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RESPONSE TO U.S. AND OHIO EPA QUESTIONS ON K-65 SILO INTERIM REMEDIATION

07/14/89

DOE-1308-89
DOE-FMPC USEPA
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RESPONSES

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July 14, 1989
DOE-1308-89

Mr. Basil G. Constantelos, Director
Waste Management Division
U. S. Environmental Protection Agency
Region V - 5H-12
230 S. Dearborn Street
Chicago, Illinois 60604

Dear Mr. Constantelos:

RESPONSE TO U. S. AND OHIO EPA QUESTIONS ON K-65 SILO INTERIM REMEDIATION

References: 1) Letter, C. A. McCord, U.S. EPA to James A. Reafsnyder, U.S. DOE, "K-65 Sand Project", dated May 22, 1989.
2) Report, AWC Incorporated, "Review of Proposed Sand Fill Project for the K-65 Silos at FMPC", dated May 18, 1989.

The purpose of this letter is to address the U. S. EPA and Ohio EPA comments on the K-65 Silo Interim Remediation Project Work Plan and to provide notification that the K-65 Silo Interim Stabilization (Sand-Fill) Project activities have been suspended until additional residue sampling information can be obtained.

The review comments and an overview of the project, were discussed with the EPAs, and the Ohio EPA subcontractor AWC Incorporated (AWC), at a meeting held at the Feed Materials Production Center on May 25, 1989. All issues addressed in this letter were discussed at that meeting and tentative agreement was reached on each of the items. The responses to the specific EPA comments (References 1 & 2) are contained in Attachments 1, 2, and 3 to this letter.

Beginning on June 16, 1989, eight core samples were extracted from K-65 Silo #2 in conjunction with the ongoing Remedial Investigation Feasibility Study at the FMPC. Visual inspection of the core samples was completed on June 23, 1989. The limited amount of residue material obtained from the sampling program was wetter than anticipated. The depths at which the sample material was obtained is uncertain.

The K-65 Silo Interim Stabilization Project is based on the belief that the residue material in the silos is sufficiently stable to support the proposed four foot sand layer. The residue material obtained thus far from the sampling program indicates that the material is wet, and possibly less stable, than anticipated. Therefore, DOE recommends that the Interim Stabilization Project activities (Sand-Fill) be suspended until additional samples can be taken and analyzed.

DOE is committed to completing the K-65 Silo Interim Stabilization Project in the safest possible manner. Therefore, it is imperative that all available information be utilized to ensure that the proposed sand fill, as well as the equipment for the sand fill, will perform as designed. DOE believes that the additional residue samples from Silo #1 and Silo #2, and the lab analysis information on the samples, is essential to ensure that the design, installation and performance of Interim Stabilization sand fill is successful.

If you have any questions, please contact Jack Craig of my staff at extension.

Sincerely,

Ray Hansen for

James A. Reafsnyder
FMPC Site Manager

DP-84:Craig

Attachments: As stated

cc w/atts.:

C. A. McCord, USEPA-5
G. Mitchell, OEPA-Dayton
W. A. Weinreich, WMCO
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bcc w/atts.:

L. M. Sparks, SE-31, ORO
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U. S. EPA Comments

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Work Plan for the K-65 Silos Interim Stabilization Project

Installation of Sand Layer

Comment 1: "The proposal should include estimates of potential routine and accidental offsite doses."

Response: This comment was discussed with the EPAs at the May 25, 1989 meeting at the FMPC. In response to the comment, a copy of the "Analysis of Potential and Probable Accidents Occurring at the K-65 Storage Silos" was given to the EPAs at the May 25 meeting. The accident analysis was done as a part of the "Feasibility Investigation for Control of Radon Emission from the K-65 Silos" prepared July 30, 1987. The accident analysis was performed to analyze the radiological health concerns associated with the existing condition of the K-65 Silos and potential accidents and incidents associated with the silos.

As a result of the discussion, the EPAs indicated that they would review the accident analysis provided. This item is considered closed.

Comment 2: "Details for the use and regeneration of the radon treatment system should be included in the proposal. Details for control of radon emissions during the entire sand fill operation should be included."

Response: The details for the regeneration of the radon treatment system carbon beds will be added to Section 2.0 - Site Preparation Prior to Radon Treatment System Operation of the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer" as agreed to at the May 25 meeting with the EPAs.

The details for minimizing radon emissions during the entire sand fill operation, and for the use of the radon treatment system, are included in the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer", previously transmitted to the EPAs (Reference 4). Specifically, Section 2.0 - Site Preparation Prior to Radon Treatment System Operation, Section 3.0 Radon - Treatment System Operation, and Section 7.0 - Radon Monitoring explain the details for the control of the radon emissions during the project.

As a result of the discussion of this item, the EPAs indicated that they would review the work plan. This item is considered closed with the addition of the information to be added to the work plan.

Comment 3: "The background monitor should be moved further offsite."

Response: This item was discussed at the meeting with the EPAs on May 25, 1989. In response to this item it was explained that in addition to the project monitors described in the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer", the FMPC also maintains an environmental monitoring program which monitors for radon emissions. The information from the monitoring program is published annually in the Feed Materials Production Center Environmental Monitoring Annual Report. Copies of the annual reports for the years 1985, 1986, and 1987 were given to the representative from AWC Incorporated at the May 25 meeting.

At the May 25 meeting it was explained that the FMPC currently maintains two offsite radon monitoring locations as a part of the environmental monitoring program. One station is located in southeastern Indiana, approximately 34 km northwest of the FMPC. The second offsite monitoring station is located in southwestern Ohio, approximately 25 km southeast of the FMPC. The data from these offsite stations are included in the FMPC Environmental Monitoring Annual Report.

As a result of the discussion of this comment, the EPAs indicated that they would review the Feed Materials Production Center Environmental Monitoring Annual Reports provided at the meeting. This item is considered closed.

Comment 4: "Consideration must be given for the use of E-PERM type radon detectors to monitor radon levels in the vicinity of the silos, at the property fence line, and the nearest resident. The detectors should be turned off during non-work periods."

Response: As a part of the FMPC Radon Monitoring Program continuous radon gas monitoring is conducted at the K-65 Silo fenceline using alpha scintillation devices known as Radon Gas Monitors (RGM-2). The location of the RGMs are approximately east and west of each of the K-65 Silos. Every hour during the sand installation, while the manways are open to the environment, the RGM-2 unit readings will be checked. Since these monitors are a part of the FMPC Radon Monitoring Program they will not be turned off during non-work periods.

Additionally, three Working Level Monitors (WLM) and two continuous Radon Gas Analyzers (RGA-40) will be used during the sand installation. One of the WLM will be placed on the silo dome, one will be placed on the top of the earthen berm, and the third unit will be placed at the working area. For the RGA-40 units, one will be placed at the top of the earthen berm and the second unit will be placed in the work area during the sand installation. The WLM and RGA-40 units will be located downwind in their respective positions.

The location of all the above mentioned monitors is shown on Figure 7.0 of the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer" (Attachment 2). These monitors will not be turned off during non-work periods. The electronic nature of the monitors is such that the equipment operates best if left on rather than turned off at the end of each days activities and then reactivated again the next day.

In addition to the above described monitors to be used in the vicinity of the silos for the K-65 Silo Interim Remediation Project, the FMPC maintains sixteen (16) radon monitoring cups on the K-65 Silo exclusion fence, sixteen (16) radon monitoring cups at the FMPC property fence, four radon monitoring cups on the dome edge of each silo, and at five radon monitoring cups at offsite locations. Six of the FMPC fence line monitors are located along Paddy's Run Road. The locations of the monitors, and the monitoring data obtained from the monitors, are included in the Feed Materials Production Center Environmental Monitoring Annual Report.

As a result of the discussion of this comment, the EPAs indicated that they would review the information provided, and the Feed Materials Production Center Environmental Monitoring Annual Reports provided at the meeting. This item is considered closed.

Per the EPA comment, we are evaluating the use of E-PERM type detectors for this project, however, it is felt that the use of E-PERM type radon detectors is not suitable for use in the vicinity of the silos for two reasons.

1) There is a fairly high non-uniform gamma field near the K-65 Silos. This field of penetrating, ionizing radiation ranges from background at several hundred meters to about 1mR/hr at the silo exclusion fence, and about 100 mR/hr at the edge of the silo domes. These gamma fields will affect the E-PERM readings and may result in artificially increased calculated radon concentrations.

2) The E-PERM can be saturated. In very high radon concentrations the charge on the electret could be quickly reduced to below its useful level, with the result being an invalid measurement. Under these conditions an artificially low radon concentration reading would result.

Comment 5: "There is no explanation of how the four curies criteria for grab sample measurement was developed or what it is intended to limit (worker dose, offsite concentrations, etc.)."

Response: It was explained that the four curies criteria is based on several factors pertaining to the sand fill project, included are both worker dose and offsite release concentrations.

Between thirty-five (35) and forty-five (45) curies of radon is contained within the dome under normal temperature and pressure fluctuations. The use of the radon treatment system prior to the sand fill project will remove approximately 90% of the radon, leaving approximately 4 curies within the silo dome. This is based on past operations of the radon treatment system.

The current dose rate on the dome surfaces ranges between 125 and 150 mRem/hr penetrating. This is from the radium, uranium, radon, and radon daughter products within the silos. After the operation of the radon treatment system the level is reduced to between 75 and 100 mRem/hr. This reduction is from the removal of approximately 90% of the radon gas. The 75 mRem/hr penetrating was assumed in the "K-65 Sanding ALARA Study", dated April 21, 1989, for the project. At the 100 mRem/hr dose rate on the dome surface, knowing the amount of uranium and radium within the silos, the radioactivity of the remaining radon within the dome space of the silo can be calculated to be approximately 3×10^6 pCi/l, which corresponds to approximately 4 curies.

This item was discussed in detail with the EPAs at the May 25 meeting. This item is considered closed.

Comment 6: "Attachment 1, Page 2, Item 3: The "downwind" direction is dynamic. Monitors should be installed in four directions to compensate for shifting downwind directions."

Response: The "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer", Figure 7.0 - Radiation Survey and Typical Air Monitoring Locations shows the locations of existing and proposed monitoring equipment (Attachment 2) for the project.

As a part of the FMPC environmental monitoring program continuous radon gas monitoring is conducted at the K-65 Silo fenceline using alpha scintillation devices known as Radon Gas Monitors (RGM-2). The location of the RGMs are approximately east and west of each of the K-65 Silos. The prevailing wind direction at the FMPC is from the south-west to the north-east. The locations of the monitors, and the monitoring data obtained from the monitors, are included in the Feed Materials Production Center Environmental Monitoring Annual Report.

In additional to the current monitoring program, three Working Level Monitors (WLM) and two continuous Radon Gas Analyzers (RGA-40) will be used for the sand installation project. During the sand fill operation one of the WLM units will be placed on the silo dome, one WLM will be placed on the top of the earthen berm, and the third WLM unit will be placed at the work area. For the RGA-40 units, one will be placed at the top of the earthen berm and the second unit will be placed in the work area during the sand installation. The WLM and RGA-40 units will be located downwind in their respective positions during the sand fill operations.

It is felt that the existing FMPC environmental monitoring program monitoring equipment, in conjunction with the additional monitoring proposed for this project, is effective in providing monitoring during the project. Technicians will be at the work site to monitor the wind directions and will locate the monitoring units as described. This item is considered closed.

Comment 7: "Doses should be designated as effective dose equivalents, which includes organ and whole body doses."

Response: Effective dose equivalents includes organ (ingested/inhaled particulates) and whole body (beta/gamma penetrating) doses.

Section 6.0 - Sand Installation of the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer" outlines the FMPC requirements for protective clothing, radiation monitoring devices, and respiratory protection that will be used by each person entering the K-65 Silo exclusion area during the sand fill project.

The criteria for respiratory protection is outlined in the project work plan.

The time and dose estimates generated in the "K-65 Sanding ALARA Study", dated April 21, 1989, do not include any estimation of the internal dose (organ) due to exposure to radon-222 and its progeny due to the required use of the above listed respiratory protection. Whole body (beta/gamma penetrating) doses at the K-65 Silos are the major concern for the personnel involved in the project. The critical organ, lung, is being addressed by the use of the respiratory equipment. It is felt that because of the use of the respiratory equipment on this project that whole body dose should be designated. This item was discussed with the EPAs and is considered closed.

Comment 8: "Page 16, Sentence 1: Explain why workers are being given criticality training? Is criticality a credible possibility?"

Response: All FMPC employees and Subcontract personnel are required to complete certain training programs prior to beginning work at the facility. These training programs include orientation, safety, environmental issues, health, radiation workers training and criticality training. Additional training for certain projects, such as the K-65 Silo Interim Remediation Project, may include specific project training, respirator training and Self Contained Breathing Apparatus (SCBA) training. This item is considered closed.

Criticality is not a credible possibility for this project. Before a criticality accident can occur, a certain amount of uranium-235 must be present. This amount of uranium necessary to cause a criticality is called a minimum critical mass. This minimum critical mass is not present in the K-65 silos. This item is considered closed.

Comment 9: "Section 6.0: The moisture limit for the sand fill should be specified in order to assure the proper radon retention times and the projected reduction in radon levels. Moisture monitors should be considered."

Response: The primary mission of the K-65 Silo Interim Remediation Project is to provide a protective barrier between the silo residues and the environment in the event of a dome failure or collapse. Potential secondary benefits from the sand layer addition include the reduction of radon gas emanations and gamma radiation from the silos.

An evaluation of the most likely systems to convey and distribute the sand over the surface of the residue material, optimum sand particle size distribution and moisture content will be considered in the detailed system design. It is realized that both sand particle size distribution and moisture content strongly influence the reduction of radon gas emanations. During the design effort, information will be forwarded to the EPA for discussion and comment. This will facilitate timely review and approval to complete the project.

Administrative controls and field checks will be used to assure that the sand delivered to the project site meets the sand specifications determined for the project. Sand particle size distribution and sand moisture content will be specified in the project specifications. Field checks will be used to verify that the sand delivered to the project site meets project specifications. However, it is planned to accept the benefit obtained with the moisture level and sand particle size distribution recorded at the project site rather than develop complex moisture adjustment methods to minimize the radon gas release.

Comment 10: "Figure 3.1.1, Section 7.3: Radon monitors should be placed in all four major compass directions. A monitor is not currently proposed in the southerly direction."

Response: The "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer", Figure 7.0 - Radiation Survey and Typical Air Monitoring Locations shows the locations of all proposed monitoring equipment (Attachment 2).

As a part of the FMPC environmental monitoring program continuous radon gas monitoring is conducted at the K-65 Silo fenceline using alpha scintillation devices known as Radon Gas Monitors (RGM-2). The location of the RGMs are approximately east and west of each of the K-65 Silos. The locations of the monitors, and the monitoring data obtained from the monitors, are included in the Feed Materials Production Center Environmental Monitoring Annual Report.

In additional to the current monitoring program, three Working Level Monitors (WLM) and two continuous Radon Gas Analyzers (RGA-40) will be used during the sand installation. One of the WLM units will be placed on the silo dome, one WLM will be placed on the top of the earthen berm, and the third WLM unit will be placed at the work area. For the RGA-40 units, one will be placed at the top of the earthen berm and the second unit will be placed in the work area during the sand installation. The WLM and RGA-40 units will be located downwind in their respective positions during the sand fill operations.

It is felt that the existing FMPC environmental monitoring program monitoring equipment, in conjunction with the additional monitoring proposed for this project, is effective in providing monitoring during the project. Technicians will be at the work site to monitor the wind directions and will locate the monitoring units as described. Based on the discussion of this item with the EPAs this item is considered closed.

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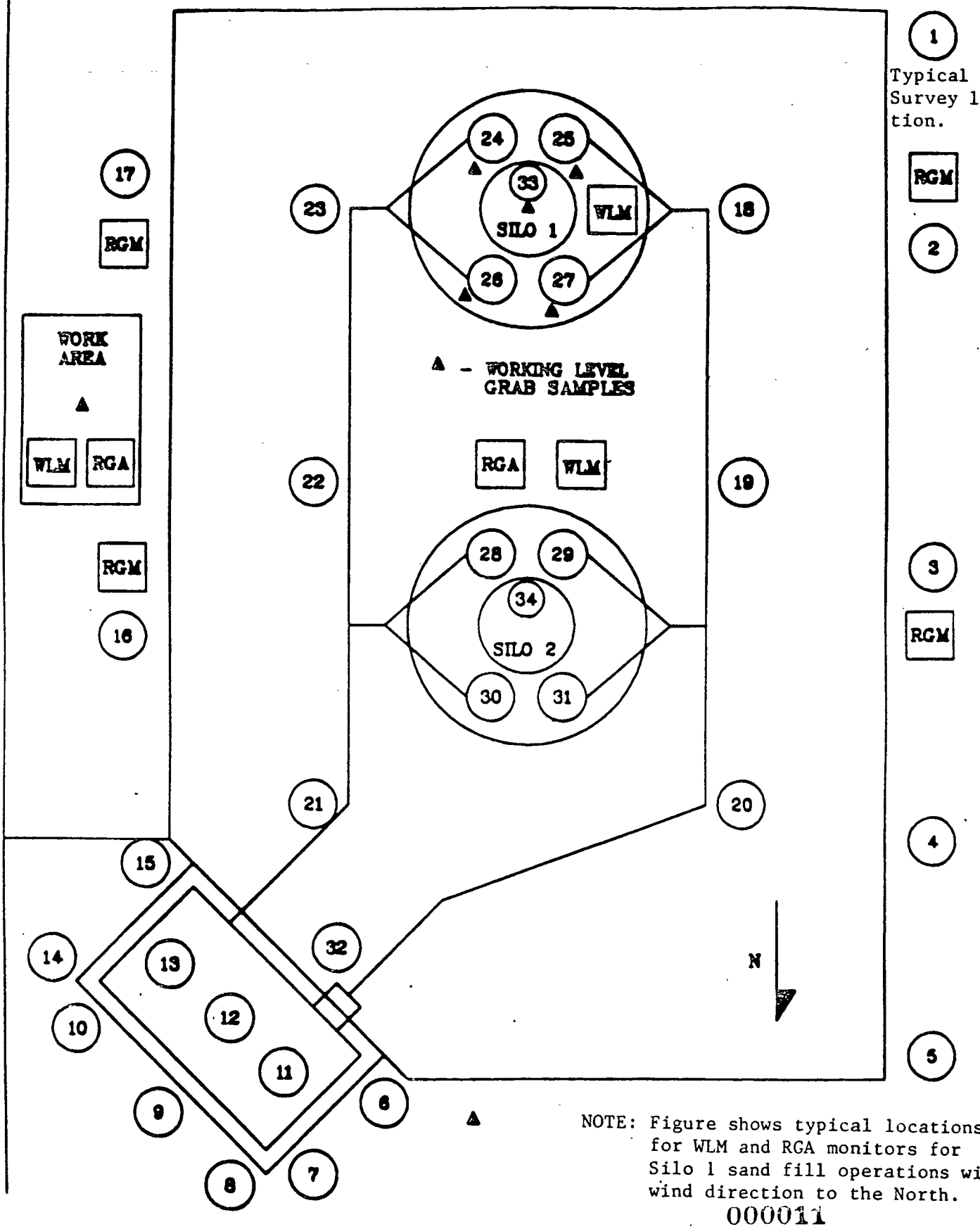
RADIATION SURVEY AND TYPICAL AIR MONITORING LOCATIONS



NOTE: Figure shows typical locations for WLM and RGA monitors for Silo 1 sand fill operations with wind direction to the North.

AWC Incorporated Comments

Review of Proposed Sand Fill Project for the K-65 Silos at FMPC

Work Plan for the K-65 Silos Interim Stabilization Project

Installation of Sand Layer

Evaluation 1: "Minimization of Effects of Dome Failure."

Response: This item was discussed in detail with the EPAs at the May 25 meeting at the FMPC. The major concerns were a clarification of the primary mission of the sand fill, why sand was chosen as the fill material, and consequences of a dome failure accident.

The primary mission of the K-65 Silo Interim Remediation Project is to provide a protective barrier between the silo residues and the environment in the event of a dome failure or collapse. Potential secondary benefits from the sand layer addition include the reduction of radon gas emanations and gamma radiation from the silos.

The decision to use sand as the fill material is based on studies performed by International Technology Corporation (IT). In June of 1988 a "Qualitative Feasibility Study of Alternatives for Interim Remediation of K-65 Silos" was performed by IT. The qualitative study evaluated seventeen (17) alternatives for interim remediation. The evaluation criteria included: application ease; exotherms; dimensional stability; technical complexity; impact on final remediation; public perception; and, environmental and safety considerations. Some of the alternatives investigated included: permanent and reversible gels; organic melts; bentonite; cementitious materials; activated carbon; magnesium sulfate; and, silica gels.

Following the qualitative study IT prepared a "Quantitative Analysis Report of Alternatives for Interim Remediation of K-65 Silos". The quantitative analysis went through a screening and development of preferred alternatives. As a result of the quantitative analysis IT identified the most suitable interim remediation, the addition of a four foot deep sand layer over the surface of the residues. The addition of the sand layer will provide a containment layer over the residue material in the event of a dome failure or collapse. The sand layer has the added benefit of potentially reducing radon gas emanations and gamma radiation from the silos.

In addition to the studies performed by IT, Camargo Associates, Inc. (CAI) performed a "Study and Evaluation Effect of Internal Attenuation Layer on K-65 Silos" for the Interim Remediation Project. CAI evaluated both a static and dynamic analysis on the silos with the proposed four foot sand layer in place. CAI was chosen to do the study since they performed the original structural analysis on the K-65 Silos in 1985. The conclusion of CAI after the analysis is that the two K-65 Silos are capable of sustaining the present loads plus the internal sand layer.

Camargo Associates, Inc. will participate in the design of the sand system to ensure that the system is fully compatible with the structural condition of the silos.

A copy of the "Analysis of Potential and Probable Accidents Occurring at the K-65 Storage Silos" was given to the EPAs at the May 25 meeting. The accident analysis was done as a part of the "Feasibility Investigation for Control of Radon Emission from the K-65 Silos" prepared July 30, 1987. The accident analysis was performed to analyze the radiological health concerns associated with the existing condition of the K-65 Silos and the potential accidents and incidents associated with the silos.

Evaluation 2: "Reduction in Gamma Radiation."

Response: The primary concerns on this evaluation point included the computer codes used for the modeling, effectiveness of the gamma reduction for onsite personnel and offsite population, and current levels of gamma radiation to FMPC personnel and the offsite population.

The computer codes (RAECOM, QAD and S3) used for the project were explained and discussed with the EPAs at the May 25 meeting. Copies of the codes, and input data, were transmitted previously to the U. S. EPA. The codes are those normally used to obtain NRC approval for decommissioning and disposition of uranium mill tailing facilities. Based on these computer models, a reduction in the gamma exposure rate is anticipated from both direct exposure and "sky shine". The reduction in direct gamma radiation would benefit FMPC personnel that will participate in future final remediation activities on the K-65 Silos.

Dose reductions during final remediation of the K-65 Silos are anticipated due to the reduction in gamma radiation levels at the K-65 Silos. The reduction of the dome surface and side embankment radiation levels could result in a significant reduction in dose, dependent on the final remediation option chosen. No estimate of this dose reduction can be made, however, until the final remediation option, and the method(s) for implementing the option, are determined.

It is estimated that the exposure to site personnel from the K-65 Silos can be as high as 0.04 mrem/hr depending on the work area proximity to the K-65 Silos. Exposure to personnel working in the K-65 Silo/Waste Pit area, outside of the K-65 Silo exclusion fence, is between approximately .02 mrem/hr and .27 mrem/hr, again based on the proximity of the work area to the K-65 Silos. The placement of the sand layer in the K-65 Silos could significantly reduce these exposure dose rates. Again, no estimate of this dose reduction can be made, however, until the final remediation options, and the methods for implementing the options, are determined.

The ALARA Study for the K-65 Silo Interim Remediation Project identifies a total dose from the whole project of 23.8 man rem using the center manway for the sand fill.

As discussed at the May 25 meeting, elevated exposure to the offsite population occurs in the area west of the K-65 Silos along Paddy's Run Road. The levels in this area are approximately 8 microR/hr above the background level. Full-time occupancy at this location (fence line) would result in a total dose of approximately 70 mrem per year. EPA regulations specify that the annual radiation dose equivalent to the offsite population should not exceed 25 mrem to the whole body. The discussion with the EPAs clarified that the primary mission of the sand fill is to place a protective barrier over the K-65 residue material, but it is hoped that an additional benefit will be a reduction in the gamma radiation from the silos.

Evaluation 3: "Reduction of Radon Emissions."

Response: The principal concerns with this evaluation item relate to the laboratory analysis and data on the testing of the proposed sand fill materials, the sand particle size distribution, the sand moisture content, and problems associated with the installation of the sand in the silos.

The laboratory analysis work on the proposed types of sand materials was done by Rogers & Associates Engineering Corporation. A copy of their report was previously transmitted to the EPAs. The tests were done on a range of sand types (fine masonry sand, medium Portland Cement sand, and coarse bituminous sand), a range of moisture and saturations, and a range of sand layer thicknesses, to determine radon flux attenuation factors. Based on the lab analysis work, a four foot layer of fine masonry sand provided the optimum benefits to reduce radon emissions.

An evaluation of the most likely systems to convey and distribute the sand over the surface of the residue material, optimum sand particle size distribution and moisture content will be considered in the system design. It is realized that both sand particle size distribution and moisture content strongly influence the reduction of radon gas emanations.

Administrative controls and field checks will be used to assure that the sand delivered to the project site meets the sand specifications determined for the project. However, it is planned to accept the benefit obtained with the moisture level, and sand particle size distribution, recorded at the project site rather than develop complex moisture adjustment methods to minimize the radon gas release.

Concern was expressed that the installed sand may dry out due to evaporation and saturation of the atmosphere with the dome void space, or by seepage into the underlying residues. The moisture content of the K-65 residue material is between 30 and 35%. This has remained fairly uniform for the long period that the residue materials have been in storage. The domes have been covered with a foam material to aid in sealing cracks in the dome surface, and to reduce thermal pumping within the silos due to wide internal temperature fluctuations. Based on this information, no significant drying out of the sand layer material is anticipated.

Items related to the installation of the sand layer were also discussed at the May 25 meeting. Camargo Associates, Inc. will participate in the design of the sand system to ensure that the system is fully compatible with the structural condition of the silos. An evaluation of the most likely systems to convey and distribute the sand over the surface of the residue material, optimum sand particle size distribution and moisture content will be considered in the system design. Preliminary feasibility studies indicated that a mechanical spreader/broadcaster type system would provide the best results, however, other types of systems will be evaluated in the design phase of the project.

Evaluation 4: (Item not listed in AWC report, evaluation items misnumbered.)

Evaluation 5: "Radon Releases During Sand Filling Operations."

Response: This evaluation item concerns the release of radon from open manways during the sand fill operation. Questions were raised to the possibility of designing a system to filter out the heavy dust load during the sand fill operation, or the possibility of designing a negative pressure system utilizing the radon treatment system.

Camargo Associates, Inc. will participate in the design of the sand system to ensure that the system is fully compatible with the structural condition of the silos. An evaluation of the most likely systems to convey and distribute the sand over the surface of the residue material, optimum sand particle size distribution and moisture content will be considered in the system design. When the sand conveying and distribution system is determined, methods to minimize or eliminate radon emissions during the sand fill operation will be evaluated as a part of the ALARA program. The use of the radon treatment system will be one of the possible options evaluated.

Every effort will be made to specify a sand material that meets the project specifications and is a clean washed sand to minimize any fugitive dust emissions during the sand fill operation.

The current plans for minimizing radon emissions during the entire sand fill operation, and for the use of the radon treatment system, are included in the "Work Plan for the K-65 Silos Interim Stabilization Project - Installation of Sand Layer", previously transmitted to the EPAs (Reference 4). Specifically, Section 2.0 - Site Preparation Prior to Radon Treatment System Operation, Section 3.0 Radon - Treatment System Operation, and Section 7.0 - Radon Monitoring explain the details for the control of the radon emissions during the project.

Evaluation 6: "Sand Radwaste Volume."

Response: This items concerns the generation of radioactive waste by the addition of the sand to the K-65 Silos. Approximately 40,000 cubic feet of sand will be added to the silos, representing an increase in material in the silos by approximately 20 percent.

The addition of the sand layer to the silos will increase the volume of materials in the silos by approximately twenty percent. However, if the residue materials are removed from the silos during final remediation, it is assumed that the silo embankments would also be removed. This would reduce the volume of sand to approximately four percent of the total final remediation material volume to be handled. Neither the addition of the sand to the silos, nor the increase in total volume of materials, is expected to prejudice the final remediation selection for the silos.

It is believed that the addition of the sand to the silos can be beneficial during final remediation activities. The sand will serve to reduce radon emanations and gamma radiation during activities on and near the surface of the silo domes. The sand could also serve as an equipment testing medium during final remediation before the actual residue material is encountered.

Evaluation 7: "Other Considerations."

Response: The final evaluation item addresses increased protection to the public and the environment as the basis for approval of the sand fill project. An evaluation of the benefits from the project in comparison to the dose to FMPC personnel to complete the project.

As stated previously, the primary mission of the K-65 Silo Interim Remediation Project is to provide a protective barrier between the silo residues and the environment in the event of a dome failure or collapse. Potential secondary benefits from the sand layer addition include the reduction of radon gas emanations and gamma radiation from the silos.

It is estimated that the exposure to site personnel from the K-65 Silos can be as high as 0.04 mrem/hr depending on the work area proximity to the K-65 Silos. Exposure to personnel working in the K-65 Silo/Waste Pit area, outside of the K-65 Silo exclusion fence, is between approximately .02 mrem/hr and .27 mrem/hr, again based on the proximity of the work area to the K-65 Silos. The placement of the sand layer in the K-65 Silos could significantly reduce these exposure dose rates. Again, no estimate of this dose reduction can be made, however, until the final remediation options, and the methods for implementing the options, are determined.

The ALARA Study for the K-65 Silo Interim Remediation Project identifies a total dose from the whole project of 23.8 man rem using the center manway for the sand fill. This amount could be reduced depending on the efficiency of the sand fill in reducing the gamma radiation.

As discussed at the May 25 meeting, elevated exposure to the offsite population occurs in the area west of the K-65 Silos along Paddy's Run Road. The levels in this area are approximately 8 microR/hr above the background level. Full-time occupancy at this location (fence line) would result in a total dose of approximately 70 mrem per year.

EPA regulations specify that the annual radiation dose equivalent to the offsite population should not exceed 25 mrem to the whole body. The discussion with the EPAs clarified that the primary mission of the sand fill is to place a protective barrier over the K-65 residue material, but it is hoped that an additional benefit will be a reduction in the gamma radiation from the silos.

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Original File Copy

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Richard F. Celeste
Governor

May 19, 1989

Mr. James A. Reafsnyder
Site Manager
DOE-FMPC
P.O. Box 398705
Cincinnati, OH 45239

Dear Mr. Reafsnyder:

Attached is a list of comments and concerns relating to the K-65 Silo Sand Fill Project. These comments were prepared by our consultant, AWC Nuclear Services, and should be the main topic for discussion at our May 25 meeting.

Sincerely,

Graham E. Mitchell
Ohio EPA FMPC Coordinator

GEM/lal

Enclosure

AWC INCORPORATED

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REVIEW OF PROPOSED SAND FILL PROJECT FOR THE K-65 SILOS AT FMPC

OVERVIEW

The purpose of the K-65 Interim Stabilization-Sand Fill Project is to install a four (4) foot thick layer of sand over the surface of radioactive residue material inside each of the two K-65 silos.

The advantages gained by such sand fill remediation would be:

1. reduction in gamma radiation by 75%
2. reduction of radon emissions by 95 to 99%
3. minimize the accidental release of radioactive particulates and radon gas/progeny if there were a catastrophic failure of the dome

INTERIM ACTION VERSUS FINAL REMEDIATION

The main question to be resolved is: Is it acceptable to allow the long-term storage or permanent disposal of the K-65 silo residues at FMPC?

If these radioactive residues are to remain at FMPC, the following concerns regarding the health and safety of both the on-site work force and the off-site population, as well as the protection of the off-site environment must be evaluated:

- radon/progeny emissions
- direct and "shine" gamma radiation levels
- leaking of the residues into the groundwater and/or surface waters
- the need for continued environmental monitoring of the effects of the K-65 residues

For the proposed sand-fill project, there is potential for reducing the radon emissions and lowering the gamma radiation level from the K-65 silos.

No data has been furnished regarding the leaching of radioactive materials from the K-65 silos; however, this important environmental issue must be fully evaluated if the residues are allowed to remain in-place.

Also, so long as the residues remain in-place, a comprehensive environmental monitoring network must continue to be maintained and all data scrutinized in a timely manner to indicate any release of radioactivity into the environment.

Therefore, before any interim action such as the Sand Fill Project is undertaken on the K-65 silos, the following information should be provided:

1. Documentation that there is no leaching of radioactive materials from the K-65 silos into the groundwater and/or surface waters. If no radioactive materials are being leached/released from the silos, then it would support leaving the residues in-place in the silos; otherwise, the residues may have to be removed.

2. The existing environmental monitoring data should be provided showing radon/progeny levels and the gamma exposure rates in the off-site areas with emphasis on locations inhabited by real people. If radiological conditions in off-site areas do not indicate levels in excess of regulatory standards, then interim actions such as the Sand Fill Project would not be justified.

Final remediation by residue removal must be considered unless there is sufficient documentation to prove that leaving the K-65 residues in-place will result in no releases of radioactivity to the off-site population above regulatory standards.

INTRODUCTION

This discussion is a summary of AWC, Inc's. review and conclusions regarding the proposed interim stabilization by sand fill of the K-65 silos located at FMPC, Fernald, Ohio.

This review is based on the four (4) documents provided by Ohio-EPA:

- Reference 1 - letter, DOE-400-89, J. A. Reafsnyder to B. G. Constantelos, "K-65 silos Near-Term Activities and Final Remediation Plan", dated January 10, 1989.

- Reference 2 - letter, DOE-628-89, J. A. Reafsnyder to B. Constantelos, "Request for Technical Information During January, 1989 TIE Meeting", dated February 21, 1989.

- Reference 3 - letter, DOE-712-89, J. A. Reafsnyder to R. Shank, "K-65 silos Interim Stabilization-Sand Fill", dated March 10, 1989.

- Reference 4 - letter, DOE-1009-89, J. A. Reafsnyder to G. Mitchell, "Ohio EPA Requested Information on K-65 Silo interim Remediation," dated May 4, 1989.

EVALUATION

The following evaluations of the sand fill project were performed with emphasis on the overall protection of the public health of the off-site population. However, there must be some consideration of the radiation dose commitment to the on-site workers for completion of this project in order to derive a balance-of-risk assessment, and to assure compliance with applicable radiation protection standards and the concept of exposures being As Low As Reasonably Achievable (ALARA).

1. Minimization of Effects of Dome Failure

The documents furnished for this evaluation did not go into any details of the potential for the catastrophic failure of the silo's dome. Apprehension still exists that such a dome failure accident may happen in the future, and that the resulting uncontrolled releases of radioactivity would subject the off-site population to exposures which could be prevented if the interim sand fill project is completed.

The addition of a four foot thick sand cover over the radioactive residue materials in the silo would provide a physical barrier which would minimize the release of radioactive particulates in the event of a dome failure. That is, the dome structure would cave-in on top of the sand rather than falling directly on top of the residues thereby releasing some concentration of long-lived radioactive particulates such as radium or uranium.

Information was not provided in the reference documents to indicate any increased deterioration of the structural integrity of the dome itself, nor that there is immediate concern that dome failure could occur in the near future. In fact, Reference 1 reports that previous work, such as the center protection caps and the polyurethane foam coating, have been effective in maintaining the structural integrity of the dome.

The sand fill project would be an advantage to minimizing the release of radioactive particulates; however, it would only apply if a dome was to actually fail and cave-in.

2. Reduction in Gamma Radiation

Reference 1 reports that computer modeling computations indicate that a potential reduction of 75% in gamma radiation is attainable from the addition of a four foot thick layer of sand. Reference 2 provides two of the computer codes used for the generation of the gamma exposure rate graph (see Attachment 3 - Gamma Reduction from Reference 1).

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The important point here is that all of these computer modeling computations provide the gamma exposure rate directly on top of the surface of the dome. Therefore, the effect of reducing the gamma radiation exposure rate by adding the four foot sand cover would apply to on-site workers who were on top of the dome or perhaps in the nearby vicinity. Reference 4 reported the expsure rate currently on top of the domes to be 125 to 150 milliRem/hr; and that it is anticipated that the sand cover will reduce this to about 20 milliRem/hr. The significance of "sky shine" from the silos is also mentioned in Reference 4, and is estimated to be about 0.04 milliRem/hr for the on-site workers. The effectiveness of the sand covers to reduce "sky shine" is estimated to reduce on-site exposures by 30 to 90%. In any event, adequate protection can be given to any on-site workers who may have to work on top of the silos through the established FMPC Health Physics program.

Reference 1 states that computer calculations performed by Oak Ridge National Laboratories showed the maximally exposed off-site individual would receive a whole body dose of 17 milliRem per year as a result of total FMPC airborne emissions prior to any remedial work on the silos. Reference 1 also states that the present exposure rate is twice the background level for the neighbors adjacent to Paddy's Run Road. The only actual environmental radiation measurements or dosimetry monitoring records which were provided indicates that there is an area along Paddy's Run Road at about 8 microR/hr above the background level (Reference 4, Attachment 3). For full-time occupancy at that location, this elevated gamma radiation would result in a total dose of 70 milliRem per year assuming there are real people there all the time.

Computer extrapolations of the off-site gamma exposure rates resulting from the sand fill operations were not provided in any of the references; and it is not practical nor necessary to complete such complex calculations at this time. Because of the ground level geometry of the off-site areas with respect to the elevated silos, and the radiation shielding provided by the existing earthen berms surrounding the silos, the proposed sand cover at the top of the silos will probably have minimal effect on reducing the actual off-site gamma exposure rate. In addition to the Paddy's Run location, all other actual environmental measurements/dosimetry monitoring data should be evaluated to determine whether the off-site population's annual dose limit is being exceeded given the existing status of the silos. If the off-site (real people) population's annual dose limit is being exceeded, the proposed sand cover could be justified.

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3. Reduction of Radon Emissions

Reference 1 states that calculations and laboratory tests for three types of sand fill would reduce radon emissions by 95 to 99%. References 2 and 4 provide the reports of the laboratory measurements and computations of the radon flux attenuation factors for the three sand types. This data was used to generate the graphs showing radon attenuation versus various sands and thicknesses - computer calculated and from testing (see attachments to Reference 1). From this information, the four foot depth for masonry sand was determined to be the optimum thickness to practically eliminate radon emissions from the silos.

Review of the basic laboratory data (see Table 2 - Radon Flux Attenuation Factors, from Reference 2 - Attachment II) indicates that the moisture content of sand is more critical for controlling radon diffusion than the type of sand cover and its thickness. For example, a four foot thick cover of masonry sand has a radon flux factor of 0.73 for a moisture content of 4.2% versus 0.39 for 9% moisture. That is, doubling the moisture content of the sand cover results in an appreciably lower radon flux (47% lower in this example). The references do not state what moisture content was used to prepare the radon attenuation graphs. Therefore, the selection of the most effective moisture content of fill sand is extremely important to minimizing radon emissions from the silos.

Over time, the installed sand cover may "dry out" due to evaporation and saturation of the atmosphere within the dome's void space, or by seepage into the underlying residues. In order to assure the continued effectiveness of the sand cover to reduce radon emissions, the optimum moisture content of the sand fill itself will have to be monitored and maintained. This may require active maintenance by periodically wetting down the sand cover inside the silos.

Reference 3 describes the mechanical spreader/ broadcaster type system which would be used to install the sand within the silo. This appears to be the best method for the sand fill operation. Sand specifications are discussed; however, only the particle size distribution (sieving of grab sand samples) will be checked. The moisture content of sand should be specified and checked daily to assure that the sand meets the required specifications for the project.

Two other problem areas are not addressed in the sand installation work plan:

1. obtaining the maximum density (i.e., compaction) of fill sand

2. obtaining a good, tight "seal" around the silo's walls

Both of these factors determine the cover's capability to inhibit the diffusion of radon gas through the porous sand particle matrix. Since the use of a spreader/broadcaster system cannot by itself compact the sand fill, and the restrictions of the dome openings may limit other mechanical techniques for compacting the fill sand, the resultant sand cover will probably achieve minimal density. The optimum sand compaction density was not provided in the references; but usually, the maximum density and moisture content (i.e., saturation) of cover material is selected to minimize radon diffusion.

Attachment 3 to Reference 4 states, "exact optimum moisture content of the sand material will be determined upon final selection of the sand conveying and spreading system." This means that the expected reduction in radon emissions may not happen in reality because the fill sand is at a lower compaction density, and moisture content, than the optimum parameters as used for the laboratory tests.

The question of obtaining a good, tight seal between the sand fill and the walls of the silo is critical. The radon gas emanated from the underlying residues would most likely take the path of least resistance by migrating along the sand/residue boundary and then diffusing upwards along the wall's surface.

Attachment 3, Reference 4 concludes that the fluid nature of the fill sand will result in a "self-healing" effect; but how this relates to compaction of the sand and obtaining a good, tight seal with the walls of the silo is not clear. Without a good "seal" between the sand and the walls, radon emissions from the sand filled silo will probably be no different than the present rate of emission from the silos. The information provided in Reference 4 does not clarify the concern for achieving an optimum fill sand moisture and compaction density within the silo; nor the ability to obtain a good, tight seal between the fill sand and the silo's walls.

Reference 1 provides some results of the FMPC radon monitoring network during 1987 and 1988. For example, the FMPC site boundary stations had an average radon concentration of 0.8 pCi/l (including natural background) for the first half of 1988. The allowable radon gas level in off-site areas occupied by the general public is 3.0 pCi/l above background levels (see NRC's 10 CFR 20, Appendix B, Table II, Column 1 - Maximum Permissible Concentrations in Unrestricted Areas for 168 hour per week exposure). Therefore, existing environmental monitoring data indicates that the present radon emissions from the K-65 silos are

well within the allowable regulatory limit. This environmental monitoring data should be reported and evaluated to determine whether radon emissions from the K-65 silos are a real problem.

No data was provided for the nine off-site radon monitoring stations. Such data should be reviewed and compared to the FMPC site boundary fence sampling locations to determine if there is indeed a significant difference between the present on-site radon levels versus the off-site levels attributable to radon emissions from the K-65 silos. Unless it can be shown that elevated radon levels exist in the off-site areas surrounding FMPC, and there should also be a real population at risk, the need to further reduce the present radon emissions from the K-65 silos is not required by any regulatory standard.

5. Radon Releases During Sand Filling Operations

Reference 3 provides detailed work plans for the sand fill operation (see Work Plan for the K-65 Storage silos Interim Stabilization Project - Installation of Sand Layer). These work plans appear to provide adequate safety and radiation protection considerations for the workers associated with the sand filling operations.

An area which is not addressed in these work plans is how to control the release of radon/progeny from the silo when the manways (dome openings) are uncovered to permit the sand fill operations. Section 3.6 of the subject work plan discusses radon sampling of the silo; but only the criteria for authorizing the opening of a manway is provided - "under no circumstances will the silos be opened to the environment when:

- the radiation dose rate on the silo surface is above 100 mRem/hr, or
- the expected release of radioactivity is more than 4 Curies, or
- the radon concentration inside the silo is greater than 3×10^6 pCi/l

After a manway or sounding pipe is opened, there will be no method to control the release to the environment of potentially high activities of radon/progeny. Working Level grab samples will be collected next to the open manways, and this information will be used to determine the required respiratory protection for the on-site workers. The continuous radon gas monitoring network at the K-65 fenceline will be used to monitor radon releases. An action level of 1500 pCi/l has been established which will require that the manway covers will be reinstalled and secured.

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The radon treatment system will be periodically operated to reduce the radon concentration inside the silo, but this system probably cannot be run continuously during the sand filling operations. If some mechanism can be designed to filter out the heavy dust load during the sand filling operation, the radon treatment system could be run longer and perhaps a "negative pressure" could be maintained within the silo thereby minimizing radon/progeny releases while the manways are open.

6. Sand Radwaste Volume

The reported K-65 residue volume is 7,200 cubic yards (or 194,400 cubic feet). The addition of the proposed four-foot thick sand cover would add an additional radwaste volume of 40,205 cubic feet. This represents an overall radwaste volume increase of 21%. This radwaste volume (40,205 cubic feet of fill sand), would result in extra time, manpower, radiation dose, and costs to remove, package, and dispose of such sand should a subsequent decision be made to remove the underlying K-65 residues. For example, if this volume of fill sand was to be repackaged in 55 gallon drums for disposal, at least 5,361 drums would be required, and 107 trailer trucks would be needed to transport just the fill sand.

Reducing radioactive waste volumes should be a goal of any FMPC site remediation activity. If the K-65 materials are to be eventually removed, additional radiation doses will be accrued by the workers during the removal of the sand covers. Increasing the overall waste volume of the silos could be justified only if there is a positive reduction of dose commitment (i.e., the dose reductions to the FMPC work force and the off-site population during the time period of interim stabilization should be greater than the real dose received by workers installing, and subsequently removing the sand fill).

7. Other Considerations

Approval of the proposed sand fill project should be based on increased protection of the public health and the environment. This should also be a consideration for minimizing on-site worker's exposures to radiation and radon/progeny emissions from the K-65 silos. With respect to such radiation protection activities, the applicable federal regulations/standards should be clearly stated. Then, a comparison could be made of the expected benefits for completing remedial actions and for the final solution to be certain that any proposed action would result in compliance with such standards.

For example, U.S. EPA regulations are specified in 40 CFR 190-192, "Environmental Radiation Protection Standards for Nuclear Power Operations". These standards contain limits for the radiation doses received by members of the public in the general environment as a result of operations which are part of the nuclear fuel cycle. These EPA standards specify that the annual radiation dose equivalent to the off-site population should not exceed 25 milliRem to the whole body. The U.S. NRC regulations are contained in 10 CFR Part 20 and Part 61. In particular, Part 61.41 specifies an annual dose limit of 25 milliRem to the whole body from land disposal of radioactive waste. These standards for the off-site population should not be confused with the 100 milliRem dose discussed in Reference 1 which deals with "radiation protection standards for public entering a controlled area" [see DOE 5480.11 (12/21/88)]. Therefore, it should be stated whether or not the goal of remedial activities at FMPC is to achieve an off-site radiation dose limit of 25 milliRem per year.

Available environmental monitoring data should then be reviewed to determine whether the public's allowable dose limit is being met under the existing status of the K-65 silos. If the dose limits are presently being exceeded, then it is justified to consider remedial work or more importantly, a final solution for the K-65 silos. In any case, the expected reductions in radiation exposure rates and exposure to radon/progeny emissions should be compared to the allowable dose limit to justify completion of proposed work.

Also, a comparison should be made between the committed dose to the workers to complete a proposed interim project versus the reduction of dose to both the on-site and off-site populations if the project is completed. For example, in the case of the proposed sand fill project, numerous on-site workers will receive substantial whole body dose while working on top of the silos or nearby the radon gas treatment system. Workers and off-site populations may be exposed to higher radon/progeny levels during the sand fill project due to the radioactivity releases while the manways/sounding pipes are open. These committed doses should be compared to the dose saved by both the on-site and off-site populations resulting from the reduced gamma exposure rate (direct and "sky shine" radiation) and lower radon/progeny levels due to the sand cover in the silos.

Although the occupational radiation exposure of the on-site workers should be adequately controlled by the DOE and its site operator to be within the permissible federal radiation protection standards, it is this on-site population which is most at risk from the presence of the K-65 silos. Therefore, any proposed interim or final remediation of the K-65 silos must fully consider all

radiation exposures received by all "real people" in both the off-site as well as the on-site populations. Afterall, even workers go home.

SUMMARY

This review of the sand fill project for the K-65 silos indicates the following:

Positive Findings

- The sand cover is expected (via computer modeling) to reduce gamma radiation exposure rates by 75% on top of the silo.
- The sand cover is expected to reduce radon gas emissions from the silos by 95 to 98% based on laboratory analysis of radon diffusion through samples of fill sand.
- In the event of dome failure, the dome structure would fall on top of the fill sand rather than falling on the radioactive residues; therefore, there would be no accidental release of radioactive particulates.

Negative Findings

- The sand fill at the top of the silos is not expected to appreciably reduce the direct gamma radiation exposure rate at ground level for the off-site population.
- The sand cover is not expected to be able to achieve the desired reduction in radon emissions unless the optimum moisture content and sand compaction, as used in the laboratory tests, are maintained within the silos.
- Without compaction, there is no means of obtaining a good, tight seal between the fill sand and the walls of the silo; therefore, radon gas will most likely migrate around the sand fill and be emitted at a rate comparable to the present release rate.

RECOMMENDATIONS

1. Establish the applicable off-site radiation dose limit; e.g., 25 milliRem whole body dose per year to any member of the general public.
2. Review available environmental monitoring data to determine if the applicable off-site dose limits are presently being exceeded.

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3. If the off-site dose limits are being exceeded, determine the most effective method to reduce radon/progeny emissions and/or the gamma exposure rate in order to achieve regulatory compliance.

4. There should be a consideration of the dose "saved" to the actual on-site and off-site populations versus the actual dose received by the workers to complete such an interim, remedial project.

CONCLUSION

The proposed sand fill project for the K-65 silos should be completed if:

1. It can be shown that applicable regulatory off-site dose limits are presently being exceeded; or

2. That upon completion of the sand fill project, the estimated dose commitment to the on-site workers and to the off-site population will be significantly reduced and will be As Low As Reasonably Achievable (ALARA); or

3. That the reduction in committed dose (i.e., dose saved) to the FMPC workforce and the off-site population over subsequent years would be greater than the dose received by workers to complete the sand fill project.

FINAL REMEDIATION

The ultimate, permanent solution to eliminating radon/progeny emissions and to reduce gamma exposure rates from the K-65 silos would be to dig up and remove all of the residues. This residue removal would obviously eliminate any potential leaching of radioactivity from the silos. Also, if all radioactive residues are removed, the comprehensive radon and progeny environmental monitoring network would not be needed.

Hopefully, such final remediation will be fully addressed in the forthcoming RI/FS Record of Decision scheduled for November, 1990. At this time, it seems imprudent to complete the proposed sand fill project of the K-65 silos unless it can be shown that such interim work will result in compliance with the applicable off-site dose limits and lead to an overall reduction in dose commitment to both on-site workers and off-site populations.

18 May 1989
Date

Gregory G. Eadie
Health Physicst

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AWC INCORPORATED

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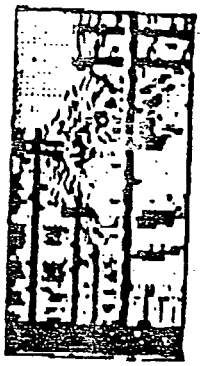

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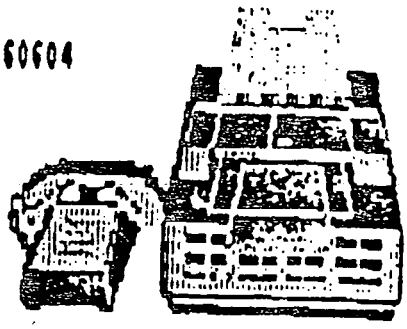

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF:
5HR-12

MAY 22 1989

Mr. James A. Reafsnyder
United States Department of Energy
P.O. Box 398705
Cincinnati, Ohio 45239-8705

Re: K-65 Sand Project
U.S. DOE-Fernald
OH6 890 008 976

Dear Mr. Reafsnyder:

In a March 10, 1989, submittal, the United States Department of Energy (U.S. DOE) and Westinghouse proposed an interim stabilization project for silos 1, 2, and 3. This project includes the installation of approximately 4 feet of sand for radon control until final remediation of the tanks is initiated. This activity is considered a removal action (#4) under the National Contingency Plan.

The United States Environmental Protection Agency (U.S. EPA) has the following comments on the proposal:

1. The proposal should include estimates of potential routine and accidental offsite doses.

2. Details for the use and regeneration of the radon treatment system should be included in the proposal. Details for control of radon emissions during the entire sand fill operation should be included.

3. The background monitor should be moved further offsite.

4. Consideration must be given for the use of E-PERM type radon detectors to monitor radon levels in the vicinity of the silos, at the property fence line, and the nearest resident. The detectors should be turned off during non-work periods.

5. There is no explanation of how the four curies criteria for grab sample measurement was developed or what it is intended to limit (worker dose, off-site concentrations, etc.).

6. Attachment 1, Page 2, Item 3: The "downwind" direction is dynamic. Monitors should be installed in four directions to compensate for shifting downwind directions.

7. Doses should be designated as effective dose equivalents, which includes organ and whole body doses.

8. Page 16, Sentence 1: Explain why workers are being given criticality training? Is criticality a credible possibility?

9. Section 6.0: The moisture limit for the sand should be specified in order to assure the proper radon retention times and the projected reductions in radon levels. Moisture monitors should be considered.

10. Figure 3.1.1, Section 7.3: Radon monitors should be placed in all four major compass directions. A monitor is not currently proposed in the southerly direction.

Please contact me at (312) or FTS 886-4436, if there are any questions.

Sincerely,

Catherine A. McCord

Catherine A. McCord
Remedial Project Manager

cc: Graham Mitchell, OEPA-SWDO
Maury Walsh, OEPA-CO
Grover Smithwick, U.S. DOE - ORO
Kitty Taimi, U.S. DOE - HDQ
Bruce Boswell, Westinghouse