CYPRUS
Foote Mineral

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May 12, 1997

James Webb, Site Coordinator
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246 North High Street
Columbus, OH 43266-0118

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Low-Level Waste & Decommissioning
Projects Branch
Nuclear Regulatory Commission
11545 Rockville Pike
Mail Stop T7F27
Rockville, MD 20852

RE: Cyprus Foote Mineral Company's Work Plan for a Phase III Investigation, Cambridge, Ohio

Dear James and Jim:

Thank you for your April 2, 1997 letter that provided the collective comments of the Nuclear Regulatory Commission (NRC) and the Ohio Department of Health (ODH) on Cyprus Foote's Work Plan for a Phase III Investigation, Cambridge, Ohio.

Our responses to the questions and comments posed in your document have been assembled into the enclosed attachment.

I hope you find this information helpful and I look forward to discussing these issues with ODH and NRC representatives on Monday, May 19,1997 in Columbus, Ohio. Please let me know if you have any questions in the meantime.

Sincerely yours,

Patrick E. Lee

PEL:amb
Enclosure

cc: D. Patterson/N. Young, Beveridge & Diamond
R. Casarona, Climaco, Climaco, etal.

FOOTE LITHIUM

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RESPONSE TO ODH COMMENTS
DATED APRIL 2, 1997

Phase III Work Plan

Comment 1 Section 2.1, pg. 2-1, Scope of Work
"The scope of work does not identify what sites or how many sites will be affected by the work plan. With respect to the settlement, what subclasses are affected by the work plan and what subclasses are not affected by the work plan?"

Response 1 The Phase III Work Plan is a plan to evaluate residential properties not previously evaluated in Phase I and Phase II, or by ORISE. Because class counsel has requested that additional properties be evaluated, the total number of properties to be evaluated during Phase II has not been finalized. To date, over twenty (20) properties have been evaluated in Phase III.

Comment 2 Section 2.2.1, pg. 2-1, Gamma Walkover Measurements
"What is the level of activity that will require action and what is the sensitivity of the instrument used to perform the walkover? Furthermore, if previous studies indicated that the slag did not have a distinctive external gamma signature, then what is the purpose of the gamma walkover measurement?"

Response 2 The methods used in Phase III to determine which properties are to be remediated are consistent with previous methods for evaluating properties in the Cambridge, Ohio area and are the basis of the Class Action Settlement Agreement ("Settlement Agreement"). As with previous evaluations of residential properties in the area, property-specific concentration guidelines will be derived in Phase III using the computer code, RESRAD.

Determination of radionuclide concentrations in slag on a property is based on analysis of representative samples from the property at a commercial, off-site laboratory. Radiation survey instruments are not used to determine radionuclide concentrations on a property or whether remediation of the property is required. Some properties previously investigated were found to have above-background concentrations of gamma-emitting radionuclides (e.g., radium-226 and its short-lived progeny) in slag. External gamma radiation measurements made at each property will be used as a qualitative indication as to whether above-background concentrations of gamma-emitting radionuclides are present in slag and, if so, at what locations. Locations identified during surface scans as having elevated gamma radiation levels will be considered for elective (biased) sampling. The evaluation method exceeds conventional survey approaches that rely on field radiation surveys, by identification, sampling, and analysis of representative slag samples from the property.

Measurement of external radiation exposure rates at one (1) meter above the

ground surface will be made to document the external radiation field at each property.

Comment 3 Section 2.2.2, pg. 2-1, Evaluation of the Areal extent and Thickness of Slag and Cover Material

"If activity is found at one location on a site that shows significant levels, will other samples be taken at and within proximity of that location to determine the extent of the contamination?"

Response 3 Remediation of a property will be performed if the above-background concentrations of radionuclides (determined by laboratory analysis of the samples) in any valid slag sample from that property exceed the guidelines derived for that property. If remediation of a property is performed, slag determined (or reasonably suspected) to have originated from Foote Mineral Company or its predecessor prior to May 13, 1987, will be removed from the entire property. This approach has served as the foundation of the Settlement Agreement and is consistent with the approach used by Cyprus Foote Mineral that has been reviewed by the NRC.

Other Comments

Comment 1 ***"If contamination is found at a sampling point, will a second count be performed to confirm that the contamination is present or will the area be remediated without a second count?"***

Response 1 As noted in the responses to previous comments, radionuclide concentrations in slag on a property will be determined by laboratory analysis of slag samples from that property. The decision to remediate a property will be based on the results of laboratory analyses of samples and will not be based on measurements made during walkover surveys.

Comment 2 ***"When will CFM take action? Will action be taken based on a single sample value or an average value? And if an average value is used, then how many samples will compose an average?"***

Response 2 According to the current remediation schedule, Cyprus Foote Mineral will remediate properties during the Summer of 1997. This schedule assumes the return of excavated materials to the Shieldalloy Plant.

As noted in the response to previous comments, Cyprus Foote has adopted a highly conservative approach under which remediation of a property will be performed if the concentrations of radionuclides in any valid slag sample from that property exceeds the guidelines for that property. Averaging of radionuclide concentrations from multiple samples will not be performed to determine whether remediation is required.

Comment 3 *"It is recommended that the Work Plan have action levels that represent what will happen if events occur outside the expectation of the work plan (i.e., alpha spectrometry data show that activity is within the free release criteria, but the gamma spectrometry data show that the activity is not within the free release criteria. This concept would also apply to duplicate samples.)"*

Response 3 The validated analytical results for each sample will be used to assess whether the property-specific radionuclide guidelines are exceeded. The limitations of specific analytical methods and the quality of analytical results will be considered to determine the radionuclide concentrations that are representative of the slag sample. In the event that there is a duplicate analysis of a slag sample, the higher concentration measurement will be used, unless there is reasonable justification to exclude an analytical result through the data validation process.

Comment 4 *"To what levels of activity will the off-site properties be remediated?"*

Response 4 Concentration guidelines for radionuclides in slag will be derived for each property, based on an environmental dose assessment described in Section 3 of the Work Plan, using the slag area and thickness determined for each property.

Comment 5 *"In the Court Settlement, a 50 mrem per year criterion is used to delineate whether a site will require remediation. What is the technical basis of the 50 mrem per year?*

More information is needed on the analysis used to determine the placement of properties into the various classes in the Settlement Agreement. Specifically, the following information is needed:

* *The derived soil concentration limits used in placing the various properties into a class.*

* *The RESRAD input and output files used in deriving the soil concentration limits. NOTE: example input and output files (such as the input and output files based on a dose limit of 500 mrem, in the Settlement Agreement) will not suffice. Specific information needed from the RESRAD input and output are:*

  1) The dose limit used (e.g., 50 mrem/yr) for each site.
  2) The assumed area of contamination (e.g., 1000 m^2) for each site.
  3) The assumed depth of contamination (e.g., 2 meters) for each site.

* *Soil concentration values used in calculating the sum of fraction for determining property classification."*

Response 5 Recommendations by international and national organizations pertaining to intervention at a site containing above-background levels of NORM from

previous operations were determined to be applicable for the residential properties in the Cambridge, Ohio area. Those recommendations indicate that the radiation dose limit for potential exposure conditions at the subject properties is 500 mrem per year. An additional ten-fold level of conservativism was provided by use of a radiation dose of 50 mrem per year for derivation of radionuclide guidelines.

This dose limit was used with numerous other conservative assumptions that overestimated any potential future exposure as input parameters to the environmental dose assessment computer code RESRAD. The RESRAD code is widely accepted for assessing potential radiation doses from hypothetical exposures to radionuclides in soil; the application of RESRAD for the subject properties has been reviewed by NRC. Property-specific area and thickness of slag were the only input parameters that were changed for RESRAD runs. Because concentration guidelines are linearly proportional to the radiation dose limit selected for the RESRAD runs, guidelines derived for dose limits other than 500 mrem per year can be calculated directly from the guidelines derived for the 500 mrem per year dose limit, with all other factors being constant.

Radionuclide concentrations in samples collected in Phase I and Phase II investigations were reported previously and reviewed by NRC (Woodward-Clyde, January 1995; Woodward-Clyde, August 1995). Natural background concentrations of radionuclides in the Cambridge, Ohio area were determined by the NRC contractor as part of the initial investigation of slag contamination (Vitkus, July 1994). Radionuclide concentrations in samples collected in the Phase III investigation will be reported in the Phase III investigation report.

Comment 6 ***"The NRC and the State of Ohio require that Shieldalloy apply for a license amendment for off-site slag to be brought back to the site for temporary storage in a staging area. This stored slag will be later be disposed of consistent with the disposal alternative, either onsite or off-site, approved by the State of Ohio and the NRC in connection with the remediation of the Shieldalloy site."***

Response 6 Cyprus Foote Mineral is evaluating the storage and disposal options for the slag removed from off-site properties during remediation.

Comment 7 ***"There is a need to cross reference the property identifications between the ORISE report and the Woodward Clyde reports."***

Response 7 Properties initially investigated by ORISE were assigned a designator "O" as part of the property identification code; for example, property O-01 through O-54 were originally identified by ORISE. These properties were referred to with these designations during subsequent characterization by Cyprus Foote Mineral contractors and sample identifications were assigned accordingly. Properties, other than the "O" properties, were assigned the designator "P2" by Woodward

Clyde, to indicate that they were part of the Phase II investigation. During the Phase III investigation, properties not previously designated as "O" or "P2" will be assigned the designator "P3".

Comment 8 ***"What is the physical particle size of the contaminants (i.e., slag)?"***

Response 8 Slag that originated from Foote Mineral Company or its predecessor prior to May 13, 1987, and used as fill on off-site properties was heterogeneous with respect to particle size. Use of the material as fill material and driveway cover necessitated that the slag range in size from coarse to fine gravel. A formal study of sizes of slag used on off-site properties has not been performed.

Comment 9 ***"Paragraph 17 of the MOU, as provided in the Court Settlement, indicates properties that are to be tested for characterization purposes. These properties are listed in Exhibit 8 of the document. The paragraph further states that the Beskid property is to be included in this subclass and that this testing is to be performed in accordance with Exhibit 9.***

Further review of the MOU indicates that the Beskid property is not listed in Exhibit 8, but in Exhibit 4, which contains a list of Subclass 3 properties that are solely to be tested for radon emanation.

It appears that the Beskid property requires physical sampling to be performed so as to determine the appropriate subclass for this property. The language in this paragraph and the listing of the property are in conflict with one another."

Response 9 Inclusion of the Beskid property in Subclass 3 (for radon testing) and with the other properties listed in Exhibit 8 (for characterization in the Phase III investigation) was done by mutual agreement of counsel.

Comment 10 ***"Exhibit 9 Table 2 'Radionuclide Testing Parameters, Analytical Methods, and Detection Limits.'***

The footnote to the 'detection limit goals' indicates that the detection limits will depend on the 'sample size [and] interferences from other radionuclides in the sample.'

Based on the fact that removal actions will be predicated on an annual dose, the action level activity will have to be determined prior to sampling. Once this action level is determined (as part of the data quality objectives), the instrument detection levels will have to be determined a priori.

The manner in which the detection limit goals are presented in Table 2 indicates that the instrument detection limits could in fact exceed the action level objectives, therefore not providing data that are statistically valid.

Please clarify how you intend to ensure that analytical data are within the 95% confidence level of the detection limits."

Response 10 Radionuclide concentration guidelines are derived for property-specific slag areas and thicknesses. These guidelines are greater than the detection limit goals by several orders of magnitude. The detection limit goals are sufficiently lower than the radionuclide concentration guidelines so as not to create a sample quantitation concern.

SLAG EXCAVATION AND REMOVAL PLAN FOR PROPERTIES NEAR CAMBRIDGE, OHIO

Prepared for
Cyprus Foote Mineral Company
Kings Mountain, North Carolina

May 14, 1997

Woodward-Clyde Consultants
2318 Millpark Drive
Maryland Heights, Missouri 63043
4E08103

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1.1 BACKGROUND AND PURPOSE OF PLAN

The Shieldalloy Metallurgical Corporation (SMC) plant in Cambridge, Ohio ("Cambridge Plant") (Figure 1) is an operating ferroalloy production facility that opened in 1953. The plant was previously owned and operated by Foote Mineral Company (FMC) until its sale to SMC in 1987. Cyprus Minerals Company purchased FMC from FMC's parent company, Newmont Mining Corporation, in 1988, one year after Newmont had sold the Cambridge plant to SMC. Following the sale of FMC to Cyprus Minerals Company, FMC's name was changed to Cyprus Foote Mineral Company ("Cyprus Foote").

All of the alloy production processes conducted at the Cambridge Plant resulted in the production of slag. Based on production process information, some of the slag produced at the Cambridge plant contained low levels of naturally occurring radioactivity from the alloy feed materials. Some of the slag from the plant apparently was sold or given away for off-site use as fill material, primarily in the 1980s.

A 1994 study by the US Nuclear Regulatory Commission (NRC) concluded that the slag from the Cambridge plant does not pose an immediate health and safety risk to residents because of its physical nature and the low level of radiation involved. Cyprus Foote conducted NRC-approved Phase I and Phase II Investigations of residential properties with slag in 1994 and 1995, respectively. These investigations confirmed that the slag exhibits little, if any, radioactivity, and that it is safe and presents no short- or long-term health risks to previous or current residents.

In December 1996, the United States District Court for the Southern District of Ohio, Honorable George C. Smith, gave final approval to a settlement reached by Cyprus Foote and class member residents of Guernsey County, Ohio. The settlement resolves a class action lawsuit that had been filed on behalf of residents who own or live on property containing slag produced at the Cambridge plant.

Under the terms of the settlement, slag will be excavated and removed from seven residential properties. Additional residential properties are being evaluated in accordance with a February

28, 1997 Phase III Work Plan. The number of properties designated for slag removal may change depending on the results of the Phase III Investigation. This Slag Excavation and Removal Plan describes the technical approach and scope of work for removal of slag from the subject properties.

1.2 DESCRIPTION OF SUBJECT PROPERTIES

Based on the terms of the settlement, the seven properties listed in the table below are currently slated for slag removal. Property maps showing the property layout and the locations of slag to be removed are presented in Figures 2 through 8.

Property Identification Designation	Property Address	Location of Slag to be Removed		
		driveway and/or parking area	home foundation	other
STRAW	66865 Barrett Hill Road; Cambridge, Ohio		X	
O-5	7311 Brick Church Road; Cambridge, Ohio	X		
O-7	10167 Catalpa Street; Byesville, Ohio	X		
O-17	20026 Gregg Street; Senecaville, Ohio	X		yard fill
O-19	58815 Grisak Road; Byesville, Ohio	X	X	
O-29	9170 Lucasburg Road; Byesville, Ohio	X		
O-47	10215 Sycamore Road; Byesville, Ohio	X		

Property STRAW was characterized by the NRC (April 22, 1994 NRC Report No. 999-90003/94032(DRSS)). The remaining six properties were characterized for the NRC in 1994 by the Oak Ridge Institute for Science and Education (ORISE). Properties O-5, O-19, and O-47 underwent additional characterization during subsequent Cyprus Foote investigations. Information regarding these properties is presented in the August 19, 1994 ORISE Survey Report, the January 1995 Phase I Report, and the August 1995 Phase II Report.

The excavation protocol is expected to result in the removal of the slag together with some of the adjacent soil. The estimated ranges of the volume of material to be excavated and removed from

each property are listed in the table below. The total estimated excavation volume ranges from 750 to 1,260 cubic yards.

Property Identification Designation	Estimated Volume Range of Material to be Excavated and Removed (cubic yards)	
	Low End	High End
STRAW	30	50
O-5	190	300
O-7	40	60
O-17	20	60
O-19	270	290
O-29	70	260
O-47	130	240
TOTAL	750	1,260

1.3 TECHNICAL APPROACH

The slag at the subject properties will be excavated and removed. The slag removal activities will consist of the following principal tasks:

- Site Preparation
- Excavation and Removal of Slag
- Post-Excavation Surveys
- Site Restoration

The majority of areas from which slag is to be removed are easily accessed driveways or parking areas. At property STRAW (Figure 2), the slag is located beneath the concrete floor of a small home annex. Slag removal from this property will, at a minimum, require demolition and replacement of the concrete floor. At property O-19 (Figure 6), slag is located in a driveway and

around the home foundation. The extent of demolition required at property O-19, if any, will depend on the extent of slag beneath the home foundation.

The slag at the subject properties is visually distinguishable from the surrounding soil. Therefore, visual inspection will be used to determine that the slag has been removed. Post-excavation gamma surface scans will be performed in the excavation areas as a supplement to the visual observations.

The excavated material from each property will be transported to a staging area until a final disposal alternative is identified. One possible staging area is the Cambridge Plant.

Site restoration may consist of a variety of activities, including replacement of removed slag with gravel-sized construction material (e.g., crushed limestone or river gravel), landscape repair, building repair/reconstruction, and utility repair/reconnection.

1.4 PROJECT ORGANIZATION

Woodward-Clyde Consultants will serve as the general contractor for this project. Slag excavation and removal will be performed by a qualified contractor. The post-excavation surveys will be performed by Auxier & Associates, Inc.

2.1 HEALTH AND SAFETY

All excavation activities and post-excavation surveys will be performed in accordance with a project-specific health and safety plan that accounts for the types of field activities and the radionuclide testing results from previous investigations. Personnel will not enter excavations deeper than four feet for any reason due to the potential risk of collapse of the excavation walls.

2.2 SITE PREPARATION

The goal at each property will be to remove the slag while minimizing disruption to the property and residents. Property owners will have provided authorization for site access and will be given advance notice of planned activities prior to initiation of field work. In addition, any permits or authorizations required by state law or local ordinance will be obtained.

The majority of areas from which slag is to be removed are easily accessed driveways or parking areas (Figures 3 through 8). Slag located around the homes at the STRAW and O-19 properties will be accessed by means of selective demolition, as needed. Site preparation activities for all properties will include, at a minimum, locating utility lines (e.g., water, gas, electric, sewers). If necessary, utility lines will be shut off and (or) removed to facilitate slag excavation and ensure worker safety.

At property STRAW, the slag is located beneath the concrete floor of a small dining room annex with dimensions of 16 feet by 14 feet (Figure 2). According to a US NRC inspection report, the foundation of the annex consists of a 3 foot-high cinder block wall on a concrete footer. The inside of the foundation was filled with slag. A concrete floor slab 3 to 4 inches thick covers most of the slag except for a small area under a stove covered by a wood floor. The upper portion of the house's basement wall borders the slag. The walls of the basement are ceramic block, and the slag is accessible through a window in the basement wall that opens to the area beneath the annex. Removal of the slag from beneath the annex will require, at a minimum, temporary relocation of the stove and adjacent cabinet and bar fixtures, and removal and replacement of the wood and concrete floors.

At property O-19 (Figure 6), slag is located around the home foundation. The extent of slag beneath the footers and basement floor has not been determined. During the site preparation phase, exploratory boreholes and test pits will be made at property O-19 to evaluate the extent of slag beneath the foundation. The ultimate disposition of the house will depend on the vertical and horizontal extent of the slag around the foundation. Demolition of the house or its components (e.g., basement floor) will be performed only to the extent necessary to access the slag and only after consultation with the home owner.

2.3 EXCAVATION AND REMOVAL OF SLAG

After site preparation activities have been completed, the contractor will mobilize its personnel and equipment and the slag will be excavated and removed. The boundaries of the slag-filled areas are typically gradational with adjacent soil. Therefore, to ensure thorough removal of the slag, the excavation procedure is expected to include removal of some of the adjacent soil. For example, a thin layer of soil may be removed from beneath the slag layers in driveways and parking areas. Excavation will continue until the slag is removed.

The slag at the subject properties is visually distinguishable from the surrounding soil. Therefore, visual inspection will be used to determine that the slag has been removed. slag removal will be completed based primarily upon visual observation. Post-excavation gamma surface scans will be performed in excavation areas as a supplement to the visual observations. The procedures for post-excavation surveys are presented in Section 2.4.

The excavated material from each property will be transported to a staging area until a final disposal alternative is identified. Transportation will comply with applicable State of Ohio and U.S. Department of Transportation regulations.

2.4 POST-EXCAVATION SURVEYS

In addition to visual inspection as discussed in Section 2.3, post-excavation gamma surveys will be performed in the excavation areas. Gamma radiation surveys will be performed at the ground surface of the excavated area, and radiation levels will be recorded on a scale drawing. The surface gamma

radiation survey will be performed by moving a gamma-ray scintillator in a serpentine pattern while advancing slowly (less than one meter per second) across the excavated area. The detector will be kept as close to the ground surface as is practical. The width of the serpentine pattern will be about 1 meter and the excavated area will be scanned in parallel paths at about 1 meter intervals, thus providing representative coverage of the surface. Identification of locations having elevated direct radiation levels will be based on detectable increases above natural background levels in the audible signal from the survey meter. Elevated gamma radiation levels, if identified, will be noted on the scale drawing, and additional visual inspections of the specific areas will be performed. Additional excavation will be performed if warranted.

Surveys of deep excavations will be performed using long cables to allow access to the bottom and side surfaces and (or) by performing gamma scans of soil collected in backhoe buckets. Personnel will not enter excavations deeper than four feet due to the potential risk of collapse of the excavation walls.

In accordance with standard industry practice, all field instrumentation will be calibrated against certified radionuclide sources traceable to the National Institute of Standards and Technology (NIST) prior to use during this investigation. Calibration certificates will be issued and maintained for all field survey equipment. Background and response checks will be performed on field instrumentation at the beginning and end of each day in the field, or at the beginning and end of their use at each property. In accordance with standard industry practice, response checks must agree within +/-20% of the calibrated efficiency. If an instrument fails a response check, it will be tagged out-of-service and replaced with a new instrument. All data from a failed instrument will be rechecked up to the last source check. Documentation will be maintained for all background and response checks. Field data sheets and calculations will undergo an independent peer review by personnel with relevant technical qualifications.

2.5 SITE RESTORATION

The goal of site restoration will be to repair or restore property landscape, drainage patterns, and structures to conditions like those that existed prior to slag removal. Site restoration may consist of a variety of activities, including replacement of removed slag with gravel-sized construction

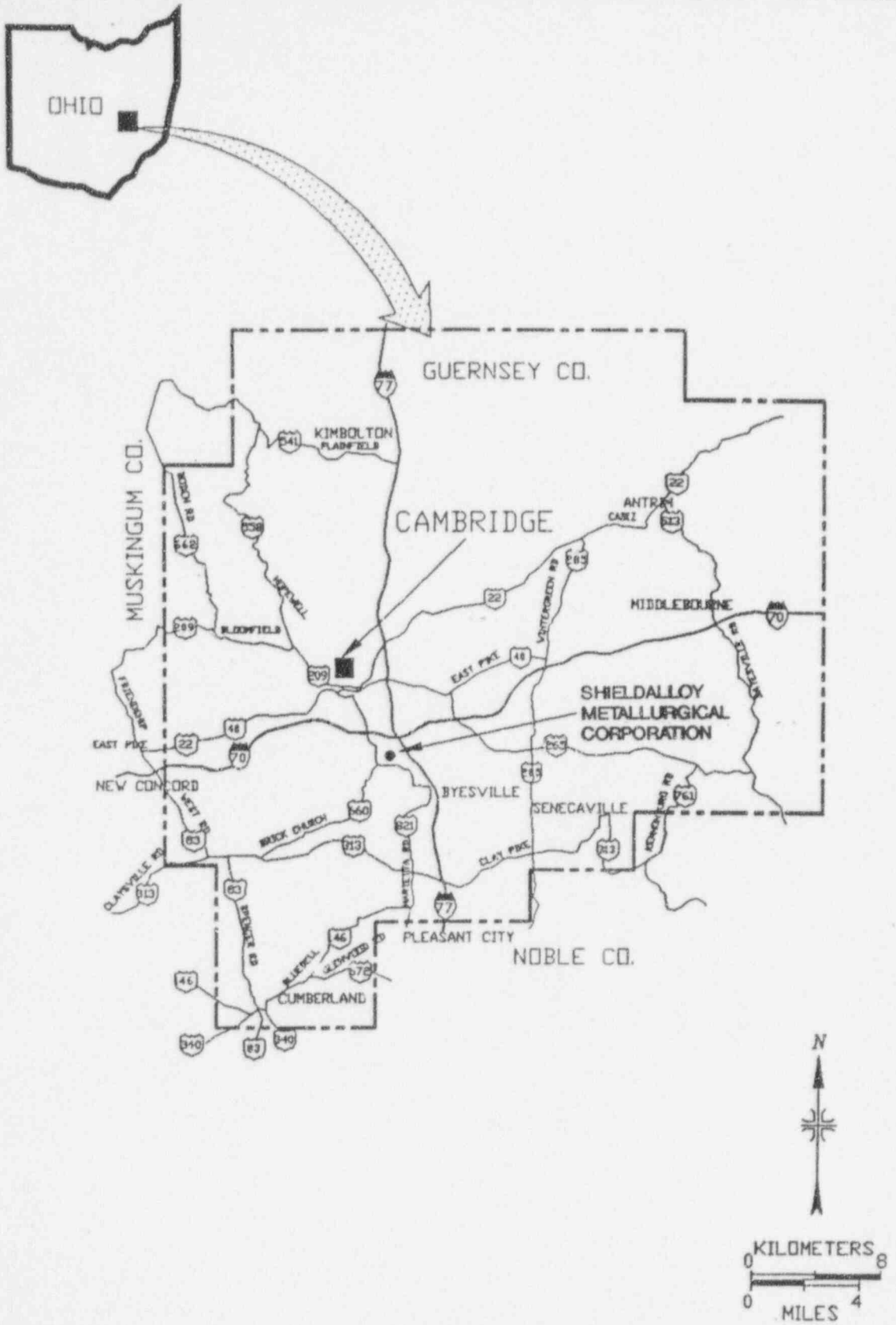
material (e.g., crushed limestone or river gravel), landscape repair, building repair/reconstruction, and utility repair/reconnection.

Damaged lawn areas will be restored by reseeding and (or) resodding. Utility lines (e.g., gas, water, electricity, sewer) will be restored and re-activated, as needed. Any outdoor features removed during the course of slag removal (e.g., sidewalks, steps) will be repaired or replaced. Any building structures, appliances, or internal and external decor removed at properties O-19 and STRAW will be repaired or replaced.

2.6 SLAG REMOVAL REPORT

Upon completion of slag removal and site restoration activities, a report will be prepared which documents the slag excavation and removal activities, site restoration activities, and the results of post-excavation surveys.

Site preparation activities, slag excavation and removal, and post-excavation surveys are expected to be completed by the end of June 1997. This schedule assumes the staging of offsite slag at the Cambridge Plant.



Source: modified from August 19, 1994 ORISE Survey Report

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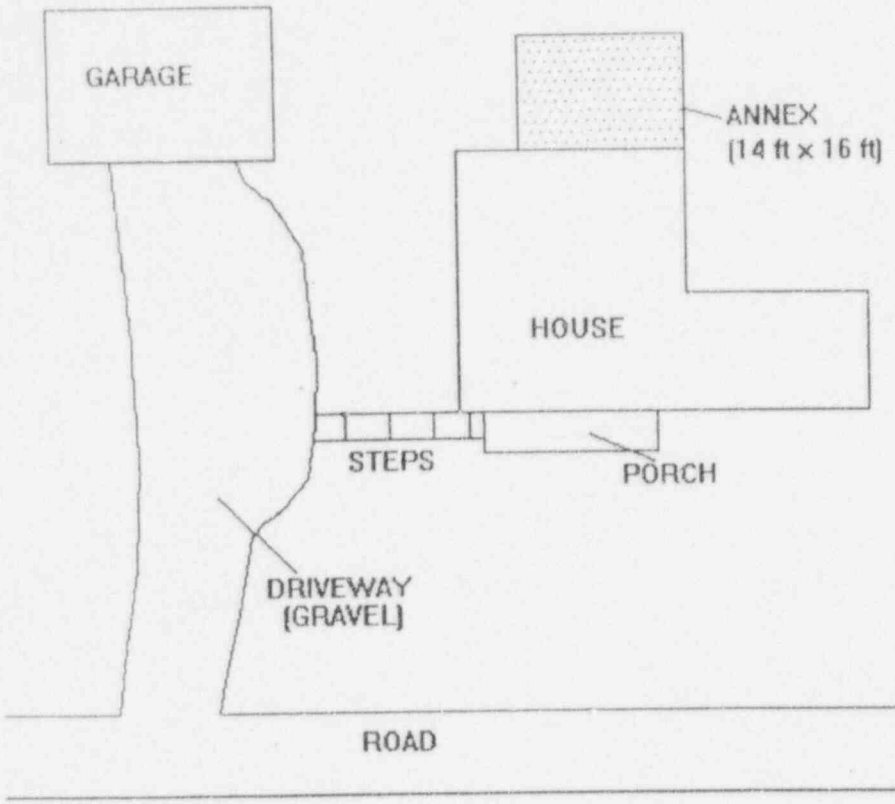
Woodward·Clyde Consultants CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS	
DRN. BY: RET CHKD. BY: CPP	SITE LOCATION MAP — FIG. NO. 1



NOT TO SCALE

Location of Slag to be Removed

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4E08103

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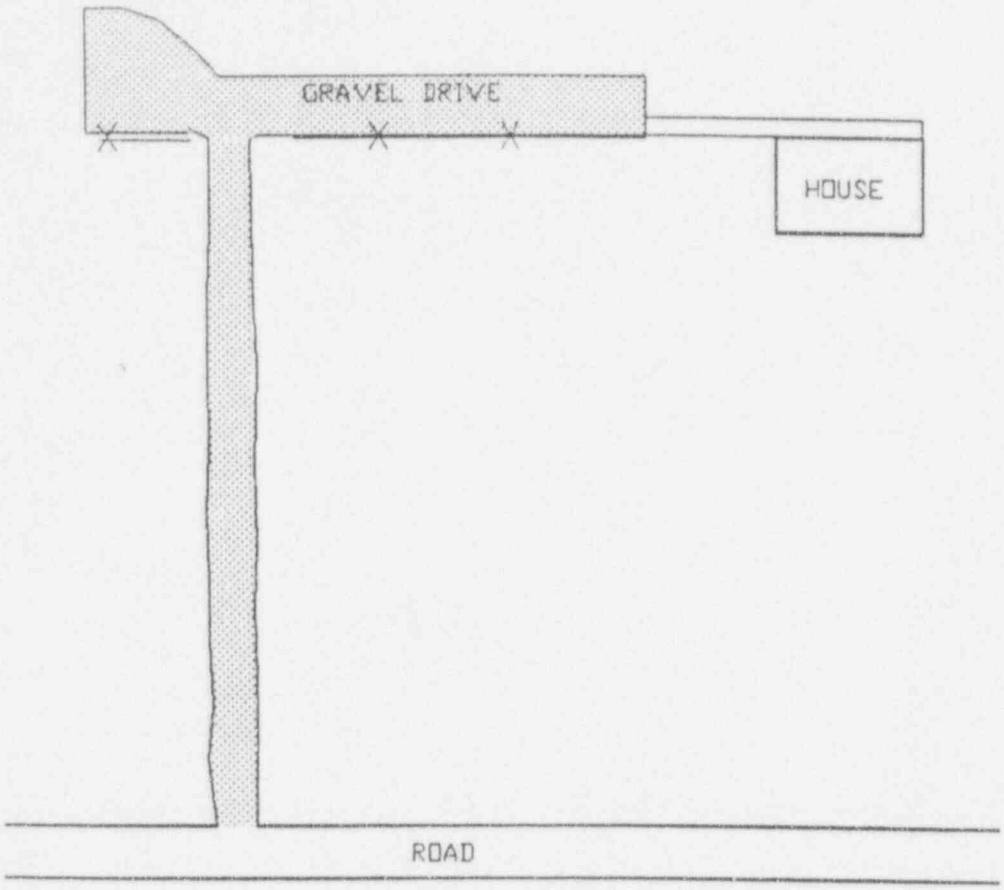
DRN. BY: RET
DSGN. BY: RET
CHKD. BY:

Property Layout and
Slag Locations, Property STRAW

FIG. NO.
2



NOT TO SCALE

Location of Slag to be Removed

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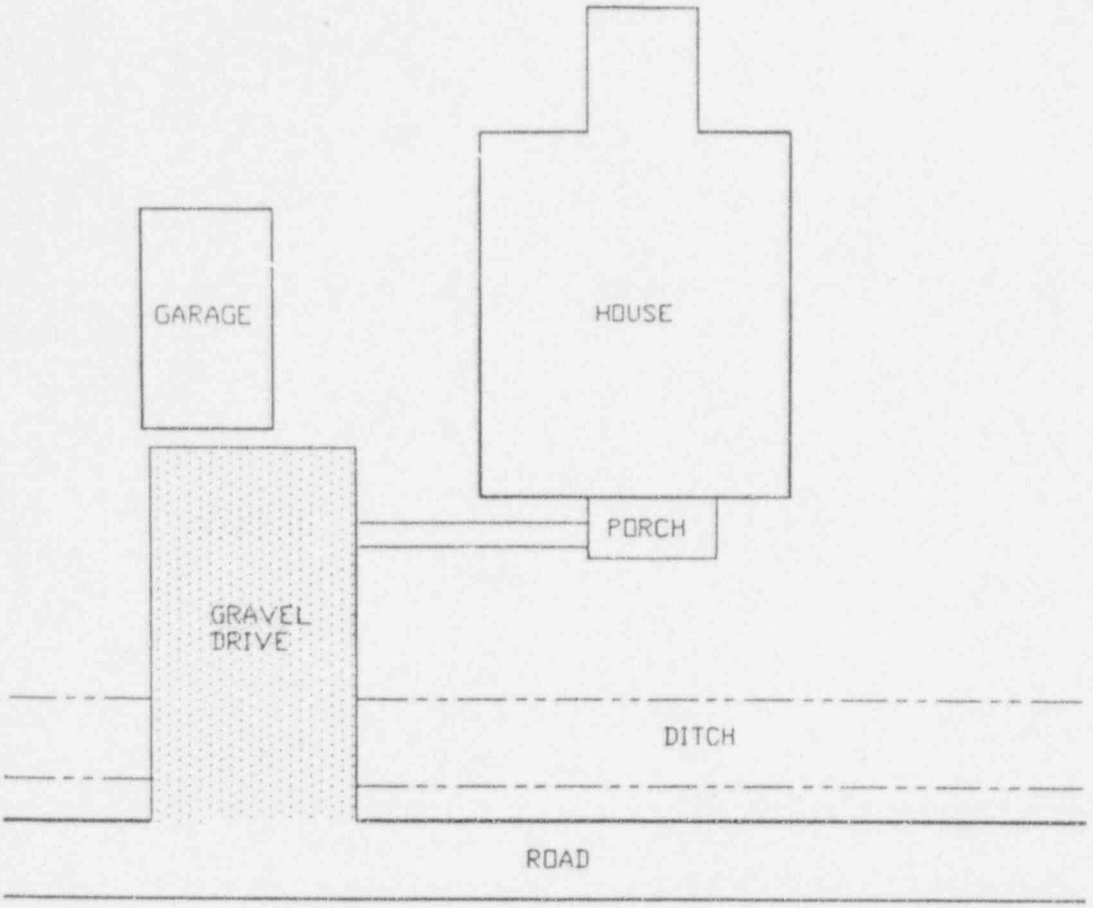
DRN. BY: R&T DSGN. BY: R&T CHKD. BY:	Property Layout and Slag Locations, Property O-5
	FIG. NO. 3



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Location of Slag to be Removed

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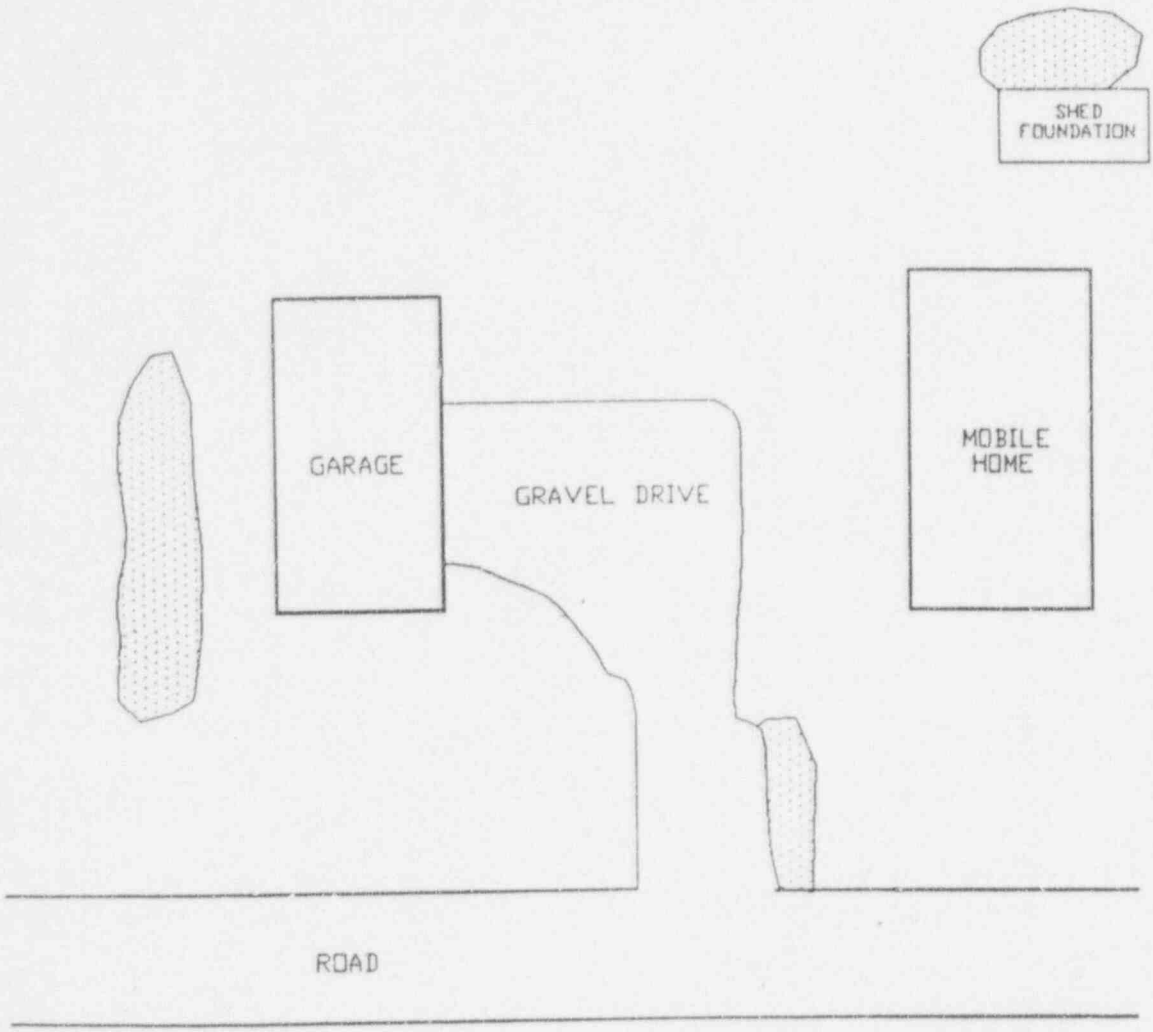
Property Layout and Slag Locations, Property O-7

FIG. NO. 4



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NOT TO SCALE

Location of Slag to be Removed

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ORISE Survey Report

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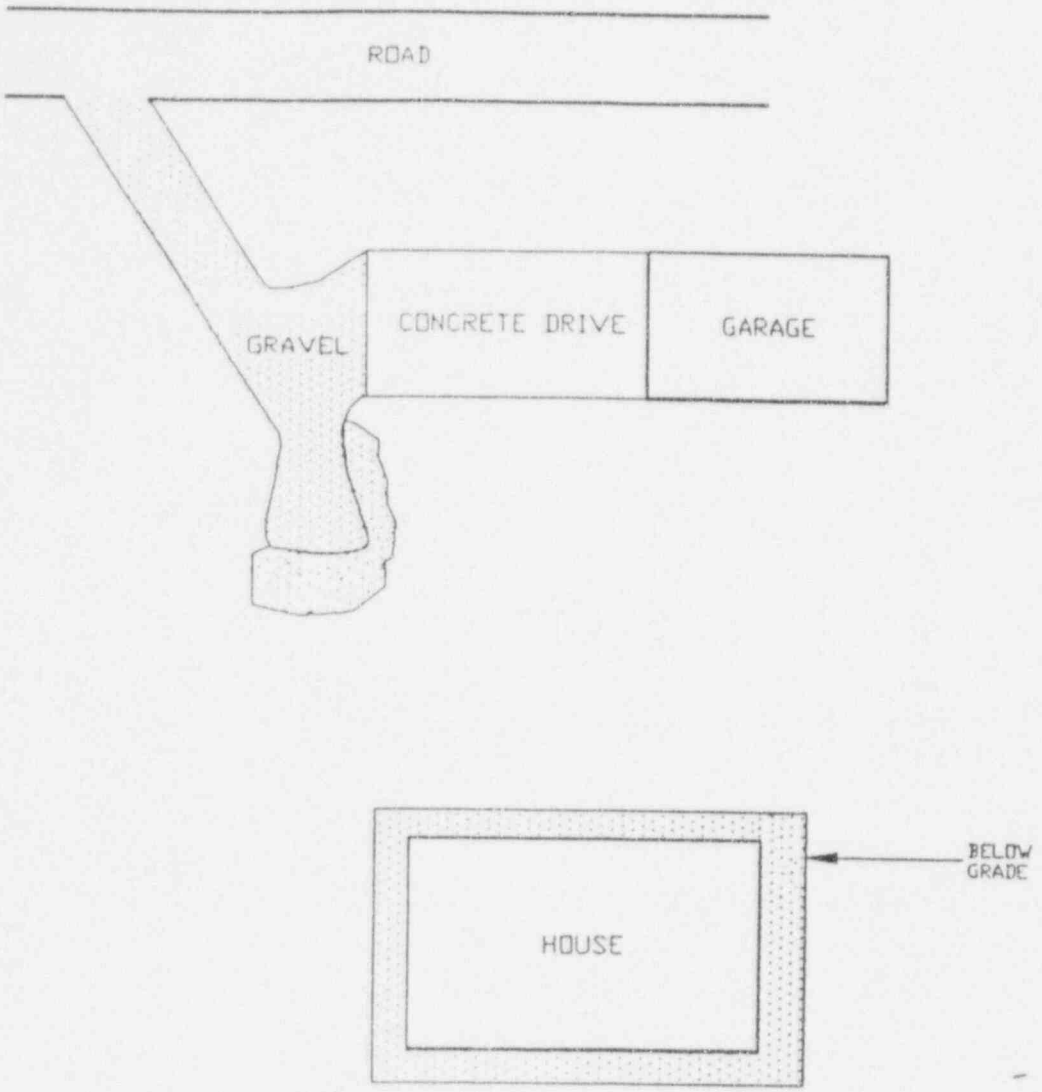
Property Layout and
Slag Locations, Property O-17

FIG. NO.
5



Location of Slag to be Removed

NOT TO SCALE

Source: modified from August 19, 1994 ORISE Survey Report

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Property Layout and Slag Locations, Property O-19

FIG. NO. 6

NOT TO SCALE

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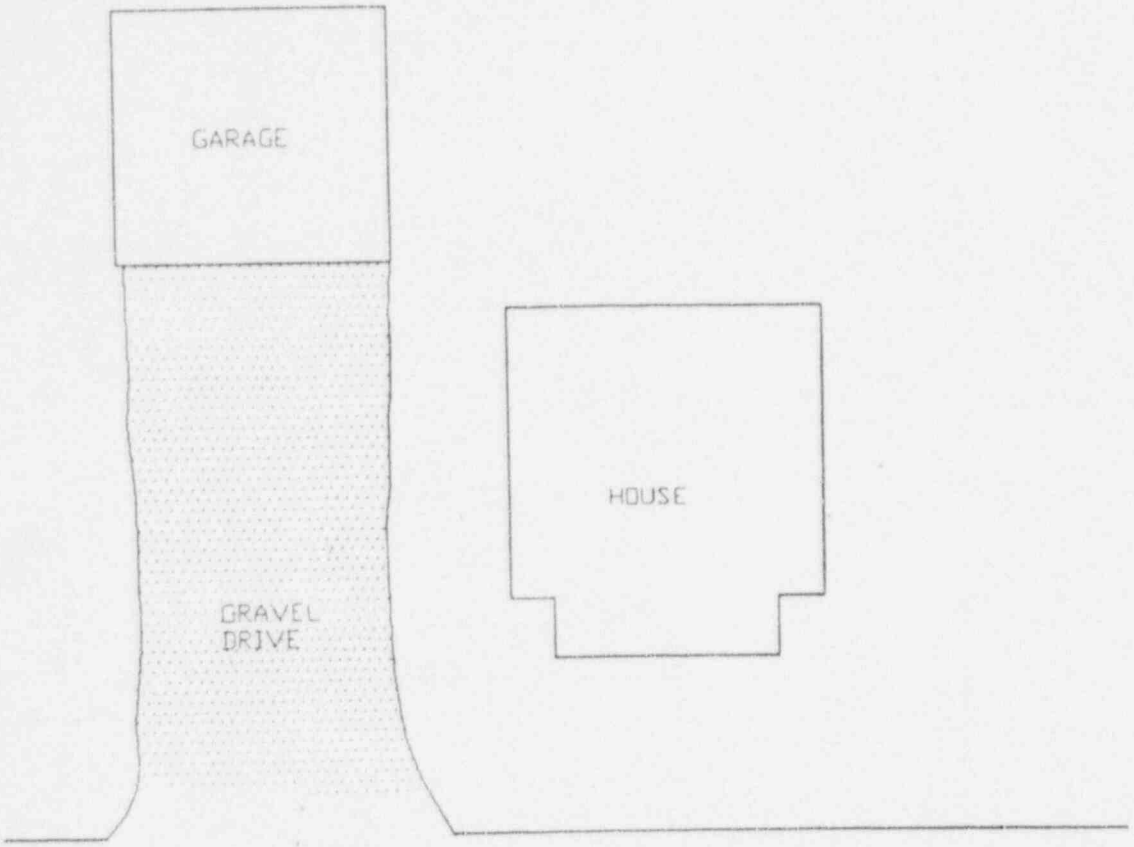
DSGN. BY: R&T
CHKD. BY:

Property Layout and Slag Locations, Property O-29

FIG. NO. 7



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NOT TO SCALE

Location of Slag to be Removed

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DRN. BY: [illegible]
DSGN. BY: [illegible]
CHKD. BY: [illegible]

Property Layout and
Slag Locations, Property O-47

FIG. NO.
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