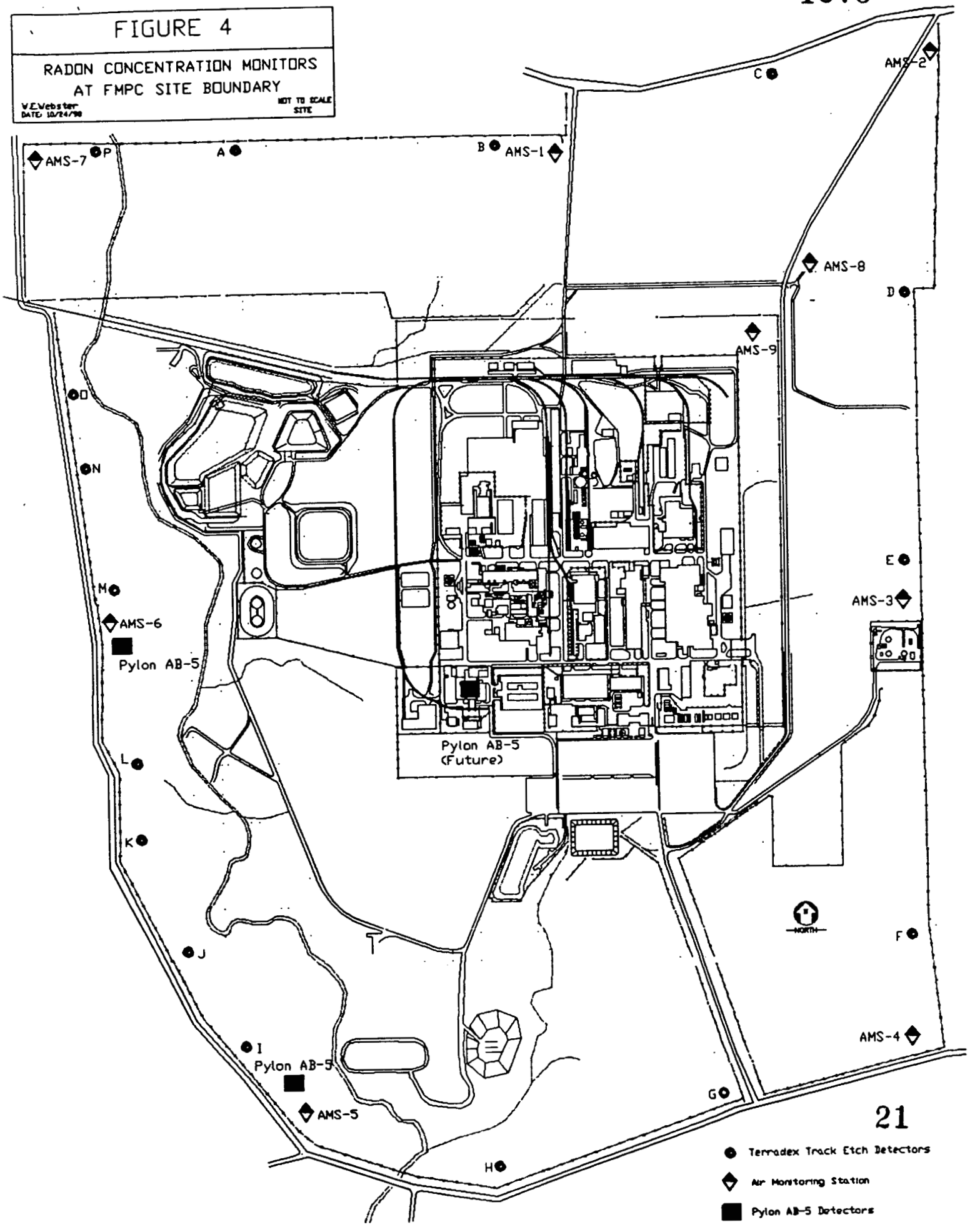
WEW DATE: 10/25/90

FIGURE 4

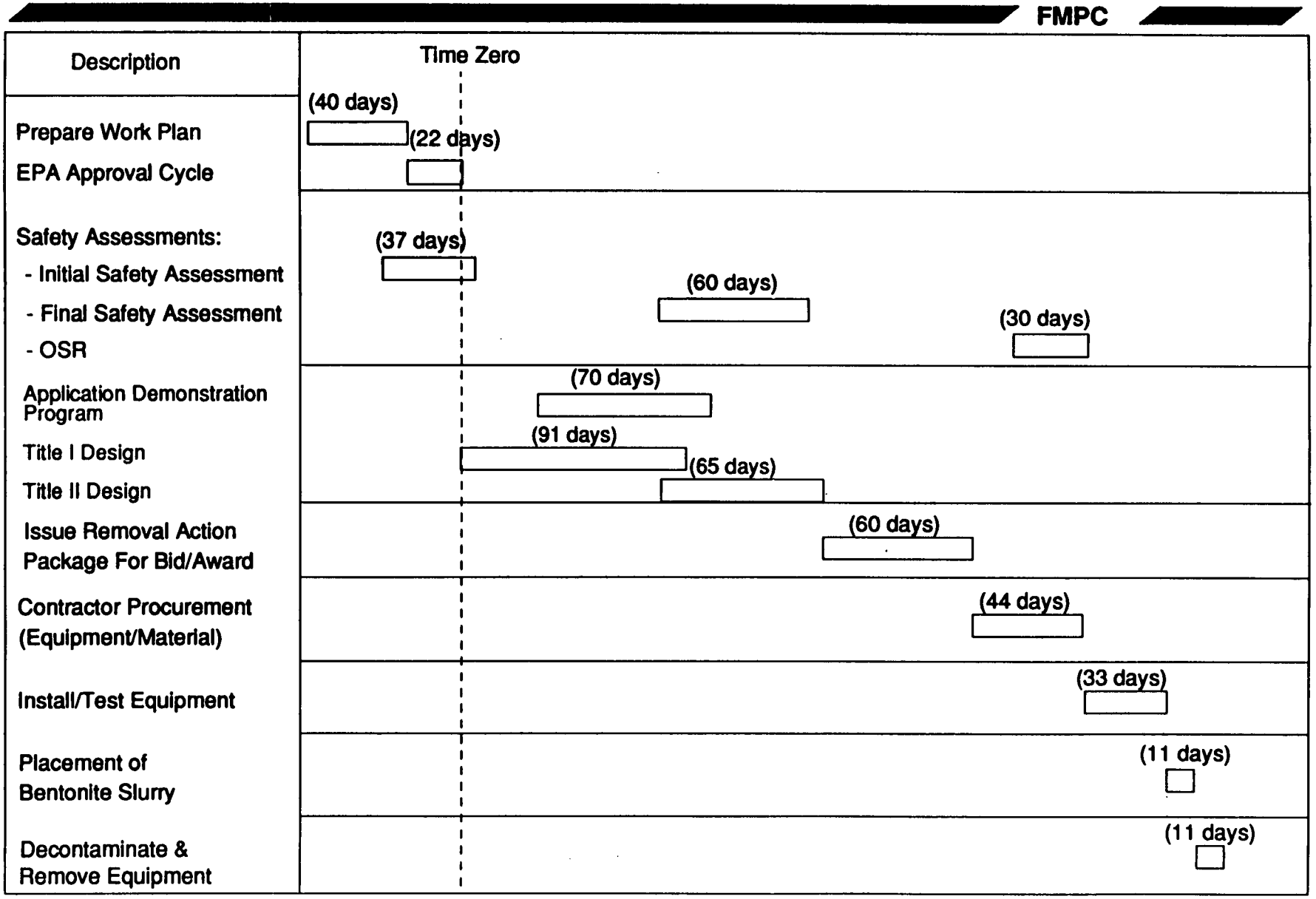
RADON CONCENTRATION MONITORS AT FMPC SITE BOUNDARY

V.E.Webster
DATE: 10/24/90

NOT TO SCALE
SITE



SILOS 1 & 2 REMOVAL ACTION SCHEDULE



Note 1: Days Are working days.
Note 2: Title I/II Design duration equals 141 days.

Attachment 1

HEALTH AND SAFETY PLAN

FOR THE

SILOS 1 AND 2 (K-65 SILOS)

REMOVAL ACTION

FEED MATERIALS PRODUCTION CENTER

November 1990

APPROVAL:

S.W. Coyle, Manager
Environmental Management
Westinghouse Materials Company of Ohio

CONCURRENCE:

for J. J. Volpe, Vice President
Industrial Radiological Safety and Training
Westinghouse Materials Company of Ohio

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1.0 TASKS TO BE PERFORMED[1]

This removal action consists of covering the K-65 residues with a gas barrier material that will retard the emission of radon gas into the space between the residues and the silos domes. The barrier material will be bentonite due to bentonite's plasticity and the relative ease by which it can be placed into the silos.

The dry bentonite bulk material will be delivered by a pneumatic tanker to a receiving/unloading area near the FMPC K-65 Area. The dry feed material will be pneumatically removed and transferred from this tanker into a hopper and then into the bentonite mixing unit via a pair of screw conveyors. Air, vented from the hopper, will be discharged into the atmosphere through a dust collector in order minimize dust emissions. The bentonite mixing unit will provide the bentonite slurry mix suitable for covering the K-65 residues in Silos 1 and 2. This mixing unit will consist of two mixer tanks, each equipped with one side mounted blender driven by an electric motor, and one transfer pump serving the two mixing tanks. The bentonite slurry will be discharged from the mixing unit by the transfer pump. The entire bentonite mixing unit will be assembled on a movable skid.

From the mixing unit, the bentonite slurry will be pumped into the manways of Silos 1 and 2 utilizing a bentonite slurry supply system and a distributor/sprayhead assembly supported by a crane. The bentonite slurry supply system will include the transport supply header from the discharge of the transfer pump and flexible hose which supplies the bentonite slurry to the distributor/sprayhead assembly unit. The distributor/sprayhead assembly unit will be supported by a crane. The distributor/sprayhead assembly will be lowered into the appropriate silo through one of the four manways by use of the crane. Use of the crane will avoid any additional structural load on Silo 1 and 2.

The bentonite slurry will be pumped from the mixing unit through the transport supply header into the distributer/sprayhead which will spray the slurry over the K-65 residue surface. The radon treatment system will be operated per FMPC standard operating procedures prior to opening the manways. This will reduce the radon emissions to the environment during installation of the bentonite through the manways. The manways in use will also be covered by a glove bag during installation of the bentonite to minimize the radon emissions.

During installation of the bentonite, a closed circuit television (CCTV) camera will be strategically located to view operations of the sprayhead. The CCTV will be installed in a manway not in use and will have a 270 degree range of view. Also, during installation of the bentonite, depth indicators and monitors will be installed to verify the depth of the bentonite installed in the silos.

[1]The plan is consistent with 29 CFR 1910.120 and the FMPC Site Health and Safety Plan.

This removal action is expected to involved the following tasks and major subtasks:

1) Construction/installation of the bentonite system
   - Bentonite receiving/unloading system
   - Bentonite mixing unit
   - Bentonite slurry transport supply system
   - Distributor/sprayhead assembly
   - Crane
   - Utility/support systems
   - Instrumentation and controls

2) System operability testing/startup
   - Bentonite receiving/unloading system
   - Bentonite mixing unit
   - Bentonite slurry transport supply system
   - Distributor/sprayhead assembly
   - Crane
   - Utility/support systems
   - Instrumentation and controls

3) Operations and maintenance
   - Operate the radon treatment system
   - Install and remove glove bag over manways
   - Open and close manways
   - Insert and remove CCTV cameras into silo
   - Place bentonite in silo
   - Maintain bentonite slurry delivery system

4) Dismantling and removal of equipment
   - Bentonite receiving/unloading system
   - Bentonite mixing unit
   - Bentonite slurry transport supply system
   - Distributor/sprayhead assembly
   - Crane

Tables 1-1 through 1-4 summarize the impacts of these tasks on the FMPC site.

Table 1-1 - Impact of Construction/Installation of the Bentonite System Task on Site

	Subtask						
Location	Receiving/unloading system	Mixing unit	Slurry supply system	Distributor/s prayhead assembly	Crane	Utility/support systems	Instrumentation and controls
Disturbs surface soil	yes	yes	yes	no	yes	no	no[1]
Disturbs subsurface soil	no	no	no	no	no	no	no
Use heavy equipment	yes	yes	yes	yes	yes	no	no
Enter confined space	no	no	no	no	no	no	no
Disturbs containerized material	no	no	no	no	no	no	no
Involve radioactivity	no	no	no	yes	no	yes	no[2]
Involve trenches	no	no	no	no	no	no	no

[1] - The exact location of the temperature sensors and radon monitors has not been determined at this time; a small disturbance of surface soil could occur.

[2] - Depending on the proximity of the temperature sensor location to the silos, low levels of penetrating radiation (gamma) or radioactive gas (Rn-222) could exist.

Table 1-2 - Impact of System Operability Testing/Startup Task

	Subtask						
Location	Receiving/unloading system	Mixing unit	Slurry supply system	Distributor/s prayhead assembly	Crane	Utility/support systems	Instrumentation and controls
Disturbs surface soil	no	no	no	no	no	no	no[1]
Disturbs subsurface soil	no	no	no	no	no	no	no
Use heavy equipment	yes	yes	yes	yes	yes	no	no
Enter confined space	no	no	no	no	no	no	no
Disturbs containerized material	no	no	no	no	no	no	no
Involve radioactivity	no	no	no	yes	no	yes	no[2]
Involve trenches	no	no	no	no	no	no	no

[1] - The exact location of the temperature sensors and radon monitors has not been determined at this time; a small disturbance of surface soil could occur.

[2] - Depending on the proximity of the temperature sensor location to the silos, low levels of penetrating radiation (gamma) or radioactive gas (Rn-222) could exist.

Table 1-3 - Impact of Operations and Maintenance Task on Site

Location	Subtask					
	Operate the radon treatment system	Install & remove glove bag over manways	Open & close manways	Insert & remove CCTV cameras into silo	Place bentonite in silo	Maintain slurry delivery system
Disturbs surface soil	no	no	no	no	no	no
Disturbs subsurface soil	no	no	no	no	no	no
Use heavy equipment	no	no	no	no	no	no
Enter confined space	no	no	no	no	no	no
Disturbs containerized material	no	no	no	no	no	no
Involve radioactivity	yes	yes	yes	yes	yes	no
Involve trenches	no	no	no	no	no	no

Table 1-4 - Impact of Dismantling and Removal of Equipment Task on Site

Location	Subtask				
	Receiving/unloading system	Mixing unit	Slurry supply system	Distributor/s prayhead assembly	Crane
Disturbs surface soil	yes	yes	yes	no	yes
Disturbs subsurface soil	no	no	no	no	no
Use heavy equipment	yes	yes	yes	yes	yes
Enter confined space	no	no	no	no	no
Disturbs containerized material	no	no	no	no	no
Involve radioactivity	no	no	no	yes	no
Involve trenches	no	no	no	no	no

2.0 SITE HISTORY

During the early 1950's, FMPC processed pitchblende (high grade uranium/radium ore) from the Belgian Congo. This ore was processed to remove uranium at Mallinckrodt Chemical Works at St. Louis and later at the FMPC. The residue of this processing contained significant amounts of radium, which at that time had significant economic value. This residue was considered valuable and, as a part of the purchase agreement, the residue was to be retained by the mining company, African Metals. Ownership was assumed by the DOE from African Metals in the early 1980's.

Silos 1 and 2 were constructed in 1951 and 1952 for the purpose of storing this residue, which was called K-65 material. These silos received residues during the years between 1952 and 1958. The silos contain approximately 9600 tons of residue. The radioactive constituents of concern are uranium-238 and 234, radium-226 and thorium-230. The radium bearing residues emit radiation in the form of alpha, beta, and gamma rays, as well as emitting radon gas.

Most of the radon that is generated in the K-65 residues are contained within the silos. Currently, approximately 12 curies of radon are released to the head space of each silo per day. Radon in the head space will build up until an equilibrium concentration is reached. The time required to obtain this equilibrium concentration is dependent on two factors: radioactive decay of the radon (half-life is 3.84 days), and the head space ventilation rate (due to diffusion through intact concrete and leakage through cracks, both of which are affected by the daily heating cycle). Once the equilibrium condition has been reached, the head space radon concentration will be affected only by changes in the ventilation rate. The concentration of radon in the head space has been measured to be as high 3×10^7 pCi/liter. Using the concentration and the volume of the head space of each silo, it has been calculated that approximately 33 curies of radon-222 exist in the head space.

Two independent studies have been completed on the structural integrity of the silos (Camargo, 1986, and Bechtel, 1990). These two structural analyses concluded that the silos had lost over half of their design strength and that no life expectancy could be predicted for the silo domes.

The result of silo dome failure would be an immediate release of radon gas from the head space of the silos to the environment. There is also the potential for the K-65 residues to become airborne under tornado loading conditions.

3.0 TASK SPECIFIC HAZARD ASSESSMENT

3.1 Hazard Assessment

A brief evaluation of the tasks to be conducted during the K-65 silo removal action (Section 1.0) indicates that physical and radiological hazards will be present; chemical hazards may be present and will be assessed as well. Table 3-1 lists the physical, chemical, and radiological hazards associated with each of the tasks identified in Section 1.0.

Table 3-1 - Hazards Associated with K-65 Removal Action

Task	Physical Hazard	Chemical Hazard	Radiological Hazard
Construction/installation of the bentonite system	Noise, vehicle traffic, overhead hazards (power lines, etc.)	Vehicle emissions	None; however, low levels of penetrating radiation (gamma) and inhalation hazard (Rn-222) may be present depending on proximity of activity to K-65 silos
System operability testing/startup	Noise, overhead hazards, electric shock, falls, heat stress	None, although lead is present in the residues it has not been detected in the exhaust air	Penetrating radiation can be expected from the uranium daughters at levels of ≈50 mrem/hr on the berm surrounding the K-65 silos; 0.6 mrem/hr at the inside of the fence to the west of the K-65 Area;≈150 mrem/hr on contact with the silo domes. An inhalation hazard due to Rn-222 which leaks from the silos. Note: The radon treatment system will be operated to reduce the Rn levels prior to commencement
Operations and maintenance	Noise, overheads hazards, electric shock, falls, heat stress	None	Penetrating radiation and inhalation hazard, as above.
Dismantling and removal of crane and bentonite slurry system	Electric shock, falls, overhead hazards, vehicle traffic, dust, heat stress	Vehicle emissions, bentonite dust	None; however, low levels of penetrating radiation may be present depending on proximity of activity to silos.

3.2 Chemical/Radiological Hazards

Table 3-2 includes the suspect contaminants along with the exposure limits, the primary hazard, the applicable action limit, and the background level in ambient air. Included in the table are the following radionuclides (in order of their expected significance) from K-65 residue are expected: thorium-230, radium-226, natural uranium and natural thorium.

3.2.1 Penetrating radiation from the K-65 silos can be expected in the range of about 50 mrem/hr on the K-65 berm to about .6 mrem/hr at the inside of the fence to the west of the K-65 Area. The highest radiation readings in the area are about 150 mrem/hr on contact with the silo domes.

3.2.2 Radon from the K-65 Silos has the highest potential for personnel exposure.

Table 3-2
CHEMICAL/RADIOLOGICAL HAZARD TABLE

Contaminant	Primary Hazard	Limit	Action Level	Action
Thorium-230	Ingestion/ Inhalation	3×10^{-12} uCi/ml[2]	7.5×10^{-13} uCi/ml	Note 1
Radium-226	Ingestion/ Inhalation	3×10^{-10} uCi/ml[2]	7.5×10^{-11} uCi/ml	Note 1
Uranium-238	Ingestion/ Inhalation	2×10^{-11} uCi/ml[2]	5×10^{-12} uCi/ml	Note 1
Radon-222 Daughters	Ingestion/ Inhalation	0.33 WL[3]	.075-16.5 WL[3]	Note 1
Bentonite	Ingestion/ Inhalation	5 mg/m^3	2.5 mg/m^3	Note 2
Lead	Skin Absorption/ Ingestion	.05 mg/m^3	.03 mg/m^3	Skin Protection

Notes

1. Full-face air purifying respirators with high efficiency/radionuclide filter cartridges.

2. Full-face air purifying respirators with high efficiency/radionuclide filter cartridges unless it contains greater than 1% crystalline silica. If greater than this silica content, the limit is 80/% of SiO_2 mg/m^3.

---

[2]This is the Derived Air Concentration (DAC). For long-lived alpha activity where the radionuclides are unknown, the Action Limits specified for Thorium-230 shall be used.

[3]WL - Working Level. Any combination of short lived radon decay products in 1 liter of air that will result in the admission of 1.3×10^5 mev alpha energy.

4.0 MONITORING

4.1 Goals

Prior to any task performed in the K-65 area, air monitoring will be performed as determined to be necessary at the time of issuance of the work permit(s) to ensure that exposure levels do not exceed established exposure limits.

4.2 Monitoring Equipment and Frequency of Monitoring

4.2.1 Airborne Radioactivity

Air monitoring will be performed to assure that contaminant concentrations in the breathing zone do not exceed the concentrations specified by established exposure levels. The air monitoring program will consist of radon and radon progeny monitoring and monitoring for long-lived particulates, such as Radium-226 and Thorium-230.

Continuous radon gas monitoring will be provided at the K-65 Area fenceline using alpha scintillation devices known as RGM-2 and/or similar devices to be specified by FMPC Industrial, Radiological Safety and Training personnel. Action limits for the RGM-2 and actions to be taken are delineated in the Radon Monitoring and Sampling Checklist for the K-65 Silos, DWP-005.

Working level grab samples (Radon Progeny) will be collected utilizing a portable, battery powered air pump (BZ) with a 37 mm membrane filter. At a minimum, grab samples will be taken before start of work, and randomly while workers are on top of the earth embankment. Samples should be taken in the worker's breathing zone to draw samples representative of the air to which the worker is exposed. Grab samples will be taken and calculated per the FMPC Radon Air Sampling Procedure.

To determine the amount of long-lived airborne radioactivity to which workers are exposed, high volume air samples will be taken at the location of personnel by use of high volume samplers or breathing zone samplers. The sample will be checked for gross radioactivity to verify the adequacy of respiratory protection. Air samples indicating that personnel may have been exposed to greater than 40 DAC-hours in one week will trigger dose assessment by Radiological Safety, Dosimetry Subsection.

4.2.2 Radioactive Surface Contamination

When personnel are in the K-65 area, daily surveys for removable radioactive surface contamination will be performed in the work areas. Contamination surveys will be performed on potentially contaminated fluid systems, as they are opened to ensure that adequate protective clothing is being worn and to verify radiological postings. Direct frisks and/or field swipe surveys will be performed on potential leak sites during dismantling

and removal activities.

4.2.3 Radiation Surveys

Radiation surveys will be conducted at the beginning of work, and intermittently during implementation of this removal action. Personnel will be required to wear direct reading dosimeters in the K-65 area and self-reading pocket dosimeters while working on the silo domes to monitor radiation exposure periodically.

4.2.4 Chemical Hazard

Exposure to significant chemical vapor concentrations are not expected with the tasks associated with the Silos 1 and 2 Removal Action. Air sampling for bentonite will be conducted as determined to be necessary by the Industrial Hygiene representative.

4.2.5 Thermoluminescent Dosimetry (TLD)

TLDs will be worn by all workers.

4.2.6 Monitoring for Physical Hazards

Industrial Hygiene shall be contacted for heat stress monitoring when the temperature reaches 80° and readings will be taken at that time to ensure that adequate control measures are taken. Control measures will include plenty of water, rest breaks and careful attention by the supervisor in charge. Also, cool vests will be utilized if necessary. The noise levels from the bentonite delivery system equipment will be monitored and if noise levels are exceed 85 dB_A hearing protection will be required for the workers.

Hard hats will be worn by the workers to provide protectection from overhead hazards associated with the crane operations.

4.2.7 Collapse of the Domes

To prevent injury or loss of workers on the dome in the event of dome collapse, all workers will stay off the central part of the dome. Minimal equipment will be brought on to the dome in order to minimize dome loading. Heavy equipment will be suspended from cranes, rather than being set on the dome. A net will be placed over the dome to prevent workers from falling into the dome cavity in the event of dome collapse.

5.0 PERSONAL PROTECTIVE EQUIPMENT

All employees in the task areas will wear the following type of personal protective equipment while performing the required tasks. The specific Personal Protective

Equipment required for each specific task associated with implementing the Silos 1 and 2 Removal Action will be determined at the time the FMPC Radiation Work Permit is issued.

ITEM	NEED	JUSTIFICATION
Full Face Air Purifying Respirator	No(Yes)[4]	Required for work on the silo domes
Cartridges: HEPA	No(Yes)[4]	Required for work on the radon treatment system and slurry supply system
Hard Hat	Yes	As needed for overhead work
Hearing Protection	No(Yes)[4]	As specified by Industrial Hygiene based on operations
Inner Gloves	No(Yes)[4]	Used beneath leather palm gloves
Rubber/Latex Boots	No(Yes)[4]	May be used for additional protection against contact with liquid
Leather-Palm Gloves	No(Yes)[4]	As needed for physical protection of hands and required in Contamination Areas
Rubber/Nitrile Gloves	Yes(No)[4]	As needed to prevent contact with liquids
Cloth or other Anti-Contamination Coveralls	Yes(No)[4]	Needed when plastic coveralls are not used
Controlled Area Coveralls	Yes	Minimum requirement for work in exclusion area
Cloth Hood	Yes(No)[4]	Needed when plastic coveralls are not used
SAR	No(Yes)	Required for work on the

[4]The decision in () will be required if the radiological safety technicians determine it to be necessary.

		domes if manways are open
Safety Glasses	Yes	Minimum Requirement, may be satisfied by full-face respirator
Safety Goggles/ Face Shield	Yes	To protect eyes from liquid splash where full-face respirator is not used
Safety Shoes	Yes	Minimum Requirement
Shoe Covers	Yes	
Plastic Coveralls	Yes(No)[4]	Needed in lieu of cloth coveralls
Plastic Hood	Yes(No)[4]	Needed in lieu of cloth coveralls

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6.0 SITE CONTROL

6.1 Access

The work associated with this removal action will be within the FMPC controlled area. In addition, the work area related to this removal action will be posted as "RWP Required for Entry". This will establish the Exclusion Zone per 29 CFR 1910.120. A portion of these tasks will be performed outside the Contamination Controlled Area at the K-65 Silos area. A layout map of the Silos 1 and 2 Removal Action area is provided in Figure 1 delineating specific exclusion zones as determined by the FMPC radiological safety technicians. Contamination Areas will be set up within the Exclusion Areas. Once identified, a more specific map will be developed identifying the step-off pads and indicate that friskers, protective clothing and a waste container will be at each step-off pad. The step-off pad will only be used decontaminating material that is easily wiped clean. The Radiological Safety Technician will control stay-times in the K-65 Area to ensure that personnel exposure remains as low as reasonably achievable and below applicable site limits.

The Exclusion Zone is the zone of high potential hazard due to physical or chemical dangers. Access to the Exclusion Zone will be restricted by Radiological Safety to trained and certified employees, as regulated by 29 CFR 1910.120, who are required to enter in order to perform their job functions. There will be different Exclusion Zones for the various tasks. The Exclusion Zone will be marked with barrier tape or other easily recognizable devices. The zone may be expanded if airborne hazards are detected. All areas requiring the use of respiratory protection are included in the exclusion zone. Entrance shall be limited to one area and controlled by the supervisor in charge.

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If necessary, Radiological Safety will establish a Contamination Reduction Zone, consisting of step-off pads, at the exit to the Exclusion Zone. This zone will be used for removal of disposable PPE and for cleaning of contaminated equipment.

6.1.1 Radiological Postings

Radiological areas will be posted in accordance with DOE Order 5480.11. The following is a brief summary of posting requirements applicable to K-65 radionuclides:

TABLE 6-1

POSTING REQUIREMENTS

Regulated Area	
(Ra-226 & Th-230)	> 20 dpm/100 cm^2 removable > 300 dpm/100 cm^2 fixed and removable
Beta-gamma emmitters	> 1000 dpm/100 cm^2 removable > 5000 dpm/100 cm^2 fixed and removable
Contaminated Area	
(Ra-226 & Th-230)	> 200 dpm/100 cm^2 removable > 3000 dpm/100 cm^2 fixed and removable
Beta-gamma emmitters	> 10000 dpm/100 cm^2 removable > 50000 dpm/100 cm^2 fixed and removable
Airborne Radioactivity Area	> 3 x 10^{-12} uCi/ml > .03 WL
Respirator Area	> 7.5 x 10^{-12} uCi/ml & .075 WL
Radiation Area	> 5 mrem/hr

In addition, special postings may be added for access to areas: "RWP Required for Entry" or "Contact HP for Entry."

6.2 Bioassay Samples

Site personnel involved in this project are required to participate in a routine periodic urine assay program. Any suspected exposure to hazardous substances shall be reported and require additional sampling. Personnel are also required to wear a TLD at all times for radiological purposes. If sample analyses indicate that thorium levels in air or on surfaces were sufficient to deliver more than eight DAC-hours to an individual, in vivo monitoring and/or other bioassay measurements will be performed on that individual as deemed appropriate by FMPC Dosimetry. Air samples indicating that personnel may have been exposed to greater than 40 DAC-hours in one week will trigger dose assessment by

Radiological Safety, Dosimetry Subsection.

6.3 Medical Monitoring

In accordance with 29 CFR 1910.120 requirements, all WMCO and WMCO subcontractor personnel are required to participate in a medical monitoring program which includes:

- A baseline medical examination
- Annual medical examination
- Medical examinations may be required after potential exposures.
- WMCO respirator clearance for users

Prior to the start of work, personnel involved in this project shall be identified by name and badge number. Each individual shall be subject to a medical surveillance approval by the Director, Medical Services. The approval statement shall certify that each individual is medically qualified to perform the work and is physically fit to wear PPE.

6.4 Training Requirements

All WMCO and WMCO subcontractor personnel assigned to the tasks will, as a minimum, meet the following training requirements including:

- Review of this health & safety plan for this work including site specified hazards and procedures. (The safety meeting(s) will be documented.)
- Site radiation safety training
- Site annual respiratory training and quantitative fit test or equivalent approved by site Industrial Hygiene
- Site nuclear criticality training
- 40-hour OSHA training
- 8-hour annual refresher training, as necessary
- 8-hour supervisory training (for supervisors)
- 24-hour supervised field experience
- FMPC site orientation video
- FMPC K-65 Silos Numbers 1 and 2 Area Emergency SOP 65-C-107
- Operational Procedures which will include:
  - •startup
  - •normal operations
  - •normal shutdown
  - •restart after normal operations shutdown
  - •routine maintenance
  - •preventive maintenance
  - •emergency shutdown
  - •restart after emergency shutdown
  - •dismantling and removal
  - •equipment decontamination and removal

The completion of this training shall be documented by the site training organization.

6.5 Safety Meetings

A safety meeting, which must be documented, shall be conducted prior to the start of each day's work. These safety meetings will cover the following applicable subjects:

[] work operations
[] personnel protective equipment
[] all monitoring data
[] hazard communications
[] monitoring tests and results
[] decontamination
[] task organization
[] physical stress
[] emergency procedures
[] communications
[] general safety
[] housekeeping

7.0 EXPOSURE SYMPTOMS

Exposure to low levels of radiation do not produce acute exposure symptoms. Such exposures may cause delayed effects such as cancer. Since any radiation exposure may involve some degree of risk, exposures are to be kept as low as reasonably achievable (ALARA). Radiation exposures will be monitored by direct reading pocket dosimeters in accordance with Standard Operating Procedure (SOP) SP-P-33-033.

Bentonite clay is not regarded as a carcinogenic substance by any state or federal agency. However, chronic and long term exposure to bentonite dust may contribute to the development of respiratory diseases, such as silicosis. Exposure to low levels of bentonite dust do not produce acute exposure symptoms. Such exposure is similar to exposure to a dust environment of other earthen materials including sand, soil, and other clays.

Personnel exposure to bentonite could be through inhalation of bentonite dust in air. However, since the equipment and systems used to supply, mix, and place the bentonite are closed systems with dust filters, personnel will not be exposed to bentonite dust unless there is an equipment failure that breaks the closed confinement system.

No unique first aid capabilities will be required.

8.0 SITE ENTRY PROCEDURES

During the activities necessary to implement this removal action the following procedures apply.

- Perform daily safety meeting to familiarize team with site specific hazards.
- Discuss alternate communications signals (if applicable).

- Perform respirator check out and negative/positive pressure fit test prior to use.

- Use buddy system. Teams of at least two individuals will be used for all activities for this removal action.

Prior to the initiation of these work tasks, the following permits are required:

[] Radiation Work Permit
[] Chemical/Hazardous Material Permit
[] Work Permit

Entrance to the Exclusion Zone shall be controlled by approval of the supervisor-in-charge.

9.0 DECONTAMINATION

An exclusion zone will be established around the K-65 silos (see Figure 1) in order to control the spread of contamination resulting from the removal action. Personnel and equipment will enter the exclusion zone through a step-off pad, in accordance with Section 6.0. The boundaries will be posted in accordance with SOP SP-P-30-025. After exiting, the personnel will remove any disposable protective clothing and monitor themselves and any outgoing equipment for contamination in accordance with SOP SP-P-30-020. Health physics staff will maintain instrument calibration for this purpose in accordance with SOP-33-033.

Report any detectable personnel alpha contamination and greater than 100 cpm beta-gamma contamination to Radiological Safety who will assist in personnel decontamination in accordance with SOP SP-P-35-017.

Any equipment found to be contaminated will be contained and transported to the Site Decontamination Facility. Action limits on equipment of 20 dpm/100cm^2 alpha removable, 100 dpm/100 cm^2 alpha fixed plus removable, 1,000 dpm/100 cm^2 beta/gamma removable and 5,000 dpm/100 cm^2 fixed plus removable will initiate decontamination activities. This facility uses both water, abrasive and chemical decontamination as appropriate and in accordance with operating procedures. If the equipment can not be decontaminated to acceptable levels it will be disposed as radioactive waste in accordance with Section 10.0.

10.0 WASTES

Wastes include but are not limited to:

Contaminated bentonite depth indicators and monitors
Bentonite feed pipe (if designated as waste)
Disposable PPEs
Excess bentonite slurry material

All potentially contaminated waste materials resulting from site activities will be collected and placed in drums or other containers. Disposable protective clothing will be placed in plastic bags and disposed of as compactible, potentially contaminated waste.

Drums or containers shall meet DOE 49 CFR Parts 171-178, EPA, 40 CFR Parts 264-265 and 300, and OSHA requirements. Hazard warning label shall be immediately applied to all drums as specified by FMPC management/supervisors and Solid Waste Compliance.

Excess bentonite will be disposed of by the bentonite system subcontractor.

Any disturbed uncontaminated soil will be regraded into the area of disturbance.

11.0 CONTINGENCY PLANS

The plans shall be consistent with FMPC-2046, "FMPC Emergency Plan".

11.1 Incidents or Injuries Involving Possible Intake of Radiological or Chemical Substances by Employees

Incidents or injuries involving potential intake of uranium or other hazardous substances shall be reported to supervisor and the site Medical Section by the involved employee and an Incident Investigation Report completed by the involved employee. Incident urine samples shall be submitted at the end of the shift and at the start of the next shift if exposure involved uranium.

11.2 Pre-Emergency Planning

During the training and pre-work safety meetings all employees involved in this task shall be trained and reminded of the provisions of the plant emergency procedure, alarm signals and communications, evacuation routes and emergency reporting.

11.3 Lines of Authority

The supervisor in charge, the K-65 silos area supervisor, has the primary responsibility for the prevention of emergency conditions. In the event that an emergency does occur the individual involved or observing the condition shall immediately notify a supervisor, the communication center or the Assistant Emergency Duty Officer (AEDO). The AEDO is responsible for ensuring that corrective actions have been implemented, the appropriate personnel notified, and reports completed as required.

11.4 Evacuation

In the event of an emergency which necessitates an evacuation of the Exclusion Area, the 3-3, 3-3 shall be sounded over the plant alarm system; a voice message

will follow over the Emergency Message System instructing employees to go to their designated Rally Point (see Figure 2). Personnel shall immediately proceed to the Rally Point and participate in the accountability process. Personnel will follow instructions given by the Rally Point Coordinator. When an all-clear condition has been achieved, personnel will be released from the Rally Point. 1875

11.5 Emergency Equipment

The following safety equipment, locations to be identified at safety meetings, is available for employee usage:

- [] fire extinguisher
- [] portable eye wash
- [] absorbent
- [] telephone
- [] spill drums
- [] manual fire alarm
- [] two-way radio
- [] emergency SCBA units
- [] respirators
- [] clean-up materials
- [] local evacuation alarm

11.6 Emergency Notification

All emergencies, including spills and leaks, shall be reported immediately. Emergencies can be reported by telephone dialing 6511; by contacting the communications center via two-way radio; or by pulling a manual fire alarm.

11.7 Fire, Explosion, or Medical Emergency

In the event of a fire, explosion or medical emergency, the communication center shall be notified immediately by manual fire alarm, two-way radio, or by calling 6511. The communication center operator will activate the emergency response team and dispatch them to your location. If a fire is in the incipient stage and perceived controllable without endangering oneself, personnel may use available fire extinguishers. If not in the incipient stage personnel in the immediate area shall evacuate to a safe position and await instructions.

11.8 Spill Control Contingency Plan

The proposed operations pose a possibility for spilling or releasing small particles of bentonite dust. All spills, regardless of their size or the classification of the liquid, shall be reported immediately. Emergencies can be reported by telephone dialing 6511; by contacting the communications center via two-way radio; or by pulling a manual fire alarm. The Emergency Response Team and AEDO will respond to the spill according to the FMPC Spill Control Contingency Plan.

11.9 Additional Information

11.9.1 Hospitals

The FMPC Medical Facility (Building 53) is the primary choice for on-site injuries (see Figure 3 for travel routes from the K-65 Area to the FMPC

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medical facility). The FMPC ambulance will transport the injured to the nearest hospital if necessary. FMPC maintains an emergency response capability which includes an ambulance and Emergency Medical Technicians.

11.9.2 Emergency Telephone Numbers

Ambulance:	6511
Hospital:	6511
Fire:	6511

Name	Work	Radio
EMERGENCY RESPONSE	6511	Control
Industrial Hygiene	6207	357
Radiation Safety	6889	355
Fire and Safety	6235	303
(Safety and Health Officer)	6231	
Assistant Emergency Duty Officer (AEDO)	6431 or 6295	202

12.0 CONFINED SPACE ENTRY

A Confined Space Entry permit will not be required because there will not be any entries into confined spaces during this removal action.

13.0 APPROVAL AND COMPLIANCE STATEMENT

13.1 Provisions

This site specific safety plan was produced for the use of WMCO employees and subcontractors. It was intended for the FMPC and specifically for personnel performing the following activities:

1) Construction/installation of the bentonite system
   a) Bentonite receiving/unloading system
   b) Bentonite mixing unit
   c) Bentonite slurry transport supply system
   d) Distributor/sprayhead assembly
   e) Crane
   f) Utility/support systems
   g) Instrumentation and controls

2) System operability testing/startup
   a) Bentonite receiving/unloading system
   b) Bentonite mixing unit
   c) Bentonite slurry transport supply system
   d) Distributor/sprayhead assembly
   e) Crane
   f) Utility/support systems
   g) Instrumentation and controls

3) Operations and maintenance
   a) Operate the radon treatment system
   b) Install and remove glove bag over manways
   c) Open and close manways
   d) Insert and remove CCTV cameras into silo
   e) Place bentonite in silo
   f) Maintain bentonite slurry delivery system

This site specific safety plan was produced for the use of WMCO employees and subcontractors. It was intended for the FMPC and specifically for personnel performing the following activities:

4) Dismantling and removal of equipment
   a) Bentonite receiving/unloading system
   b) Bentonite mixing unit
   c) Bentonite slurry transport supply system
   d) Distributor/sprayhead assembly
   e) Crane

The personnel performing the tasks listed in Section 13.0 must read and understood the attached site specific health and safety plan and agree to follow its provisions[1]. Written documentation with signatures of those personnel performing these tasks must be maintained.

13.2 Amendments To Plan

This Health and Safety Plan is based on information available at the time of preparation. Unexpected conditions may arise which require reassessment of safety procedures. Unplanned activities and/or changes in the hazard status shall require a review of and may require changes in this plan. Changes in the anticipated hazard status or unplanned activities are to be submitted as an amendment to this plan. Amendments must be approved by the plan author and IRS&T prior to implementation of the amendment.

[1]Compliance with the provisions of the Health and Safety Plan may be audited through announced or unannounced site visits. Be sure that the provisions of this safety plan are implemented and document the reasons for field actions/changes when they are necessary. Site visits may be performed by the DOE or WMCO personnel.

14.0 REFERENCES

The following references are Standard Operating Procedures (SOP):

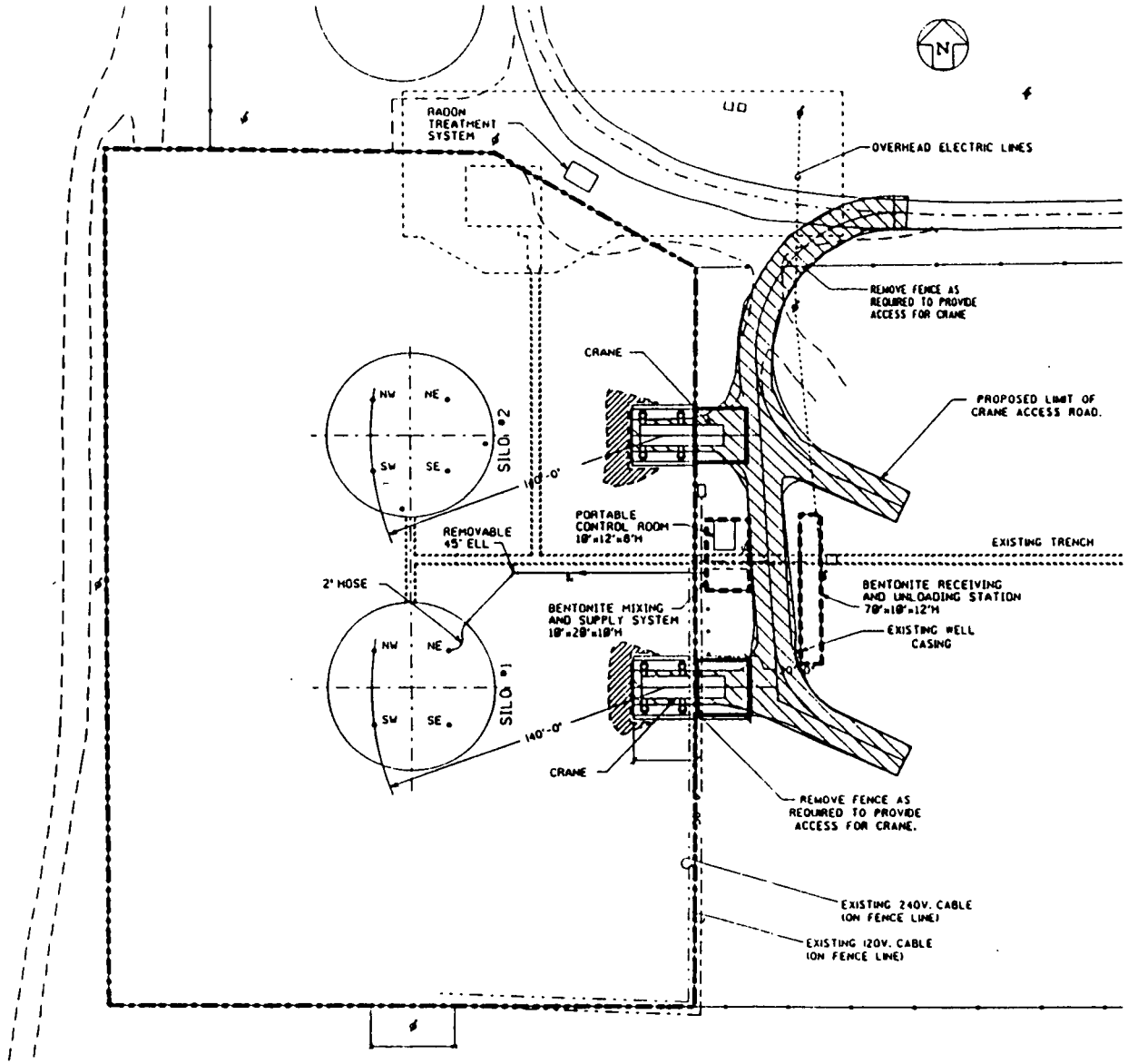
SP-P-30-010	Measuring Radon Daughter Concentrations, Rev.1
SP-P-30-011	Measuring Thoron Daughter Concentrations, Rev.1
SP-P-30-020	Contamination Survey, Rev.0
SP-P-30-025	Radiological Posting, Rev.0
SP-P-30-032	Area Radiation Surveys, Rev.0
SP-P-33-033	The Use of Direct Reading Dosimeters, Rev.0
SP-P-35-005	Alpha CAM Operation, Rev.0
SP-P-35-007	Beta CAM Operation and Use, Rev.0
SP-P-35-010	Unrestricted Release of Materials from FMPC, Rev.2
SP-P-35-016	Completion of Radiation Work Permit Form, Rev.1
SP-P-35-017	Procedure for Personal Decontamination, Rev.0
SP-P-35-018	Radiological Survey Requirements for Non-Process Area Trash to be Released for Off-Site Disposal, Rev.1
SP-P-35-020	Monitoring of Exiting Vehicles from FMPC, Rev.1
SP-P-35-026	Occupational Air Sampling, Rev.0
SP-P-41-016	Emergence, Rescue, and Non Routine Use of Respiratory Equipment, Rev.0
SOP-65-C-201	Operation of K-65 Silos Radon Treatment System

LEGEND

RADIOLOGICAL EXCLUSION ZONE

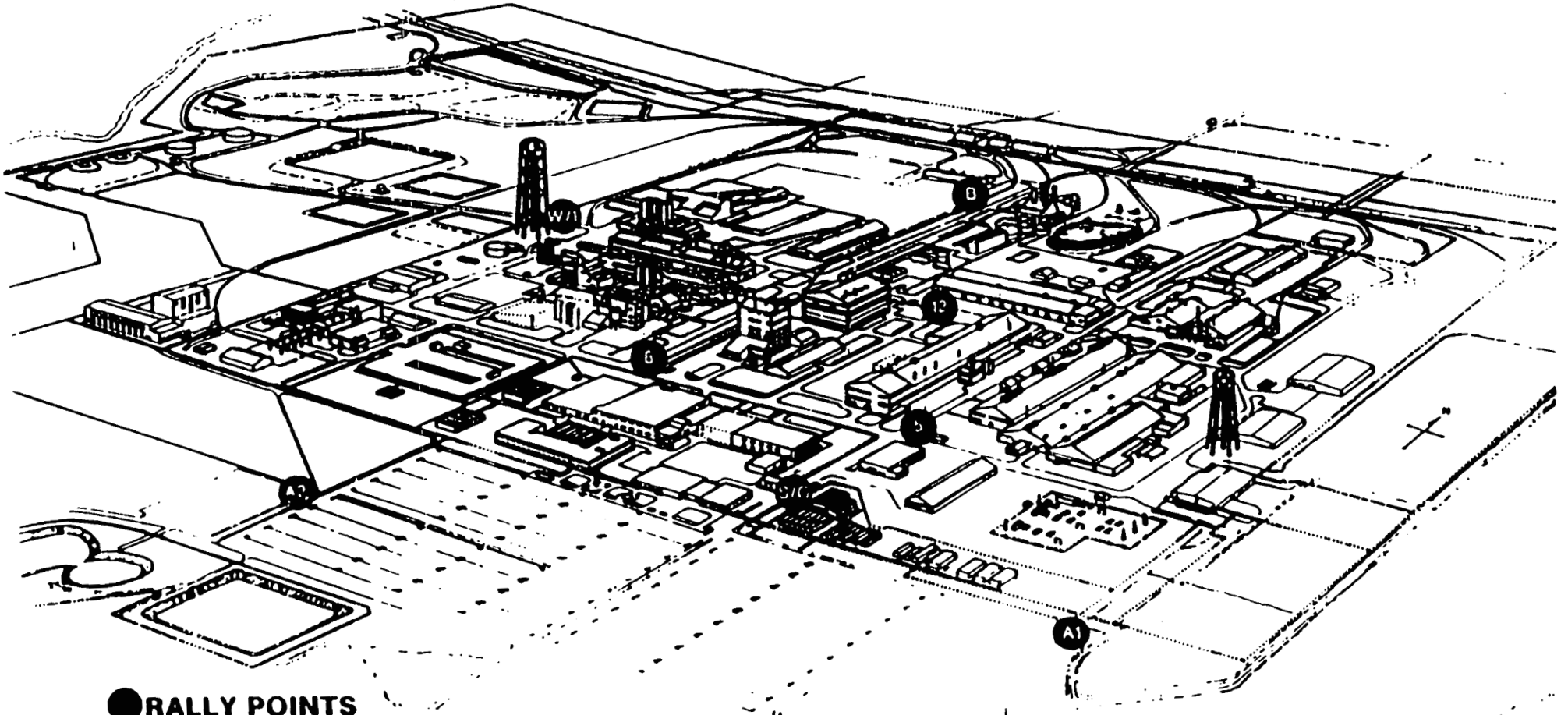
CONSTRUCTION EXCLUSION ZONE

CONTAMINATION REDUCTION ZONE



SILOS 1 AND 2
REMOVAL ACTION EXCLUSION AREAS
SKETCH NUMBER 458-003
FIGURE 1

FMPC RALLY POINTS



RALLY POINTS

I.D. Label	Plant or Area Description
A1	Administration
A2	Alternate Administration
B	Boiler Plant
S/G	Security & Garage
W/1	Waste Pit Area & Plant 1
5	Plant 5
8	Plant 8
12	Building 12

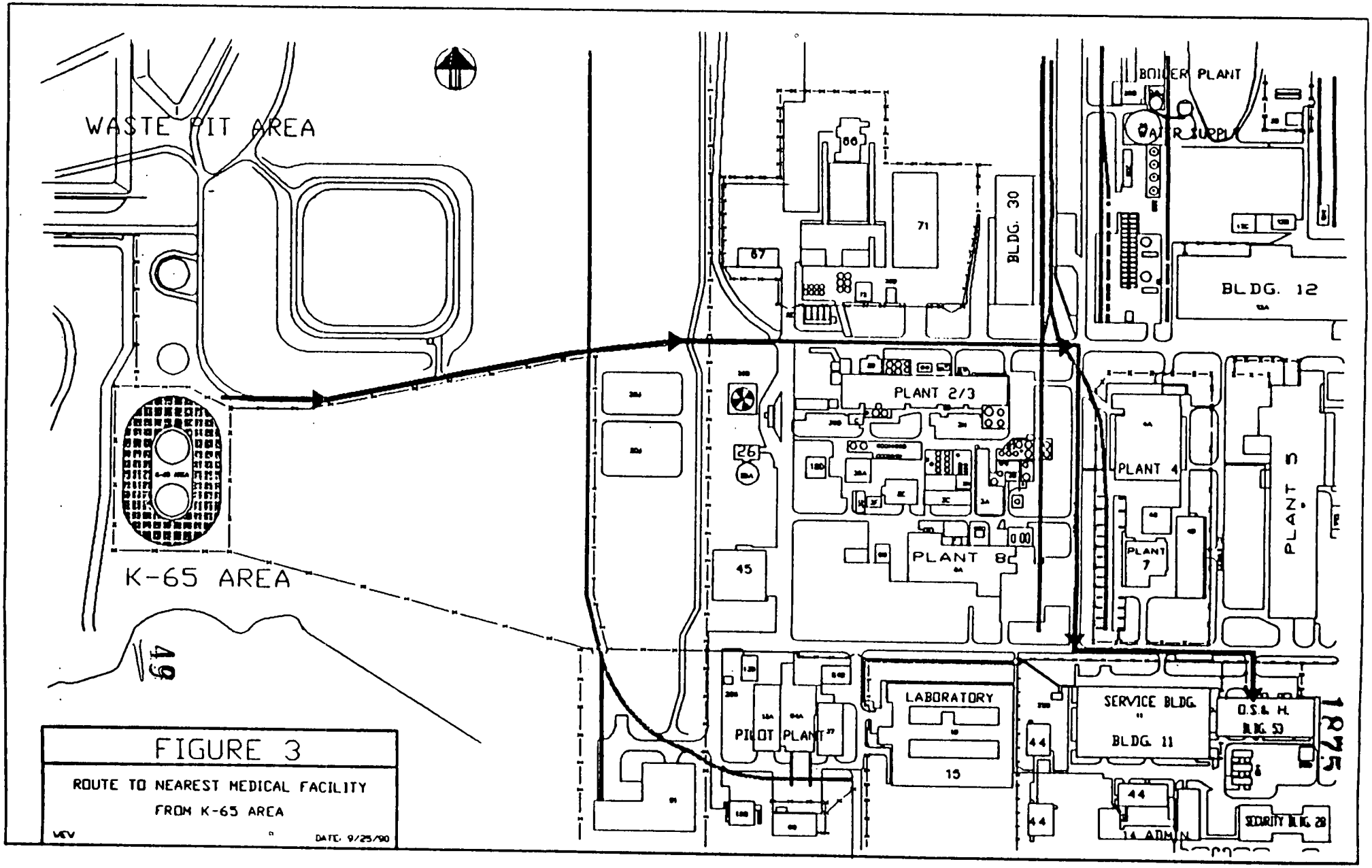


FIGURE 3

ROUTE TO NEAREST MEDICAL FACILITY FROM K-65 AREA

DATE: 9/25/90