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SL-1332

ORISE

OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 53, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 53 on August 6, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 53 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 10 meters west of the road. Figure 2 shows the remediated portions of VP 53. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then subdivided the excavated portion of the property into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of BNI's post-RA survey and sampling

indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 53 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated areas status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified one location of slightly elevated direct gamma radiation on the west wall of the excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples within the excavation. These samples were collected from the center and four points equidistant from the center and the corners of the 100 m^2 area. Additionally, one sample was collected from the location of elevated gamma radiation. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at each soil sampling location and results are presented in Table 1. Exposure rates ranged from 9 to 14 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.8 to 1.2 pCi/g for Ra-226, less than 4.9 to 5.6 pCi/g for Th-230, and less than 0.5 to 1.3 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

All residual radionuclide levels satisfied these guidelines after subtracting background.

In summary, the radiological status of VP 53 satisfies the applicable guidelines for release for unrestricted use. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

391-032 (1)

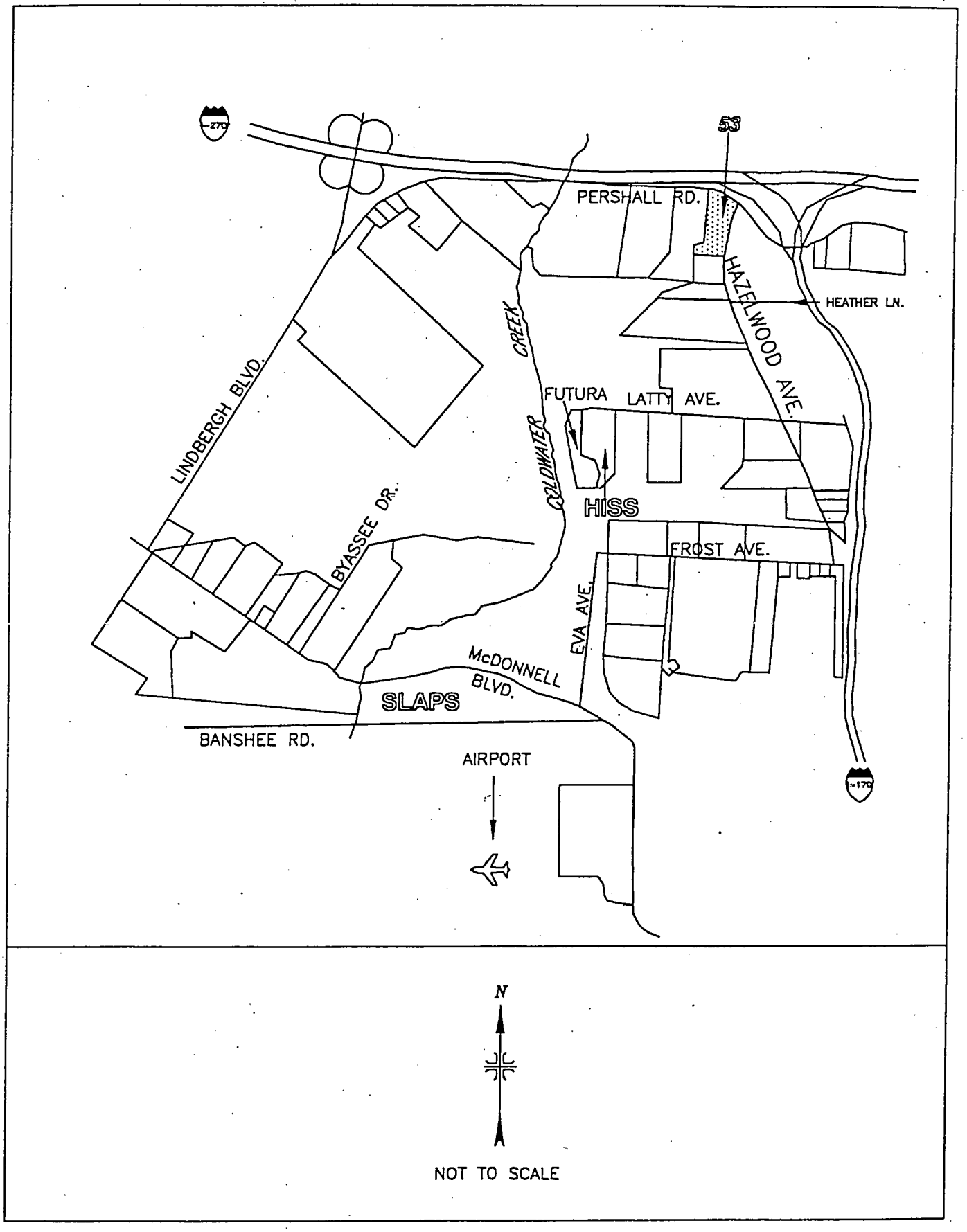

FIGURE 1: Location of SLAPS Vicinity Property Number 53

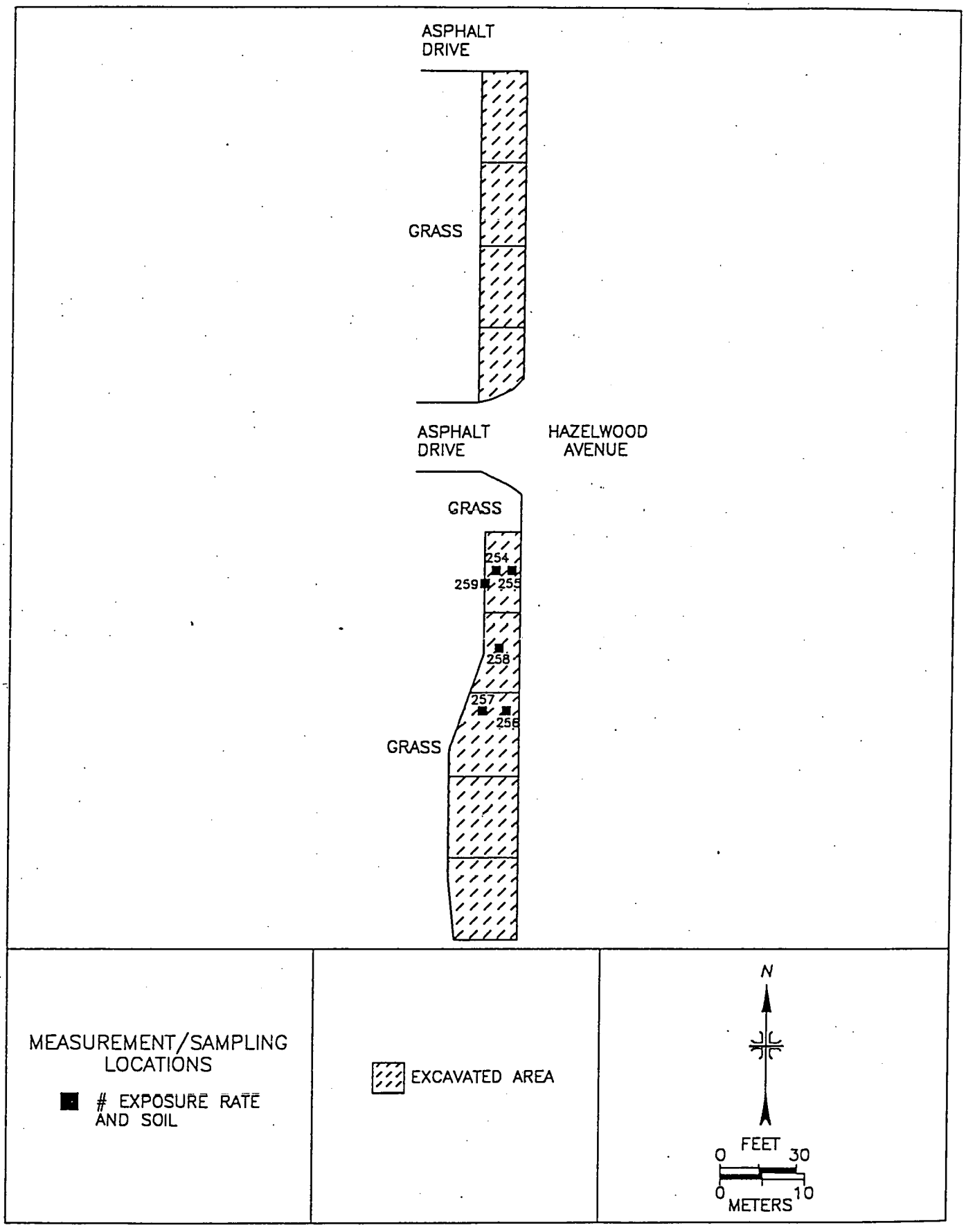

FIGURE 2: SLAPS Vicinity Properties, Property 53 – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 53 HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentrations (pCi/g)[b]		
		Ra-226	Th-230	U-238
254	14	0.8 ± 0.1[c]	<4.9	1.3 ± 0.4
255	14	1.2 ± 0.1	<4.2	1.3 ± 0.4
256	13	0.9 ± 0.1	<4.1	<0.5
257	10	0.9 ± 0.1	3.8 ± 2.8	1.1 ± 0.4
258	10	0.8 ± 0.1	5.2 ± 3.7	1.0 ± 0.5
259	9	0.8 ± 0.1	5.6 ± 2.7	1.0 ± 0.4

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41; 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 4L, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 4L on September 11, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 4L is located on Latty Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to two small sections, each covering approximately 100 m^2, located approximately 7 meters south of Latty Avenue. Figure 2 shows the remediated portions of VP 4L. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 to 2.5 meters below the surface. BNI then performed post-remedial action (post-RA) surveys and sampling of the excavations. The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 4L following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified one location of elevated direct gamma radiation in the east excavation. Based on previous sample radionuclide concentrations at locations of elevated direct gamma radiation identified by ESSAP, BNI performed additional remediation of the location. ESSAP personnel then collected five systematic surface (0-15 cm) soil samples within the excavation. Samples were collected from the center and at four points equidistant from the center and the corners of the 100 m^2 area. The location of elevated gamma radiation was included in the sampling. Sample locations are shown on Figure 2. An exposure rate measurement using a microrem meter was performed at 1 meter above the surface at the excavations center sampling location and results are presented in Table 1. The exposure rate was 9 μR/h and was comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.8 to 1.5 pCi/g for Ra-226, less than 4.7 to 29.9 pCi/g for Th-230, and 1.0 to 1.6 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. Two soil samples exceeded the subsurface guideline for Th-230, one of which was collected at the location identified by ESSAP surface scans and additional remediation was performed by BNI. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The maximum Th-230 concentration was below the hot spot

criteria and average Th-230 concentration for this excavation was less than 11.6 pCi/g, which satisfied the subsurface guideline.

In summary, verification surveys of the property identified two locations of undocumented residual contamination, one of which was remediated by BNI. With application of the 100 m^2 averaging and hot spot criteria, the radiological status of VP 4L satisfies the applicable guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

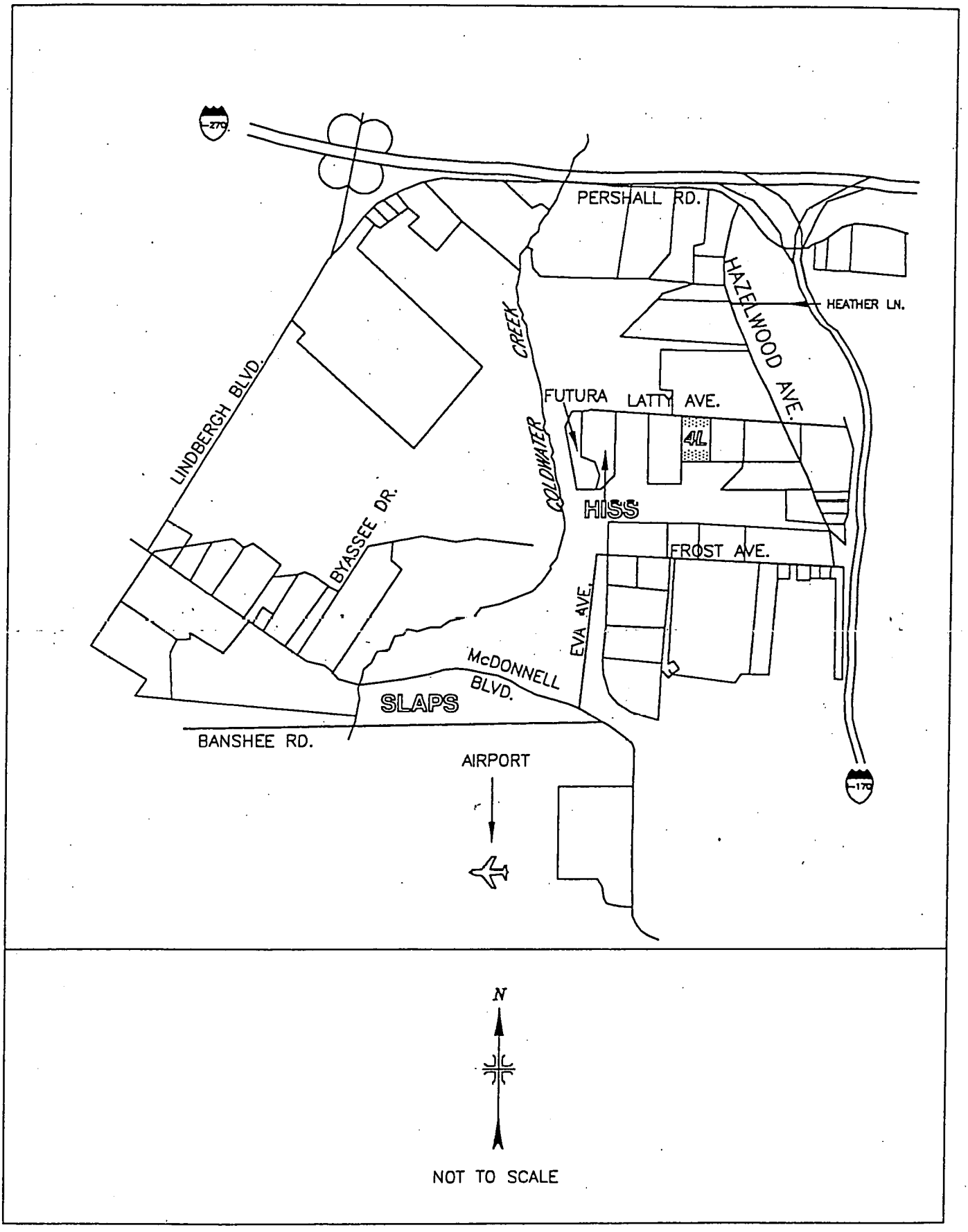

FIGURE 1: Location of SLAPS Vicinity Property Number 4L

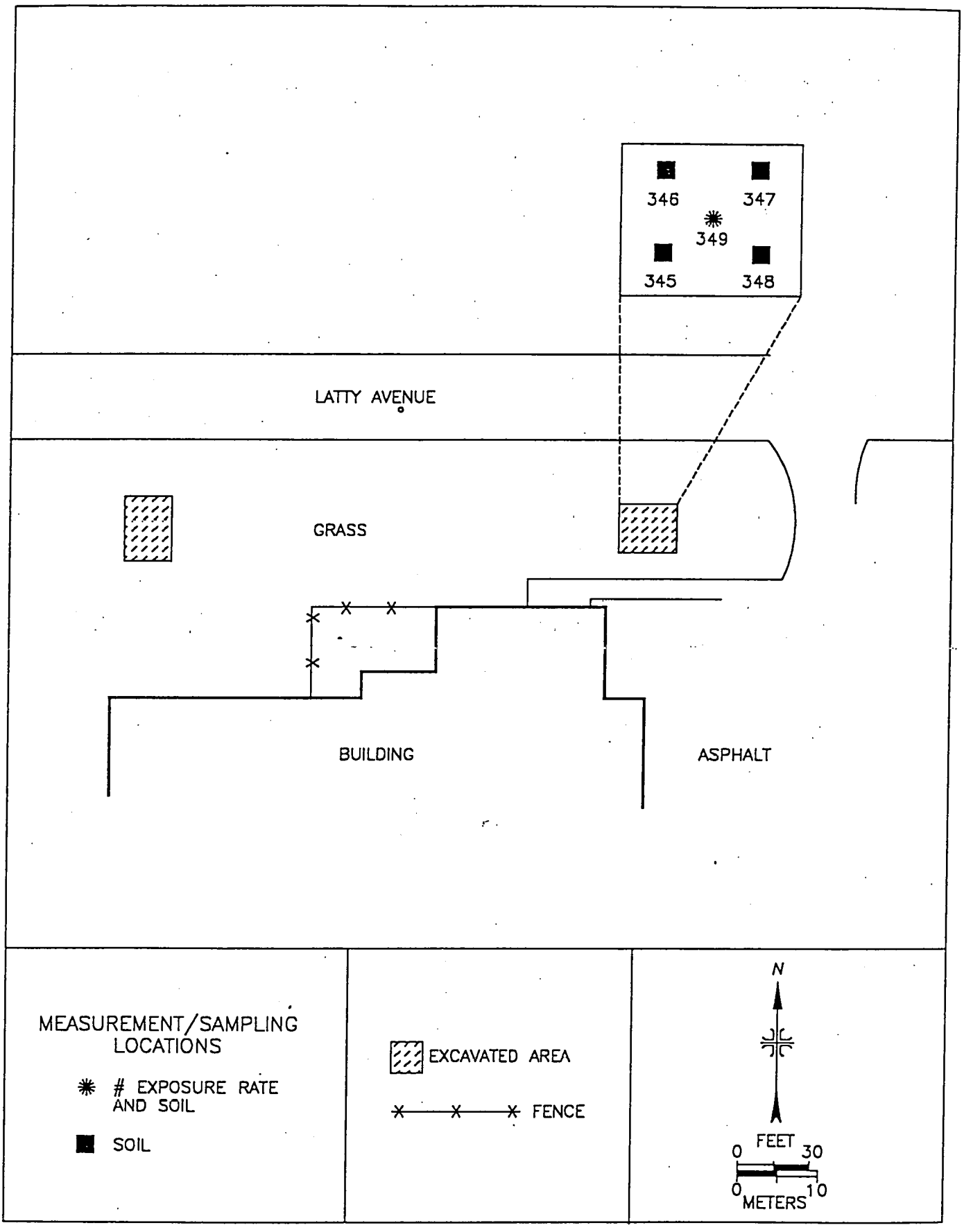

FIGURE 2: SLAPS Vicinity Properties, Property 4L – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 4L
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rate at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
345	—	0.9 ± 0.1[c]	<4.7	1.4 ± 0.5
346	—	0.9 ± 0.1	<4.5	1.0 ± 0.4
347	—	1.5 ± 0.1	29.9 ± 3.4	1.6 ± 0.3
348	—	1.1 ± 0.1	16.3 ± 5.9	1.1 ± 0.5
349	9	0.8 ± 0.1	2.7 ± 2.9	1.2 ± 0.4
100 m^2 Average			<11.6	

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

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ORISE
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December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 5L, HAZELWOOD, MISSOURI

Dear Mr. Leake

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 5L on September 11, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 5L is located on Latty Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to two small areas of approximately 100 m^2 each. One excavation was located in the northern portion of the property approximately 5 meters south of Latty Avenue and the second excavation was near the south end of the property. Figure 2 shows the remediated portions of VP 5L. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then performed post-remedial action (post-RA) surveys and sampling of the

excavation. The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 5L following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans did not identify any locations of elevated direct gamma radiation within the excavations. ESSAP personnel collected five systematic surface (0-15 cm) soil samples from the northern excavation. Samples were collected from the center and at four points equidistant from the center and the corners of a 100 m^2 area. Sample locations are shown on Figure 2. An exposure rate measurement using a microrem meter was performed at 1 meter above the surface at the center soil sampling location and the result is presented in Table 1. The exposure rate was 9 μR/h and was comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.9 to 1.1 pCi/g for Ra-226, less than 4.6 to 18.1 pCi/g for Th-230, and 0.9 to 1.3 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Two soil samples exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. One of the two soil samples also exceeded the subsurface guideline for Th-230. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The average Th-230 concentration was less than 7.9 for the excavation, which satisfies the subsurface guideline.

In summary, verification surveys of the property identified one location of undocumented residual contamination. However, application of the 100 m^2 averaging and hot spot criteria indicates that the radiological status of VP 5L satisfied the applicable guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
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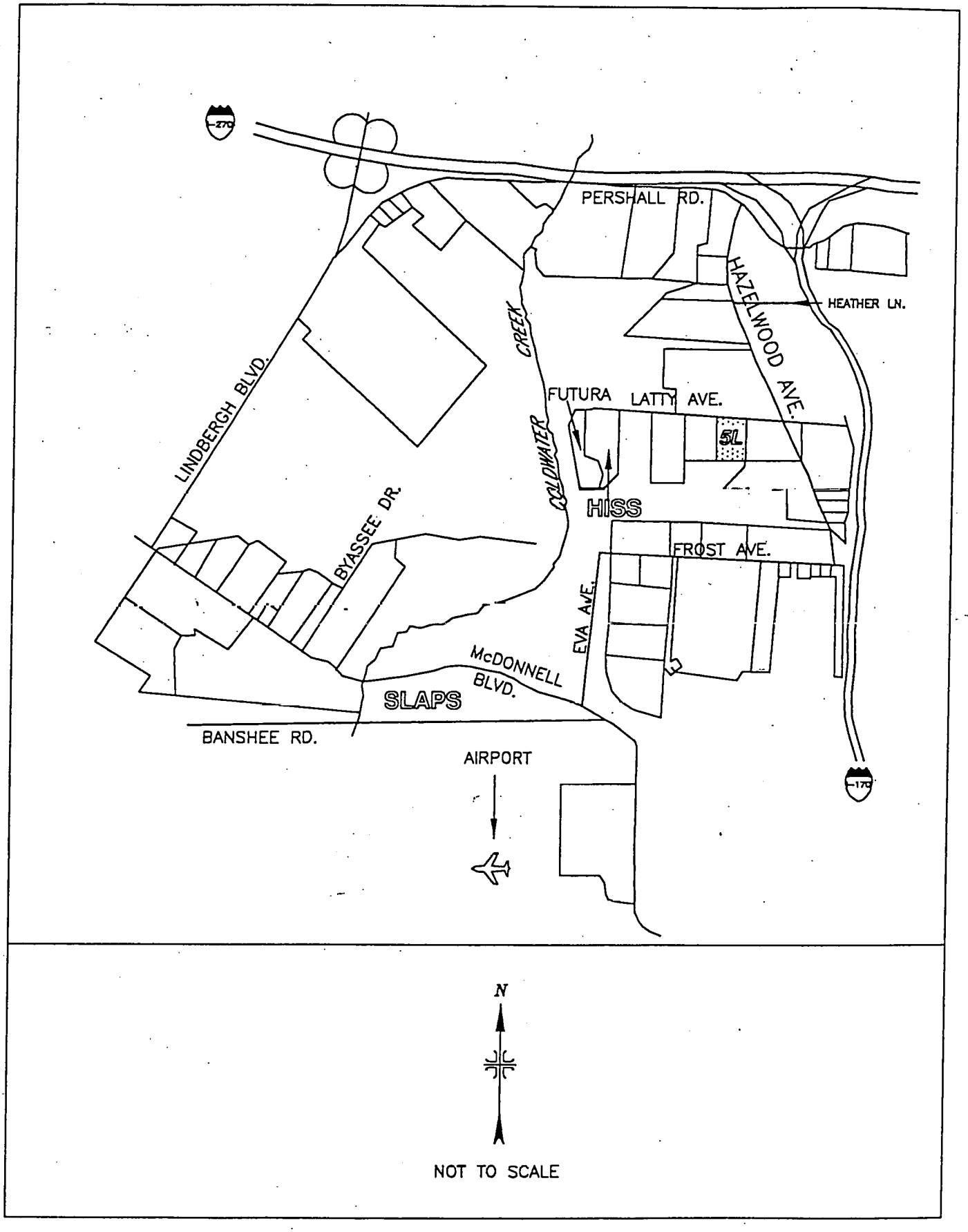

FIGURE 1: Location of SLAPS Vicinity Property Number 5L

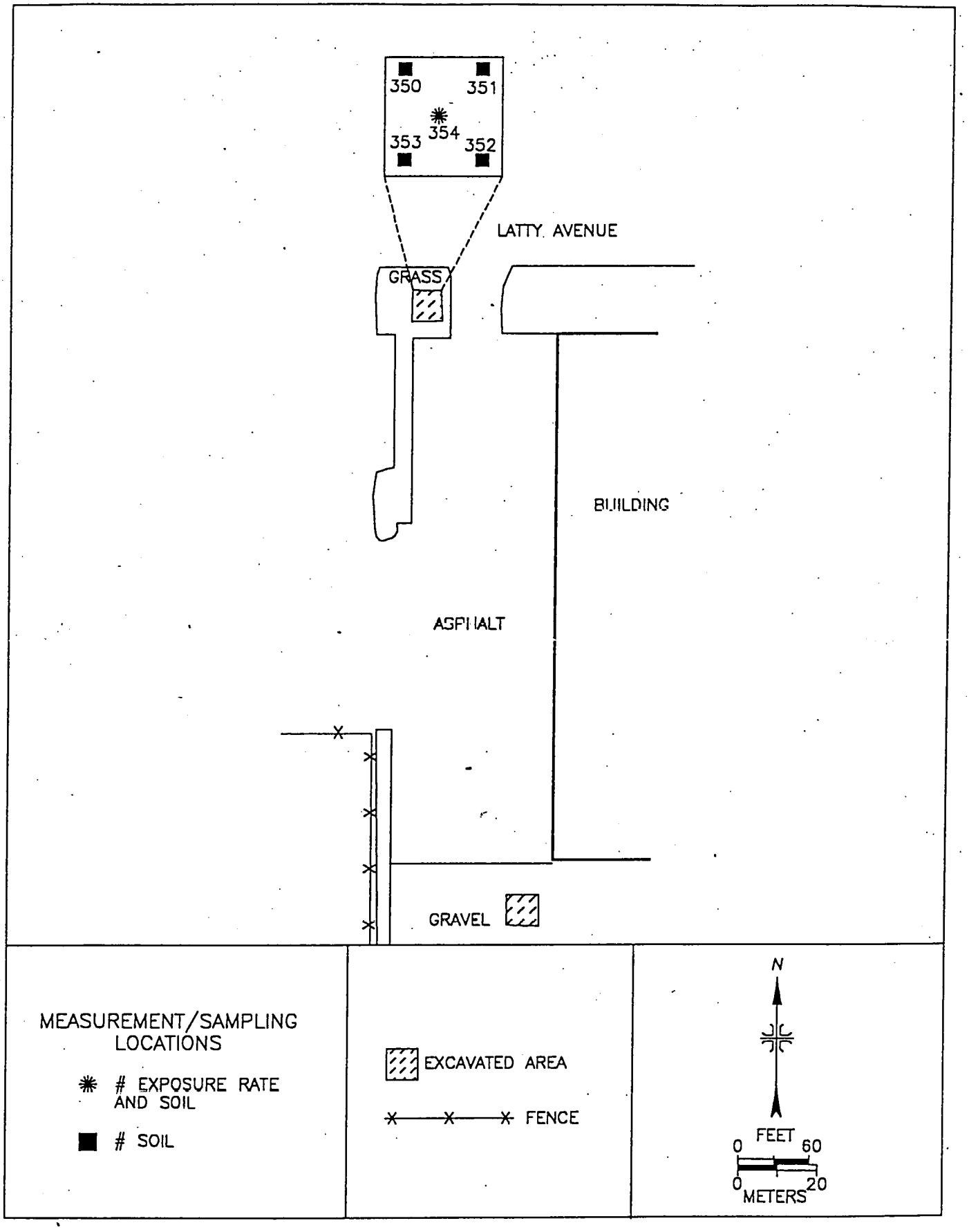

FIGURE 2: SLAPS Vicinity Properties, Property 5L – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 5L HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
350	—	0.9 ± 0.1[c]	<3.8	0.9 ± 0.3
351	—	0.9 ± 0.1	<4.6	1.0 ± 0.4
352	—	1.0 ± 0.1	8.4 ± 4.0	1.1 ± 0.4
353	—	0.9 ± 0.1	4.5 ± 3.7	1.2 ± 0.5
354	9	1.1 ± 0.1	18.1 ± 5.1	1.3 ± 0.5
100 m^2 Average			<7.9	

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

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December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 31A, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted initial verification activities at the SLAPS Vicinity Property (VP) No. 31A on August 7, 1997, and additional verification activities on August 27, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 31A is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination extended from the boundary with Hazelwood Avenue to approximately 25 meters east of the road. Figure 2 shows the remediated portions of VP 31A. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 to 1 meter below the surface. BNI then subdivided the excavated portion of the property into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 31A following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified four locations of elevated direct gamma radiation within the VP 31A excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples within the excavation. Samples were collected from the center and at four points equidistant from the center and the corners of the 100 m^2 area. Samples were not collected from two of the locations of elevated gamma radiation because BNI had already agreed that additional excavation of the locations would be performed. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at each soil sampling location and results are presented in Table 1. Exposure rates ranged from 9 to 11 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in initial soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 1.0 to 2.3 pCi/g for Ra-226, less than 4.6 to 29.0 pCi/g for Th-230, and 1.1 to 3.1 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Two samples exceeded the subsurface guideline for Th-230. As a result of these two sample concentrations and the two additional locations identified by ESSAP gamma scans, BNI removed additional soil from within the excavation. ESSAP then performed additional verification activities of this property on a subsequent survey visit. Gamma scans within the excavation where additional remediation was performed identified two locations of elevated direct gamma radiation. BNI

performed more remediation which included the removal of surface soil from land areas adjacent to the original excavation. Figure 2 shows the extent of the additional soil excavation. ESSAP then performed additional verification activities that included gamma scans and collection of four soil samples. These soil sampling locations are shown on Figure 2. Radionuclide concentrations in the post-RA samples are also presented in Table 1. After the additional remediation, final concentrations ranged from1.0 to 1.4 pCi/g for Ra-226, less than 4.5 to 17.9 pCi/g for Th-230, and less than 0.4 to 1.2 pCi/g for U-238. Because these samples were collected from a post-excavation depth of greater than 15 cm the subsurface guideline is applicable. One post-RA sample exceeded the subsurface guideline. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The average Th-230 concentration was less than 10.6 pCi/g which satisfied the subsurface guideline.

In summary, initial verification surveys of the property identified four locations of undocumented residual contamination. Two of these locations were sampled and exceeded the subsurface guideline for Th-230. Two additional locations were not sampled as BNI had agreed that the ESSAP scan data was significant enough to require BNI to perform additional remediation. Follow-up investigations of the VP 31A excavation indicated that additional soil contamination was present in the excavation and in soil adjacent to the excavation. Final remediation and verification activities indicated that the radiological status of the property satisfied the guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

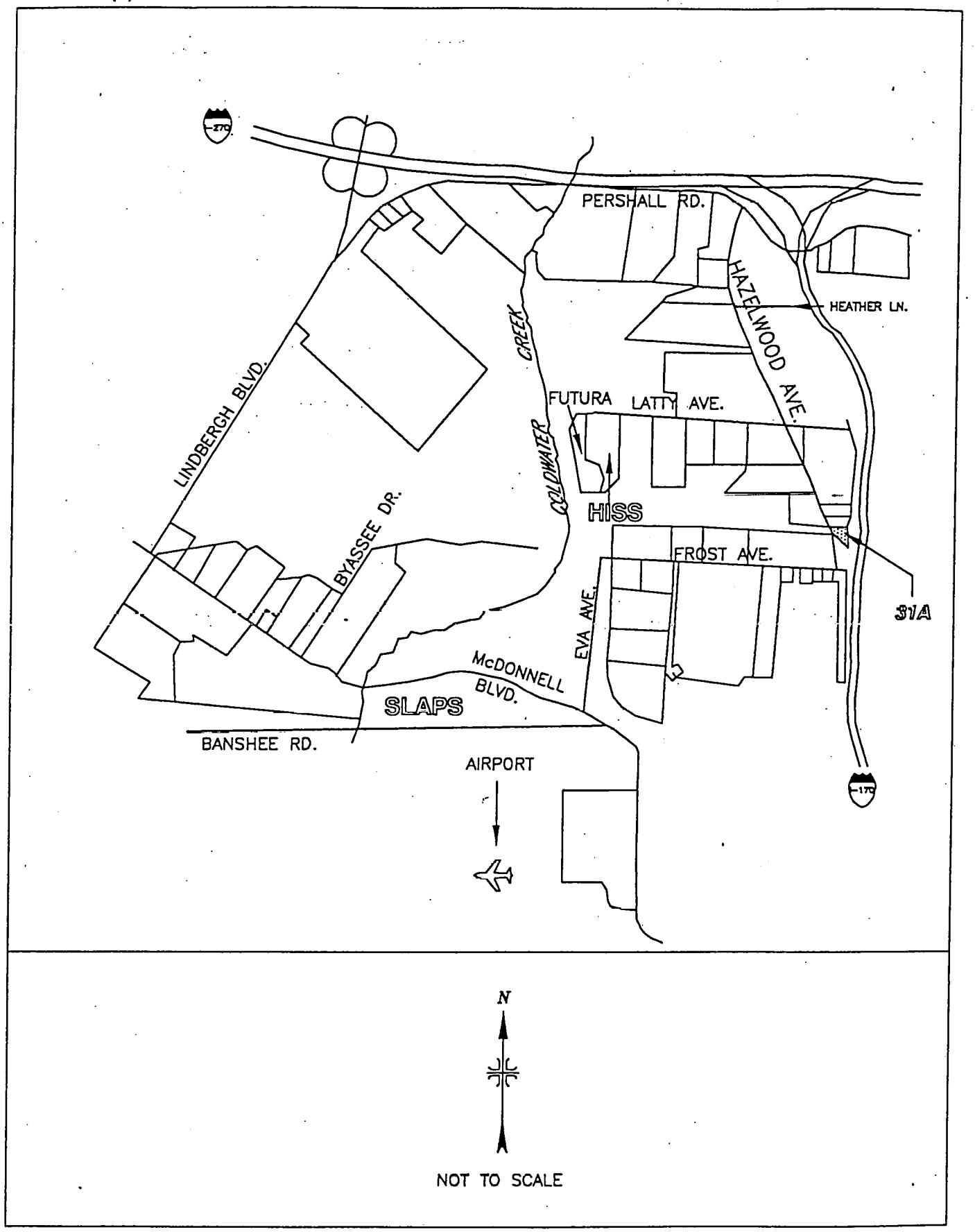


FIGURE 1: Location of SLAPS Vicinity Property Number 31A

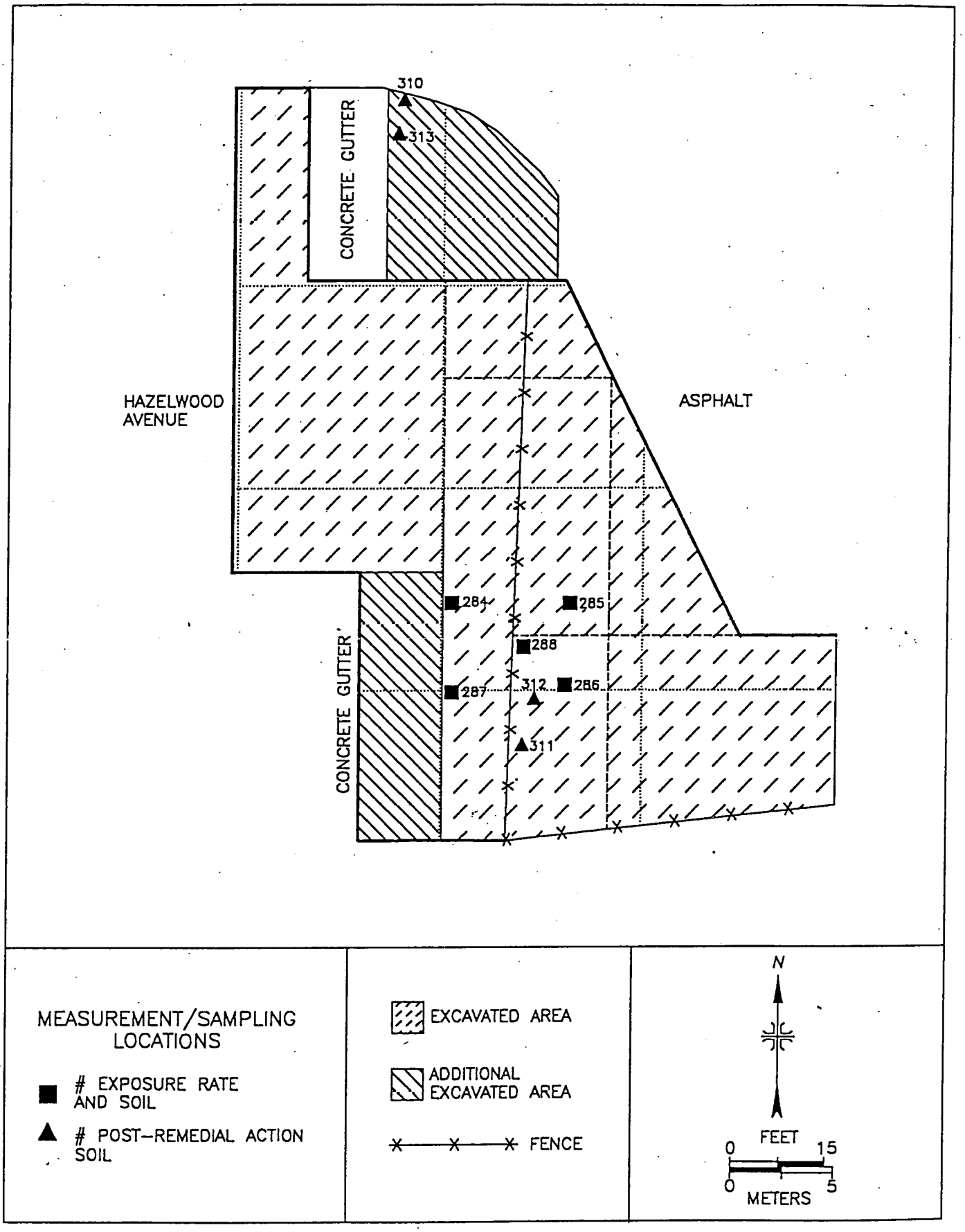


FIGURE 2: SLAPS Vicinity Properties, Property 31A – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 31A HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
284	10	2.3 ± 0.2[c]	22.9 ± 4.9	3.1 ± 0.5
285	9	1.0 ± 0.1	<4.6	1.1 ± 0.5
286	9	1.2 ± 0.1	2.2 ± 2.9	1.3 ± 0.3
287	11	1.8 ± 0.2	29.0 ± 4.9	2.2 ± 0.6
288	9	1.2 ± 0.1	5.6 ± 3.4	1.3 ± 0.4
PRA[d] 310	—	1.4 ± 0.1	17.9 ± 4.0	1.2 ± 0.4
PRA 311	—	1.1 ± 0.1	<4.5	1.1 ± 0.4
PRA 312	—	1.0 ± 0.1	<4.4	1.0 ± 0.4
PRA 313	—	1.1 ± 0.1	<3.9	<0.4
100 m^2 Average			<10.6	

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.
[d]Post-remedial action samples collected by ESSAP following additional BNI remediation.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT - VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 35, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 35 on October 20 and 21, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1998.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard, formerly Brown Avenue, Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 35 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was mainly confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 5 to 10 meters east of the road. However, soil contamination was also identified in two small areas along the north property boundry, two small areas in the northeast corner of the property, and two small areas in the southwest corner of the property. Figure 2 shows the remediated portions of VP 35. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meter below the surface. BNI then subdivided the excavated portion of the property into sections A through H, further subdividing larger sections into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of

BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 35 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use by the DOE in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans did not identify any locations of elevated direct gamma radiation within the VP 35 excavations. However, one area of elevated direct gamma radiation was located in the unexcavated area between Sections B and D. ESSAP personnel collected five systematic surface (0-15 cm) soil samples from one grid block in each of Sections A, B, C, D, G, and F. Samples were collected at the center and four points equidistant from the center and the corners of a 100 m^2 area. Additionally, one sample was collected from the location of elevated gamma radiation between Sections B and D. Sample locations are shown on Figures 3 through 8. Exposure rate measurements using a microrem meter were performed at one meter above the surface at the center soil sampling location in each grid block and results are presented in Table 1. Exposure rates ranged from 7 to 14 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in initial soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.7 to 22.4 pCi/g for Ra-226, less than 4.9 to 1,750 pCi/g for Th-230, and less than 0.1 to 2.5 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Eight soil samples exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. One sample collected from Section A, and the sample collected from the unexcavated area between Sections B and D, exceeded the subsurface guideline for Th-230. The sample collected between Sections B and D also exceed the subsurface guideline for Ra-226. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100

m^2 and application of the hot spot criteria. The average Th-230 concentration was less than 13 pCi/g for the 100 m^2 area in Section A, which satisfied the subsurface guideline.

Based on ESSAP gamma scan findings, BNI excavated the area between Sections B and D and performed final status surveys and collected four samples (and a composite of the four) from the excavation (Figure 9). BNI samples were sent to ESSAP for comparative analysis and the results are presented in Table 2. ESSAP radionuclide ranges for the five BNI samples were: 0.7 to 1.2 pCi/g for Ra-226, less than 4.3 to 6.0 pCi/g for Th-230, and 1.2 to 1.8 pCi/g for U-235. BNI's range for Th-230 was 2.4 to 5.7 pCi/g.

In summary, verification surveys of the property identified locations of undocumented residual contamination within two sections of the excavation which BNI removed with additional remediation. One soil sample collected from a grid block in section A exceeded the subsurface guideline. However, the average Th-230 concentration in subsurface soil is less than the applicable guidelines and the radiological status of the property satisfied the guidelines for release for unrestricted use. Post-remedial action samples collected by BNI from the area between Sections 35B and D following excavation, and analyzed by ESSAP for comparison, also satisfied the guidelines. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previuosly provided comments on the post-remedial action survey methods to BNI for their resolutuion. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

391-051 (x)

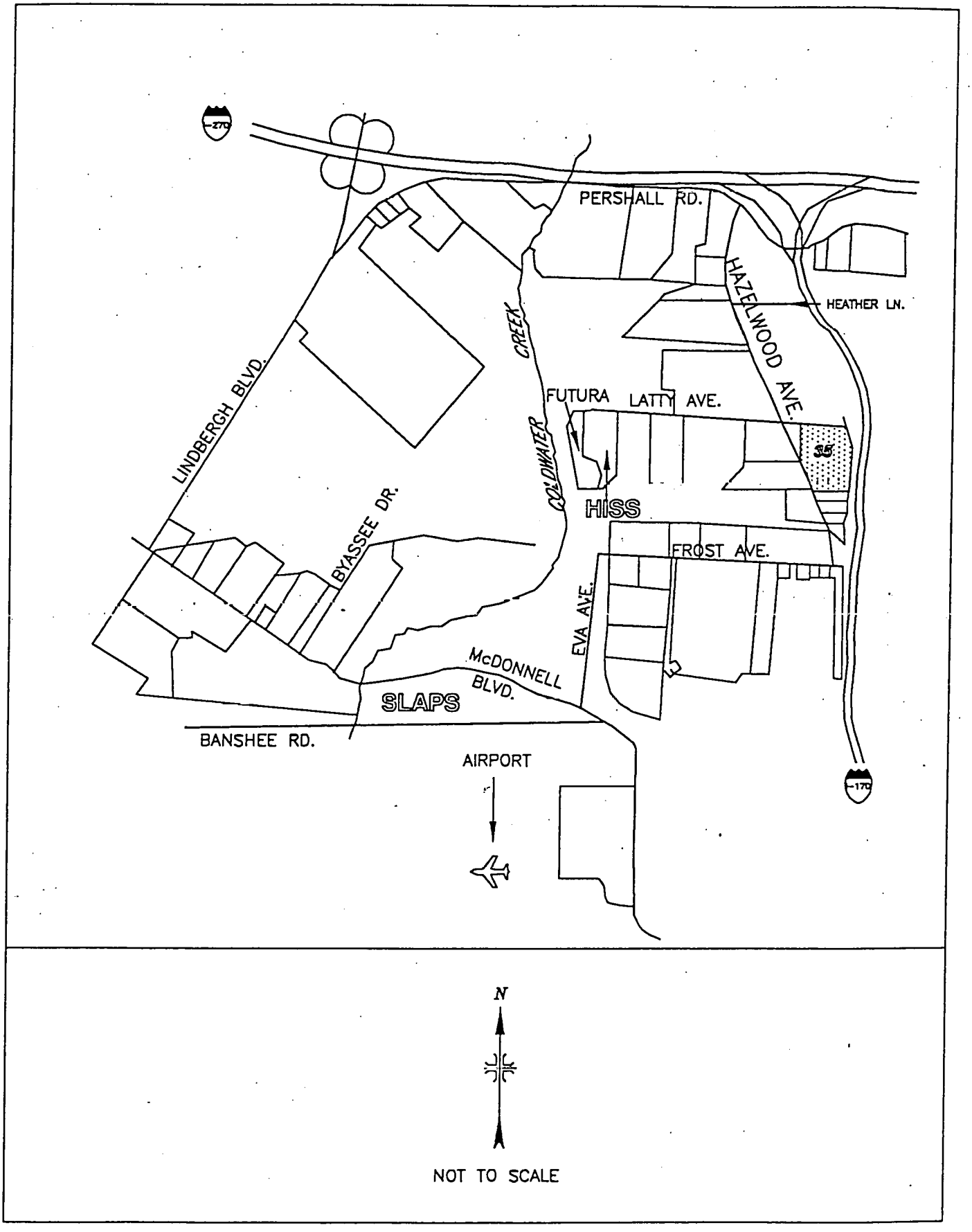


FIGURE 1: Location of SLAPS Vicinity Property Number 35

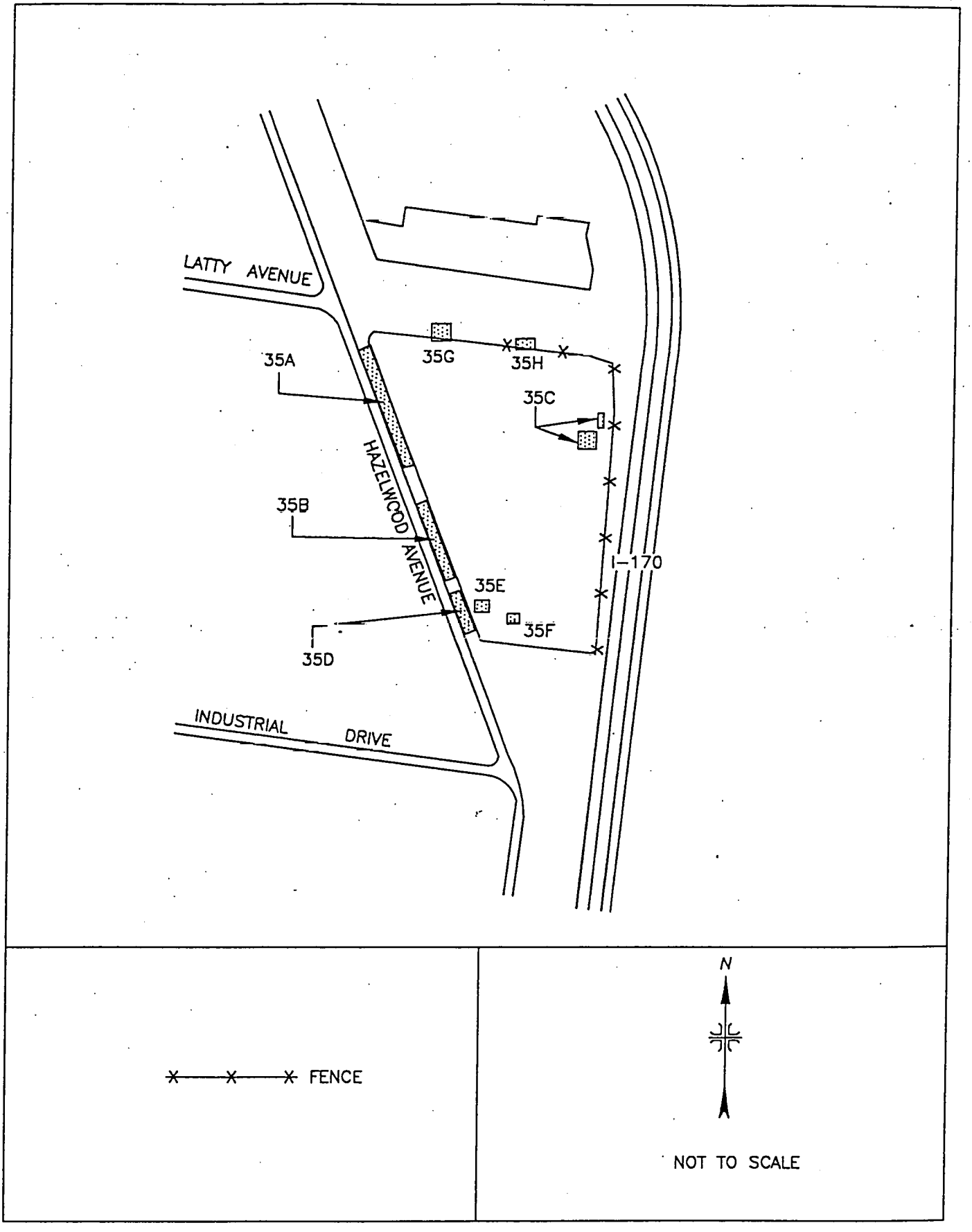


FIGURE 2: SLAPS Vicinity Properties, Property 35 – Showing Sections A Through H

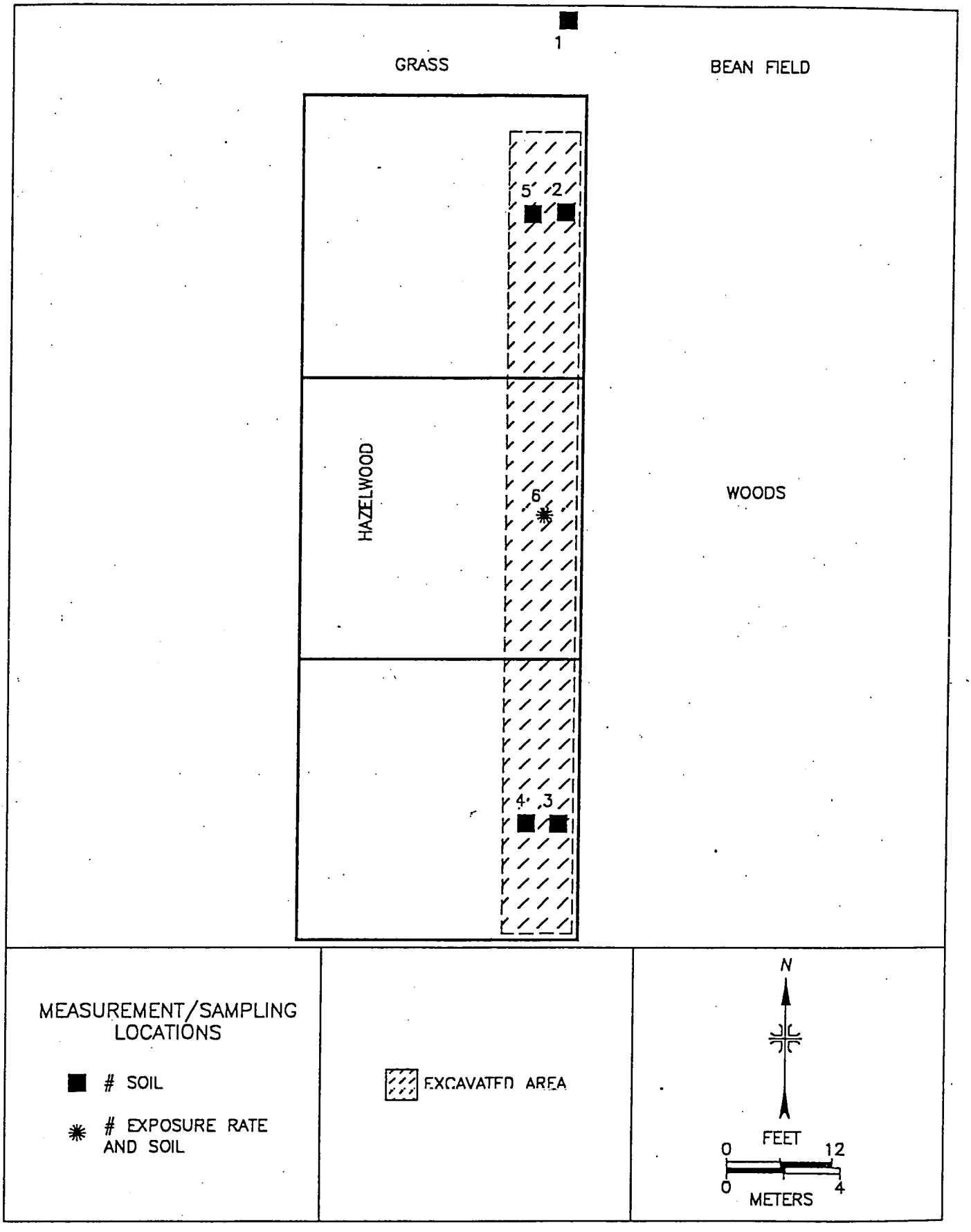


FIGURE 3: SLAPS Vicinity Properties, Property 35D – Measurement and Sampling Locations

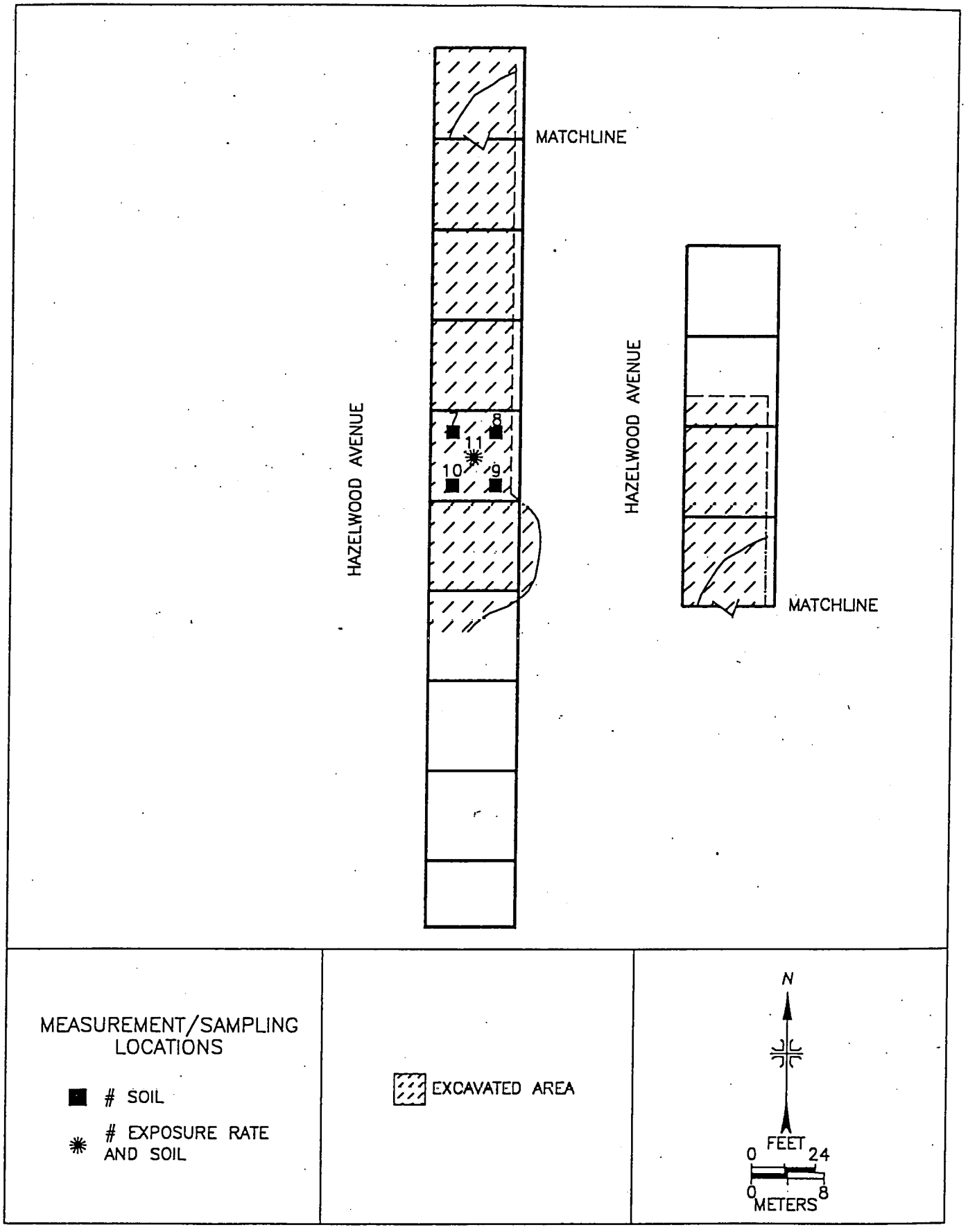


FIGURE 4: SLAPS Vicinity Properties, Property 35A – Measurement and Sampling Locations

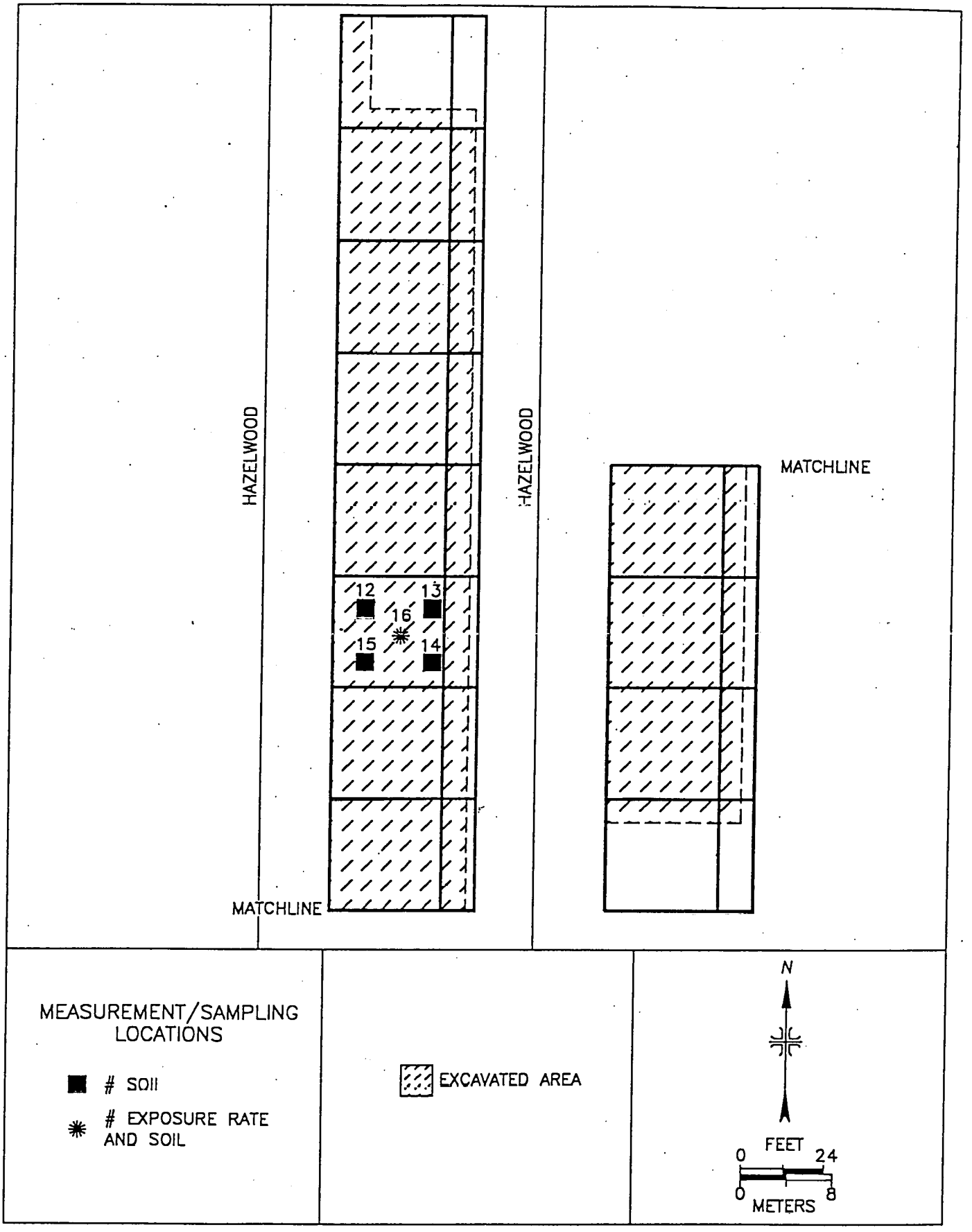


FIGURE 5: SLAPS Vicinity Properties, Property 35B – Measurement and Sampling Locations

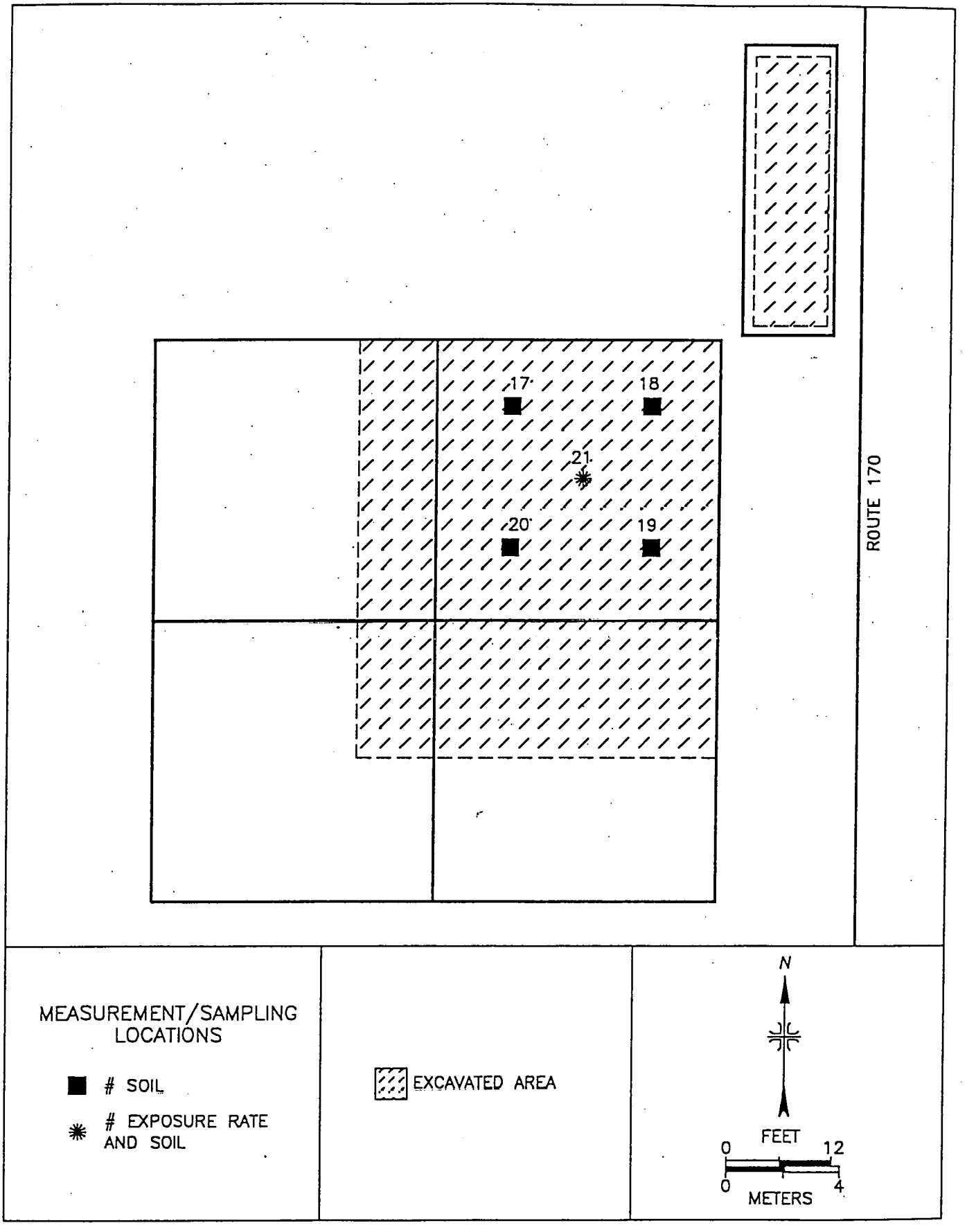


FIGURE 6: SLAPS Vicinity Properties, Property 35C – Measurement and Sampling Locations

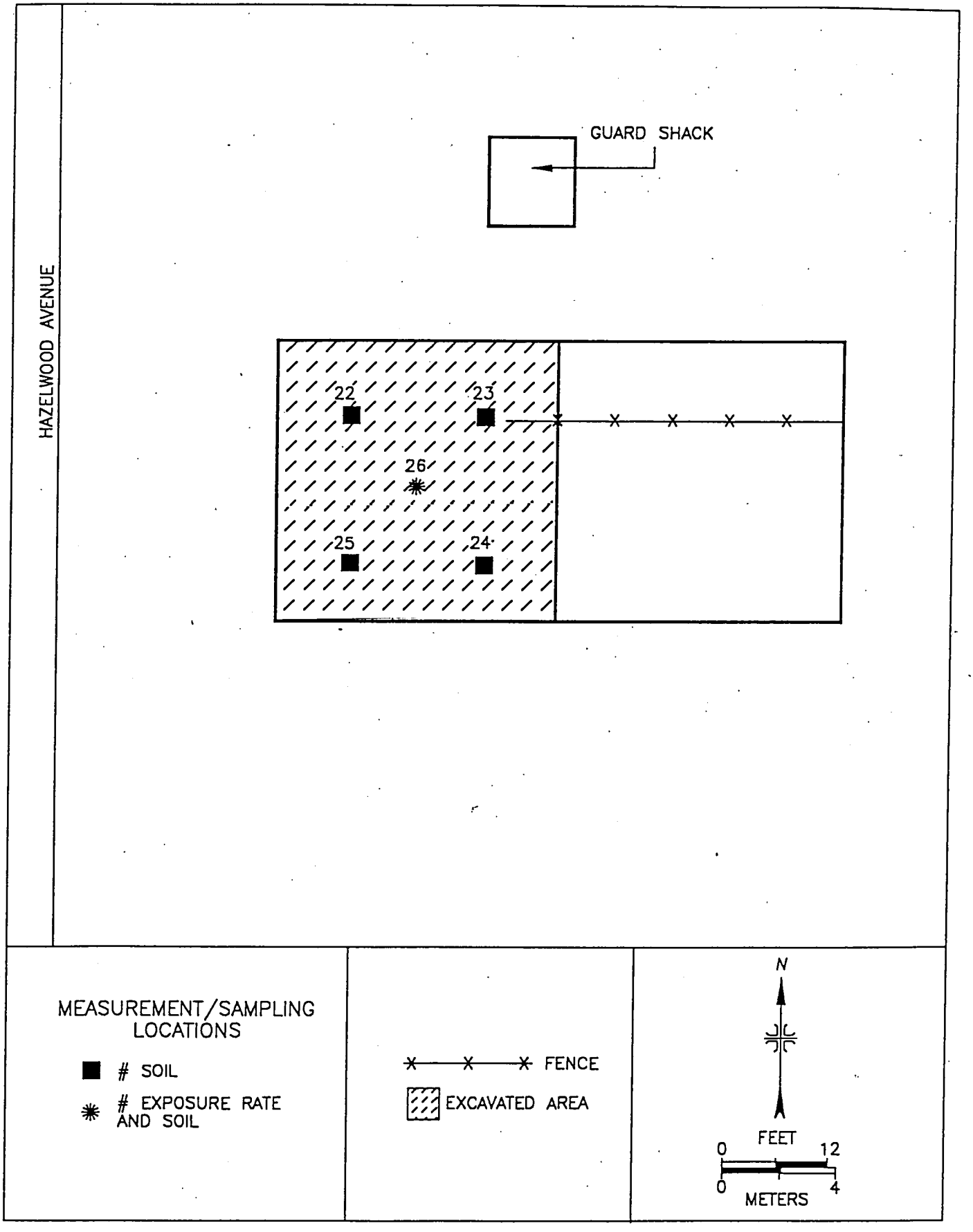
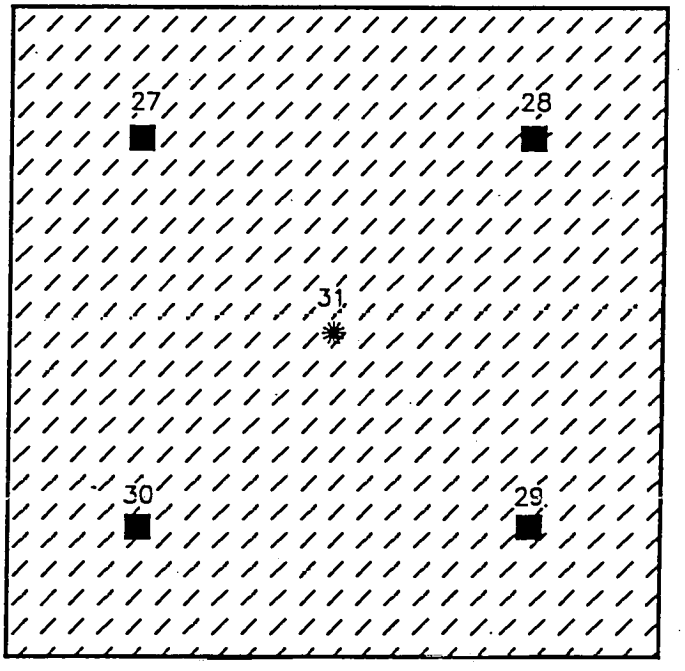


FIGURE 7: SLAPS Vicinity Properties, Property 35G – Measurement and Sampling Locations



MEASUREMENT/SAMPLING LOCATIONS

■ # SOIL

✱ # EXPOSURE RATE AND SOIL

▨ EXCAVATED AREA

N

FEET
0 6

0 2
METERS

FIGURE 8: SLAPS Vicinity Properties, Property 35F – Measurement and Sampling Locations

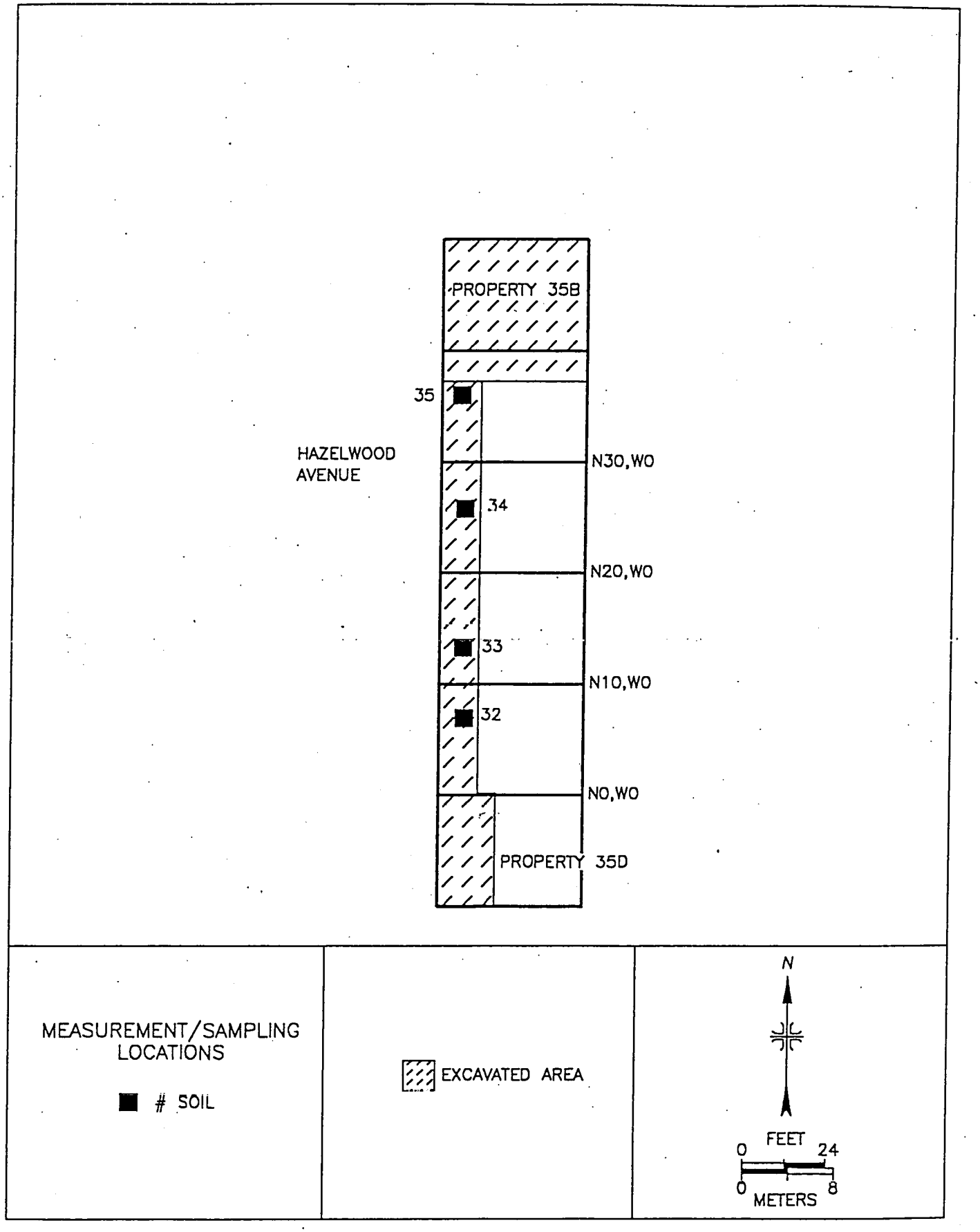


FIGURE 9: SLAPS Vicinity Properties, Area Between Sections 35B and 35D – BNI Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 35
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Section D				
Location 1	—	22.4 ± 3.0[c]	1,750 ± 190	<2.6
Location 2	—	0.7 ± 0.1	<4.0	1.1 ± 0.4
Location 3	—	0.8 ± 0.1	<3.7	0.8 ± 0.3
Location 4	—	0.9 ± 0.1	5.9 ± 3.5	2.5 ± 0.4
Location 5	—	0.9 ± 0.1	8.4 ± 4.1	2.5 ± 0.5
Location 6	10	0.7 ± 0.1	7.8 ± 3.1	0.9 ± 0.3
Section A				
Location 7	—	1.3 ± 0.1	36.5 ± 5.7	2.3 ± 0.5
Location 8	—	0.7 ± 0.1	<4.9	0.9 ± 0.3
Location 9	—	0.7 ± 0.1	7.4 ± 3.2	1.0 ± 0.3
Location 10	—	0.9 ± 0.1	12.5 ± 3.9	1.6 ± 0.4
Location 11	12	0.8 ± 0.1	3.9 ± 3.2	1.2 ± 0.4
100 m^2 Average			<13	
Section B				
Location 12	—	0.7 ± 0.1	5.7 ± 3.3	1.1 ± 0.3
Location 13	—	0.8 ± 0.1	<3.7	1.3 ± 0.4
Location 14	—	0.7 ± 0.1	<4.0	1.2 ± 0.5
Location 15	—	0.7 ± 0.1	<3.7	1.2 ± 0.4
Location 16	11	0.7 ± 0.1	<3.8	0.7 ± 0.4

[a]Refer to Figure 3 through 8.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 1 (Continued)

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 35
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Section C				
Location 17	—	0.7 ± 0.1	<4.2	1.1 ± 0.4
Location 18	—	0.7 ± 0.1	<3.9	1.1 ± 0.4
Location 19	—	0.7 ± 0.1	<3.7	1.2 ± 0.4
Location 20	—	0.8 ± 0.1	<3.8	1.2 ± 0.3
Location 21	11	0.8 ± 0.1	<3.7	1.2 ± 0.4
Section G				
Location 22	—	0.8 ± 0.1	<3.7	0.8 ± 0.3
Location 23	—	0.9 ± 0.1	<3.1	0.9 ± 0.3
Location 24	—	0.8 ± 0.1	<3.0	0.7 ± 0.3
Location 25	—	0.9 ± 0.1	<3.6	0.9 ± 0.4
Location 26	7	0.8 ± 0.1	<3.5	0.7 ± 0.3
Section F				
Location 27	—	0.9 ± 0.1	<4.9	1.3 ± 0.3
Location 28	—	0.8 ± 0.1	<3.5	1.2 ± 0.3
Location 29	—	0.1 ± 0.1	<1.2	<0.1
Location 30	—	1.1 ± 0.1	<4.4	1.1 ± 0.4
Location 31	14	0.9 ± 0.1	<3.7	0.9 ± 0.4

[a]Refer to Figure 3 through 8.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

TABLE 2

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
COLLECTED BY BNI
FOLLOWING EXCAVATION OF THE AREA BETWEEN SECTIONS B AND D
ST. LOUIS AIRPORT SITE VICINITY PROPERTY 35
HAZELWOOD, MISSOURI

Sample Location[a]	Radionuclide Concentration (pCi/g)[b]			
	Ra-226	Th-230 (ESSAP)	Th-230 (BNI)	U-238
Location 32	0.8 ± 0.1[c]	<4.3	5.7	1.5 ± 0.4
Location 33	0.9 ± 0.1	<3.8	4.3	1.5 ± 0.4
Location 34	0.7 ± 0.1	<3.6	2.4	1.2 ± 0.3
Location 35	0.8 ± 0.1	3.2 ± 2.9	4.6	1.3 ± 0.4
Composite of 32-35	1.2 ± 0.1	6.0 ± 3.7	3.5	1.8 ± 0.4

[a]Refer to Figure 9.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 38, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 38 on September 10 and 11, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 38 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 5 to 10 meters west of the road. Figure 2 shows the remediated portions of VP 38. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then subdivided the excavated portion of the property into sections A through D, further subdividing each section into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation.

The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 38 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified two locations of elevated direct gamma radiation within the VP 38 excavation, one each in sections B and D. ESSAP personnel collected five systematic surface (0-15 cm) soil samples from two grid blocks in section A and from the grid block in section B where the elevated direct gamma radiation was located by surface scans. Samples were collected from the center and at four points equidistant from the center and the corners of a 100 m^2 area. BNI performed additional remediation at the two locations identified by surface scans and ESSAP collected a post-RA sample from each location. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at the center soil sampling location in each grid block and results are presented in Table 1. Exposure rates ranged from 9 to 11 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in initial soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.7 to 1.7 pCi/g for Ra-226, less than 5.1 to 27.6 pCi/g for Th-230, and 0.9 to 3.2 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Five soil samples exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. Two samples collected from grid B, section A

exceeded the subsurface guideline for Th-230. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The maximum Th-230 concentration was below the hot spot criteria and the average Th-230 concentrations was less than 12.6 pCi/g for this grid block, which satisfies the subsurface guideline.

In summary, verification surveys of the property identified locations of undocumented residual contamination within two sections of the excavation which BNI removed with additional remediation. Two soil samples collected from a grid block in section A exceeded the subsurface guideline. However, the average Th-230 concentration in subsurface soil is less than the applicable guidelines and the radiological status of the property satisfied the guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

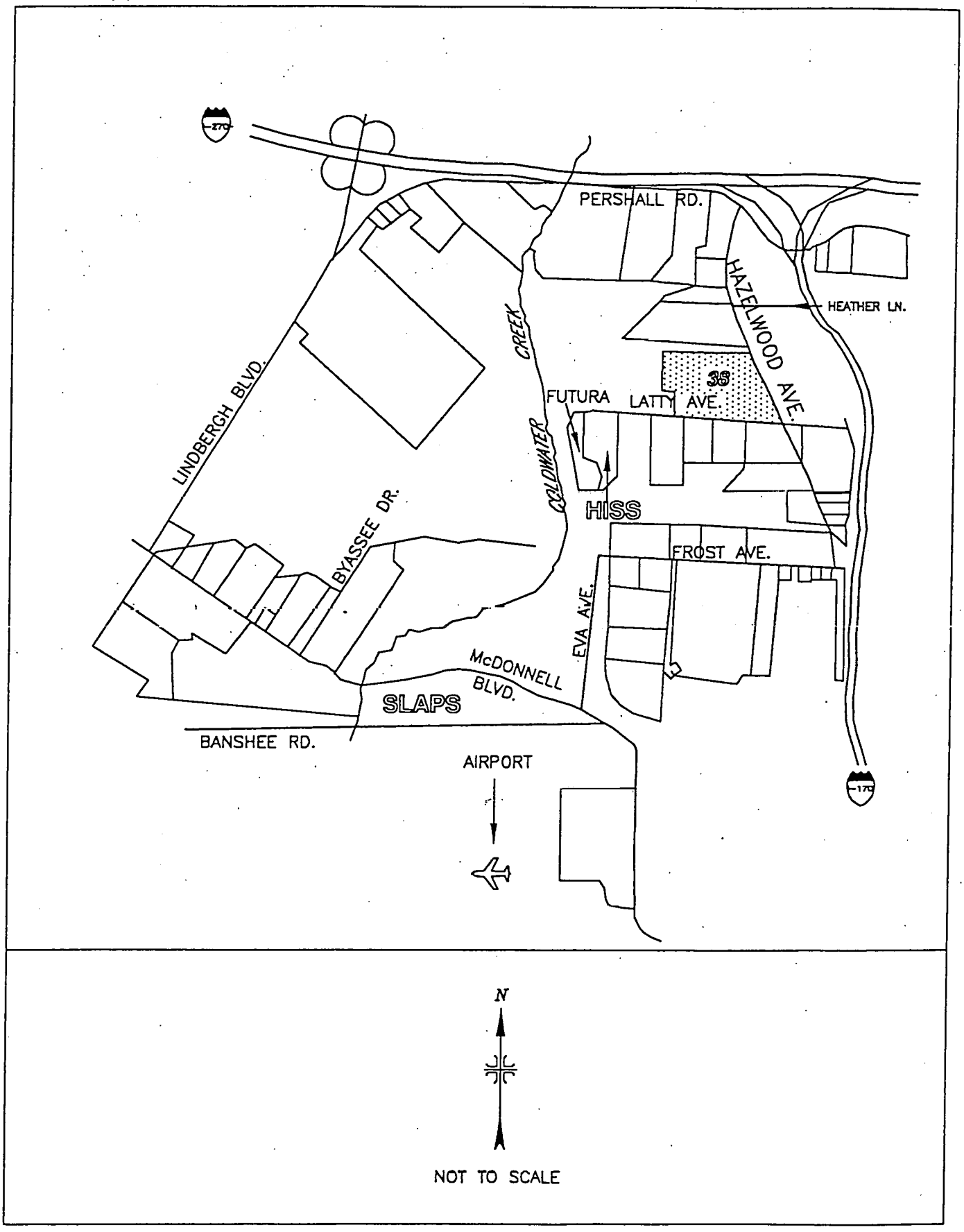


FIGURE 1: Location of SLAPS Vicinity Property Number 38

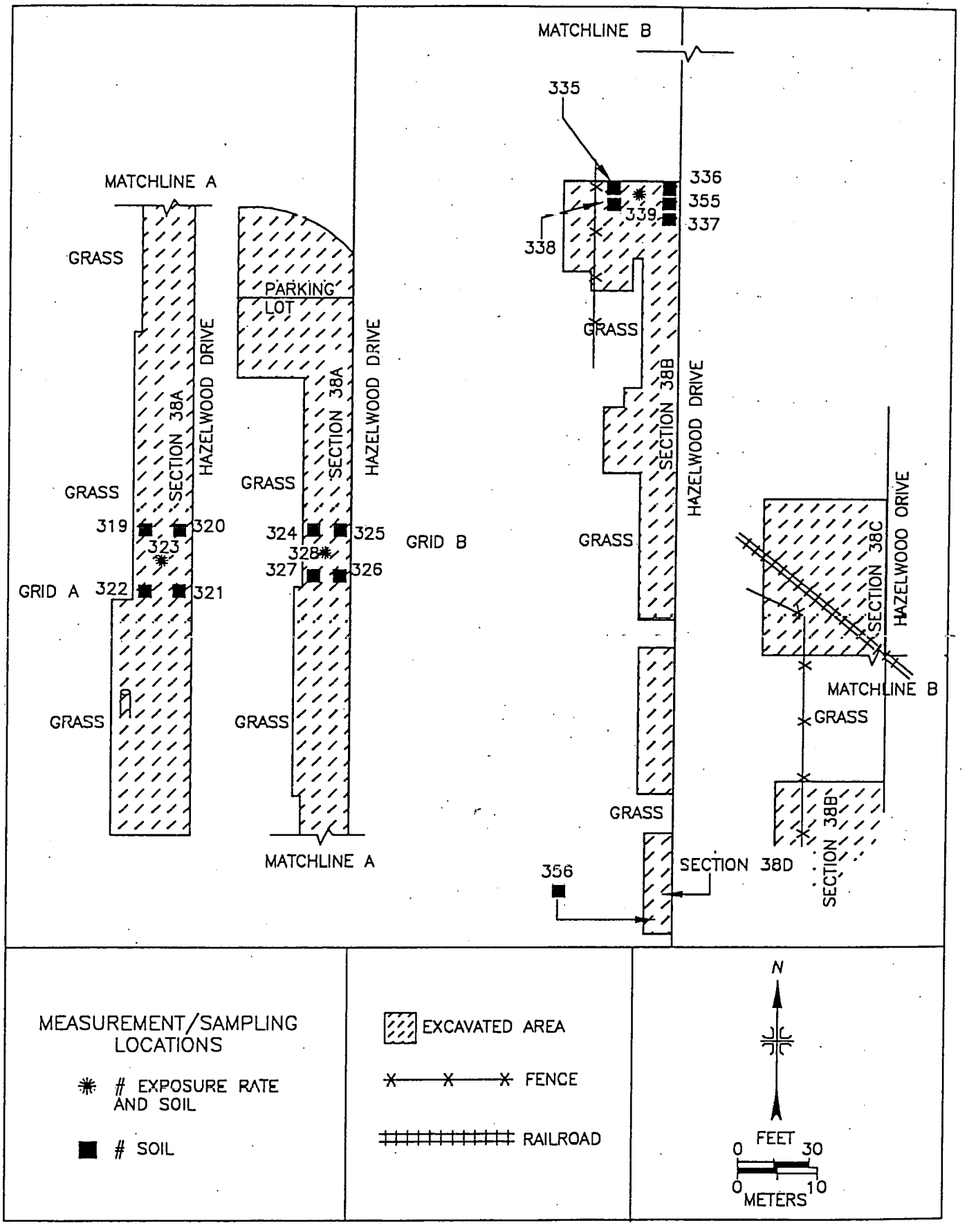


FIGURE 2: SLAPS Vicinity Properties, Property 38 – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 38
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Section A, Grid A				
319	—	0.8 ± 0.1[c]	<4.6	1.2 ± 0.4
320	—	1.7 ± 0.2	3.7 ± 3.7	2.2 ± 0.4
321	—	1.4 ± 0.1	10.7 ± 3.8	1.9 ± 0.4
322	—	0.8 ± 0.1	<4.2	1.1 ± 0.4
323	11	0.7 ± 0.1	<4.4	1.0 ± 0.5
Section A, Grid B				
324	—	1.0 ± 0.1	27.6 ± 5.9	1.7 ± 0.5
325	—	1.0 ± 0.1	4.5 ± 3.2	1.5 ± 0.4
326	—	1.3 ± 0.1	20.1 ± 4.8	3.2 ± 0.6
327	—	0.9 ± 0.1	6.3 ± 3.6	1.2 ± 0.4
328	9	0.8 ± 0.1	<4.4	1.5 ± 0.4
100 m^2 Average			<12.6	
Sections B and D				
335	—	0.9 ± 0.1	<4.9	1.3 ± 0.5
336	—	0.9 ± 0.1	<4.5	1.0 ± 0.4
337	—	1.0 ± 0.1	11.2 ± 4.0	1.2 ± 0.4
338	—	0.8 ± 0.1	<5.1	0.9 ± 0.5
339	10	0.9 ± 0.1	<4.5	1.1 ± 0.4
PRA 355[d]	—	0.9 ± 0.1	<4.8	1.1 ± 0.4
PRA 356[d]	—	0.9 ± 0.1	<4.3	1.2 ± 0.4

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.
[d]Post-remedial action samples collected by ESSAP following additional BNI remediation.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 39, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 39 on August 27 and September 10 and 11, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 39 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination extended from the boundary with Hazelwood Avenue to approximately 5 to 15 meters east of the road. Figure 2 shows the remediated portions of VP 39. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 to 1 meter below the surface. BNI then subdivided the excavated portion of the property into sections A through D, further subdividing each section into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and

sampling of the excavation. The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 39 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified one location of elevated direct gamma radiation within the VP 39, Section B excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples from four 100 m^2 areas within the VP 39 excavation. Samples were collected from the center and at four points equidistant from the center and the corners of each 100 m^2 area. One additional sample was collected from the location of elevated direct radiation identified by surface scans. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at the center location of each sampled survey unit and results are presented in Table 1. Exposure rates ranged from 8 to 12 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.7 to 1.9 pCi/g for Ra-226, less than 5.0 to 51.2 pCi/g for Th-230, and less than 0.5 to 5.1 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Seven samples exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. One sample in Section B and one in Section C exceeded

the subsurface guideline. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The maximum Th-230 concentration was below the hot spot criteria and the average Th-230 concentration was less than 14.0 pCi/g for Section B and less than 11.6 pCi/g for Section C, which satisfied the subsurface guidelines.

In summary, verification surveys of the property identified seven locations of undocumented residual contamination. Soil samples from two of these locations exceeded the subsurface guideline for Th-230. However, application of the 100 m^2 averaging guideline and the hot spot criteria indicates that the radiological status of VP 39 satisfies the applicable guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

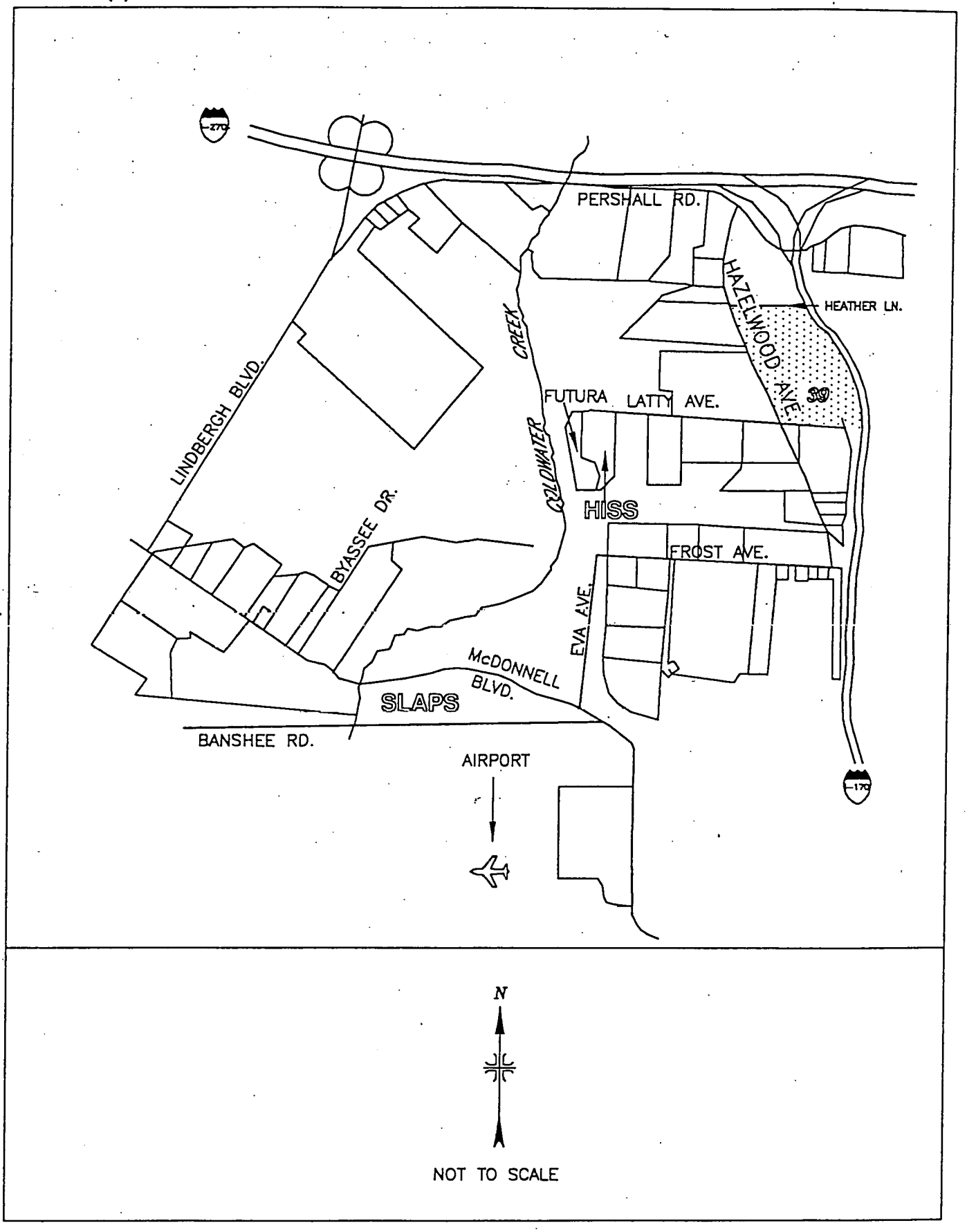


FIGURE 1: Location of SLAPS Vicinity Property Number 39

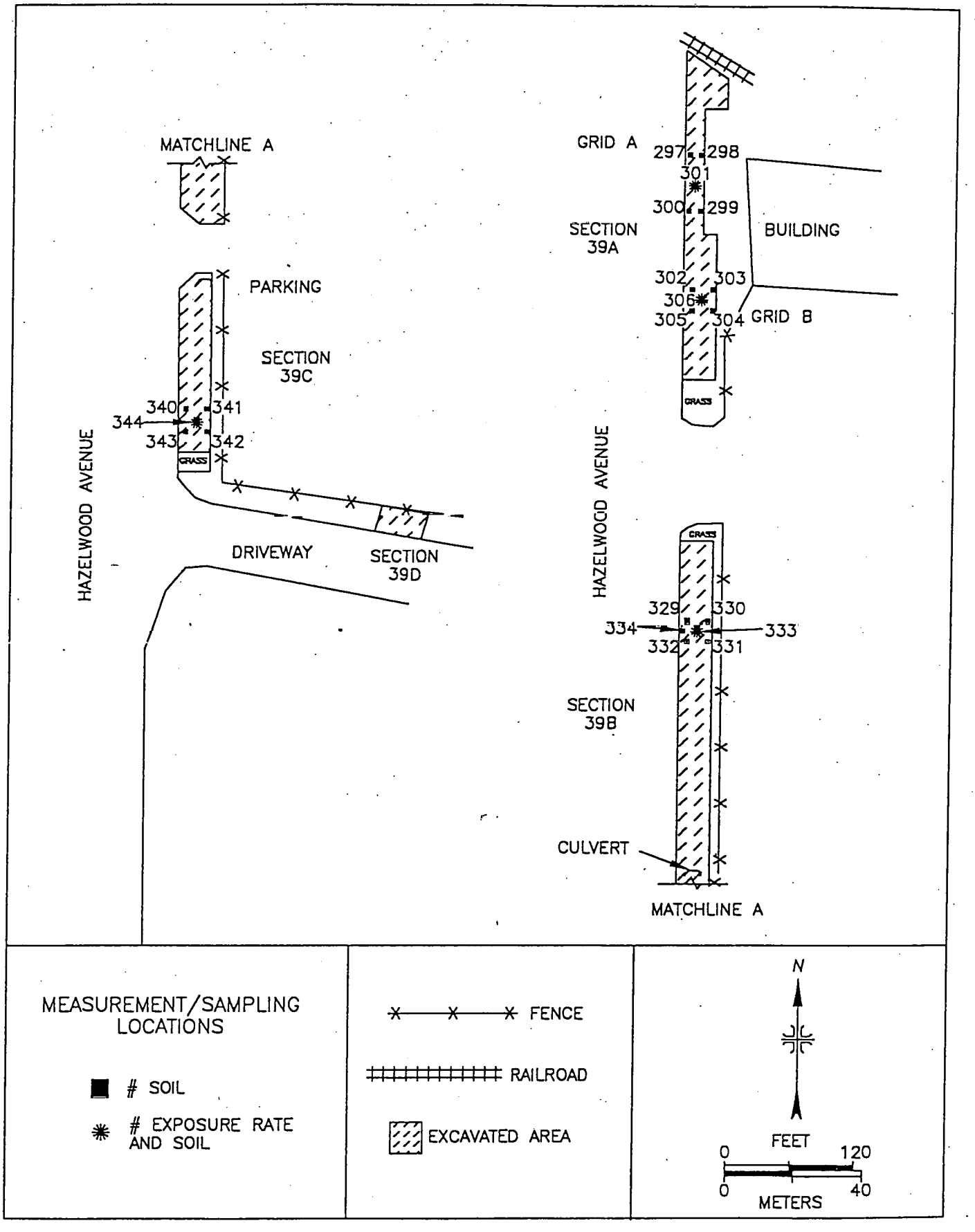


FIGURE 2: SLAPS Vicinity Properties, Property 39 – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 39
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Section A, Grid A				
297	—	1.4 ± 0.1[c]	<4.4	5.1 ± 0.6
298	—	1.1 ± 0.1	<5.0	1.7 ± 0.5
299	—	1.0 ± 0.1	<4.3	1.0 ± 0.4
300	—	1.2 ± 0.1	7.8 ± 3.7	1.3 ± 0.4
301	12	1.0 ± 0.1	<4.1	1.0 ± 0.4
Section A, Grid B				
302	—	1.0 ± 0.1	<4.2	1.1 ± 0.4
303	—	1.1 ± 0.1	<4.5	0.9 ± 0.4
304	—	1.0 ± 0.1	7.1 ± 3.7	<0.5
305	—	1.0 ± 0.1	<4.6	1.1 ± 0.4
306	9	1.0 ± 0.1	<4.1	<0.4
Section B				
329	—	0.8 ± 0.1	7.6 ± 4.1	1.6 ± 0.6
330	—	0.7 ± 0.1	<4.5	1.1 ± 0.4
331	—	0.7 ± 0.1	5.2 ± 4.3	0.8 ± 0.4
332	—	0.8 ± 0.1	11.4 ± 3.7	1.0 ± 0.4
333	8	0.7 ± 0.1	<4.1	1.1 ± 0.4
334	—	1.9 ± 0.2	51.2 ± 4.9	3.4 ± 0.4
100 m^2 Average			<14.0	

TABLE 1 (continued)

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 39
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Section C				
340	—	1.0 ± 0.1	<4.2	1.8 ± 0.5
341	—	0.8 ± 0.1	4.2 ± 3.3	1.0 ± 0.4
342	—	0.9 ± 0.1	5.5 ± 3.7	0.9 ± 0.5
343	—	1.5 ± 0.1	40.1 ± 5.8	2.1 ± 0.5
344	10	0.9 ± 0.1	<4.1	1.1 ± 0.4
100 m^2 Average			<11.6	

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

U.S. Department of Energy. Memorandum from J. Fiore to L. Price, "Uranium Cleanup Guidelines for St. Louis, MO, FUSRAP Sites." November 6, 1990b.

ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 40, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 40 on August 7, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 40 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 5 to 10 meters west of the road. Figure 2 shows the remediated portions of VP 40. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then subdivided the excavated portion of the property into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of BNI's post-RA survey and sampling indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 40 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified two locations of elevated direct gamma radiation within the VP 40 excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples from two grid blocks. These samples were collected from the center and four points equidistant from the center and the corners of each 100 m^2 area. Additionally, two samples were collected from the locations of elevated gamma radiation. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at each soil sampling location and results are presented in Table 1. Exposure rates ranged from 8 to 12 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in initial soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: less than 0.1 to 13.0 pCi/g for Ra-226, less than 5.3 to 870 pCi/g for Th-230, and less than 1.5 to 3.0 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Ten soil samples exceeded the surface guideline for Th-230, two of which also exceeded the Ra-226 surface guideline. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. Eight samples exceeded the subsurface guideline for Th-230. As a result, BNI excavated additional soil from the two grid blocks. ESSAP then performed additional verification activities of these grid blocks on a subsequent survey visit that included gamma surface scans, exposure rate measurements, and collection of soil samples. Measurement and sampling locations are also shown on Figure 2.

Radionuclide concentrations in these post-RA samples are also presented in Table 1. After the additional remediation, final concentration ranges were 1.0 to 2.2 pCi/g for Ra-226, less than 5.0 to 8.3 pCi/g for Th-230, and less than 1.5 to 1.8 pCi/g for U-238. Of the final samples, one sample in grid B exceeded the applicable subsurface guideline for Th-230. However, the guidelines permit averaging residual radionuclide concentration levels over an area of 100 m^2 and application of the hot spot criteria. The maximum Th-230 concentration was below the hot spot criteria and the average Th-230 concentration of post-RA samples was 13.1 for Grid B, which satisfied the subsurface guideline.

Additionally, ESSAP's gamma scans following the additional remediation identified one location of elevated direct gamma radiation in Grid C, location 309. The Th-230 concentration for this location exceeded the subsurface guideline at 49.9 pCi/g (Table 1). BNI, based on their own lab results, further remediated the area around sample location 309 and collected five soil samples within an approximately 25 m^2 area (Figure 3). BNI sent the samples to ESSAP and analytical results are also summarized in Table 1. One BNI sample exceeded the subsurface guideline, however, the average of 10.3 pCi/g satisfied the subsurface guideline.

In summary, verification surveys of the property identified locations of undocumented residual contamination within two grid block excavations. Eight soil samples exceeded the subsurface guideline requiring BNI to perform additional remediation. Follow-up investigations of these locations indicated that the average Th-230 concentration in subsurface soil was less than the applicable guidelines and the radiological status of the property satisfied the guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
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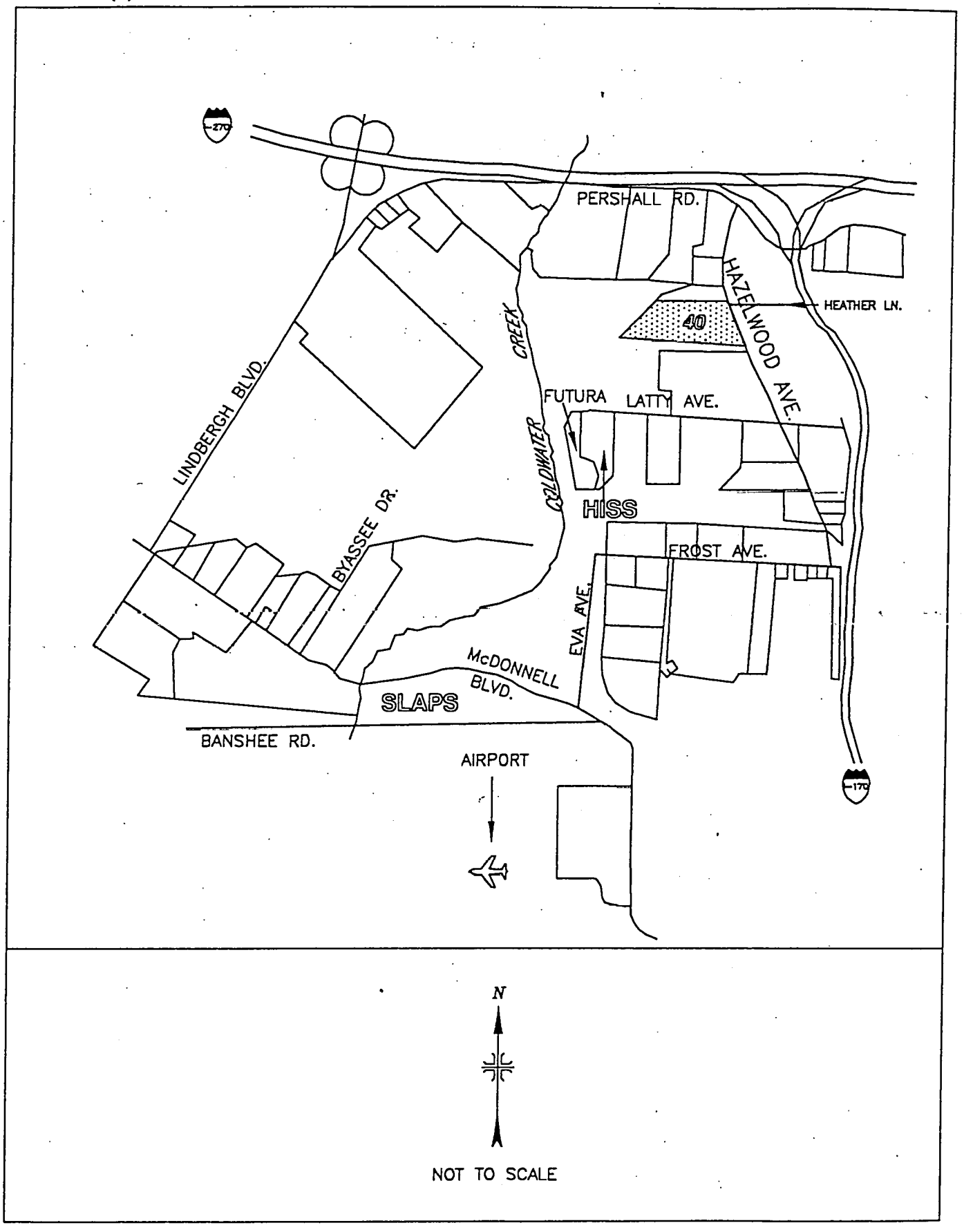

FIGURE 1: Location of SLAPS Vicinity Property Number 40

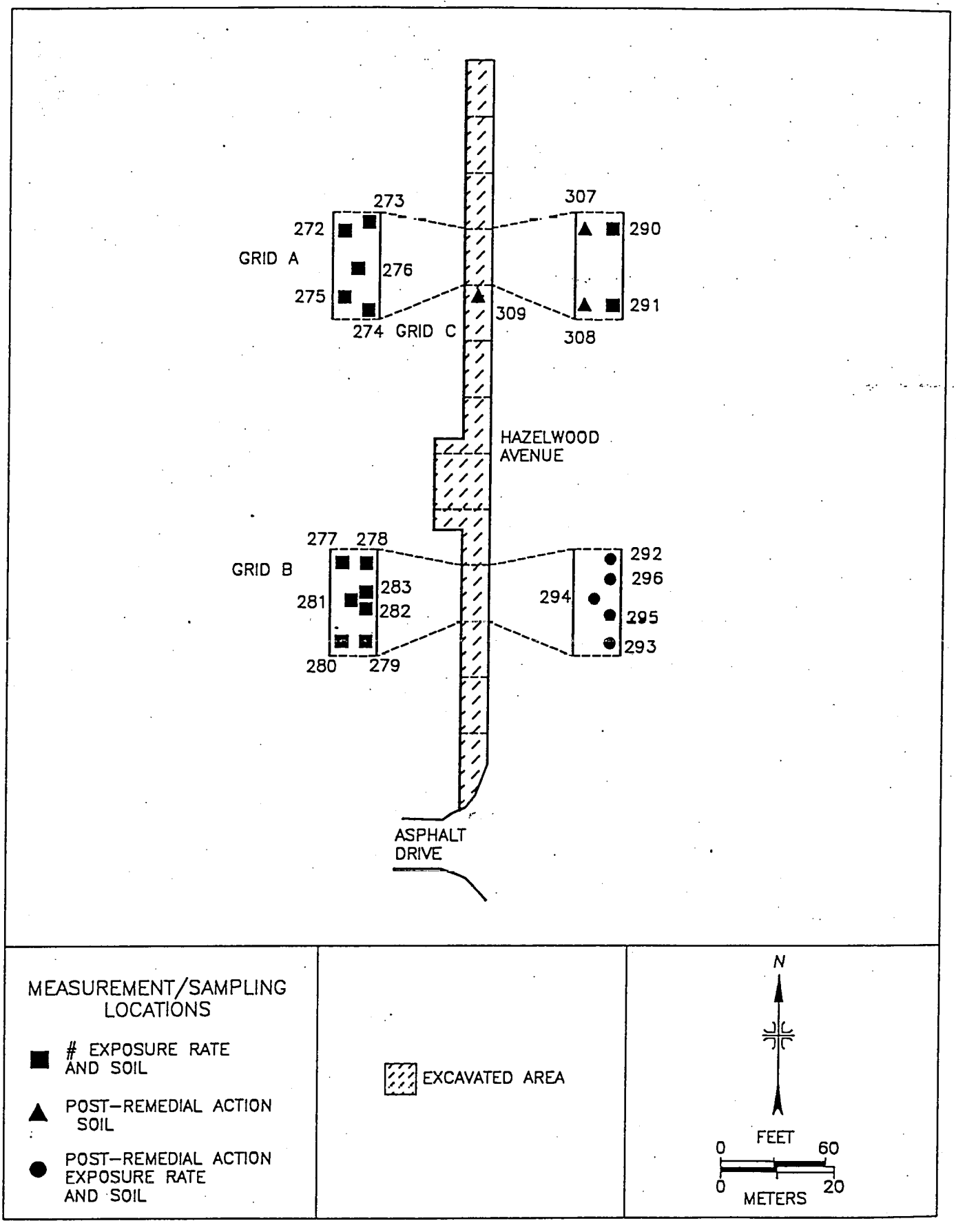

FIGURE 2: SLAPS Vicinity Properties, Property 40 – Measurement and Sampling Locations

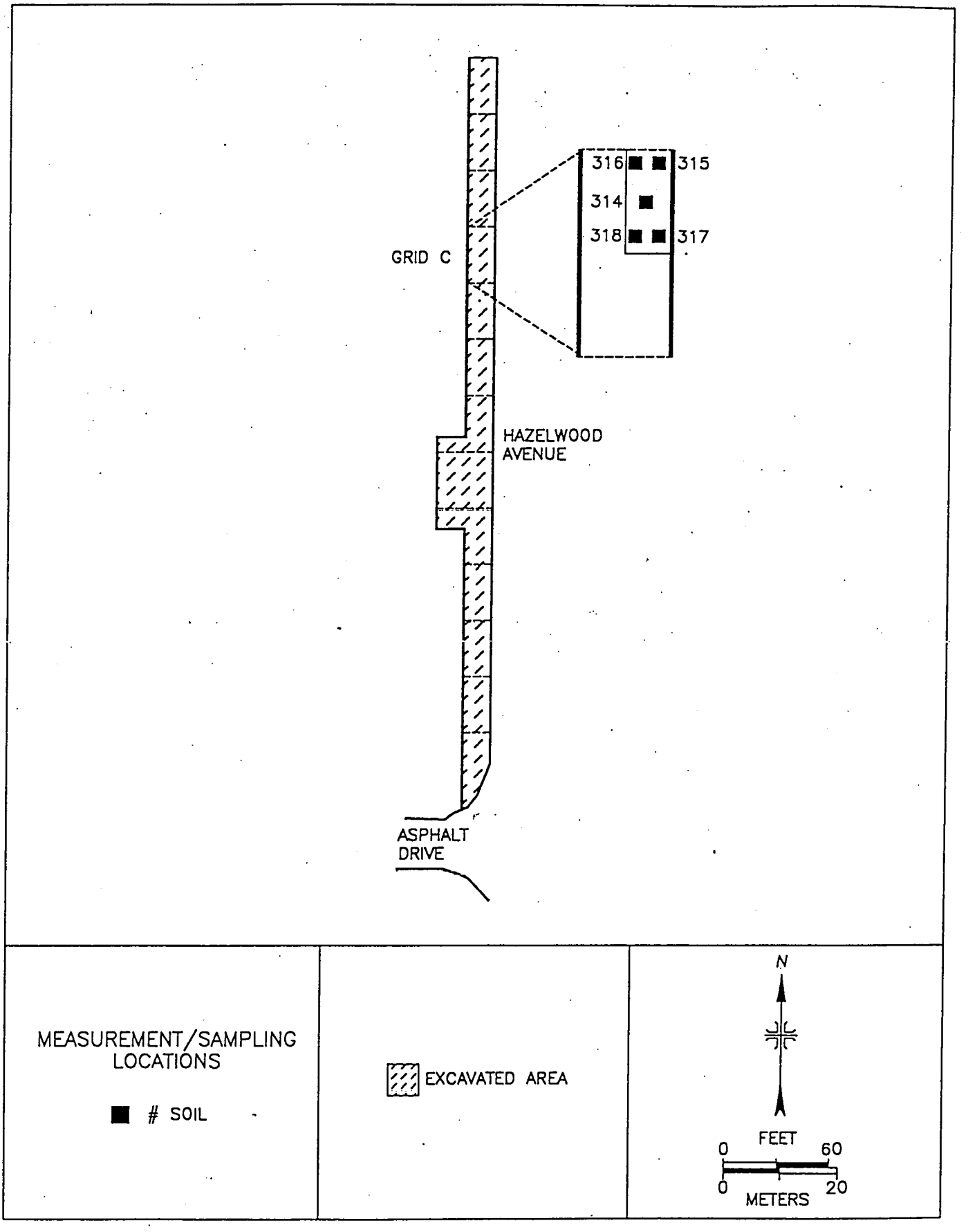

FIGURE 3: SLAPS Vicinity Properties, Property 40 – BNI Additional Remediation Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 40
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Grid Block A				
272	9	<0.1	6.3 ± 4.0[c]	<0.6
273	8	2.6 ± 0.4	114 ± 13	<0.9
274	12	3.2 ± 0.3	166 ± 11	3.0 ± 0.6
275	11	0.8 ± 0.1	<4.0	1.1 ± 0.3
276	9	1.1 ± 0.1	15.4 ± 3.9	1.1 ± 0.4
PRA[d] 290	9	1.9 ± 0.2	8.3 ± 4.8	1.8 ± 0.9
PRA 291	10	1.1 ± 0.1	<4.5	<1.5
PRA 307	N/A	1.0 ± 0.1	<4.5	<0.5
PRA 308	N/A	1.1 ± 0.2	<5.0	<0.5
Grid Block B				
277	10	1.1 ± 0.1	9.0 ± 3.9	1.1 ± 0.4
278	9	1.7 ± 0.1	48.7 ± 5.5	1.7 ± 0.4
279	8	1.4 ± 0.1	33.5 ± 4.6	1.4 ± 0.4
280	10	1.0 ± 0.1	<5.3	<0.5
281	12	1.3 ± 0.2	18.2 ± 4.3	<0.7
282	11	13.0 ± 1.0	870 ± 48	1.8 ± 0.9
283	11	10.3 ± 1.4	580 ± 63	<1.5

TABLE 1 (continued)

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 40
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
Grid Block B (continued)				
PRA 292	8	1.3 ± 0.1	10.4 ± 4.2	1.5 ± 0.5
PRA 293	10	1.3 ± 0.1	13.2 ± 4.4	1.4 ± 0.4
PRA 295	10	1.8 ± 0.2	32.1 ± 5.0	1.8 ± 0.4
PRA 296	9	1.2 ± 0.2	5.7 ± 3.9	<0.7
100 m² Average of PRA Samples			13.1	
Grid Block C				
PRA 309	N/A	2.2 ± 0.2	49.9 ± 6.4	1.7 ± 0.5
BNI[c] 314	N/A	2.3 ± 0.3	9.9 ± 5.1	2.7 ± 0.6
BNI 315	N/A	1.6 ± 0.1	19.3 ± 5.6	2.1 ± 0.6
BNI 316	N/A	1.3 ± 0.1	6.5 ± 3.9	2.0 ± 0.4
BNI 317	N/A	1.7 ± 0.1	12.3 ± 4.7	2.4 ± 0.5
BNI 318	N/A	0.9 ± 0.1	3.9 ± 3.4	1.1 ± 0.4
100 m² Average of BNI Samples			10.3	

[a]Refer to Figures 2 and 3.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.
[d]Post-remedial action samples collected by ESSAP following additional BNI remediation.
[e]Post-remedial action samples collected by BNI and sent to ESSAP for comparative analysis.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

U.S. Department of Energy (DOE). Radiation Protection of the Public and Environment. Washington, DC: DOE Order 5400.5. June 5, 1990a.

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ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

December 22, 1997

U.S. Army Corp of Engineers
ATTN: CEMVS-PM-M
Mr. David Leake
1222 Spruce Street
St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 42, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification activities at the SLAPS Vicinity Property (VP) No. 42 on August 7, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 42 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 5 meters west of the road. Figure 2 shows the remediated portions of VP 42. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then subdivided the excavated portion of the property into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of BNI's post-RA survey and sampling

indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 42 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified one location of elevated direct gamma radiation within the VP 42 excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples within the excavation. These samples were collected from the center and four points equidistant from the center and the corners of the 100 m^2 area. Additionally, one sample was collected from the location of elevated gamma radiation. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at each soil sampling location and results are presented in Table 1. Exposure rates ranged from 7 to 12 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in initial soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.8 to 7.1 pCi/g for Ra-226, less than 4.4 to 400 pCi/g for Th-230, and less than 0.6 to 5.9 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

Three soil samples exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. One sample exceeded the subsurface guideline for Th-230 and the surface guideline for Ra-226. As a result, BNI excavated additional soil from the location. ESSAP then performed additional verification activities of this location on a subsequent

survey visit that included gamma surface scans, an exposure rate measurement, and collection of a soil sample. Radionuclide concentrations in the post-RA sample are also presented in Table 1. After the additional remediation, final concentrations were 1.4 pCi/g for Ra-226, less than 4.2 pCi/g for Th-230, and less than 0.5 pCi/g for U-238.

In summary, verification surveys of the property identified four locations of undocumented residual contamination. Three of these locations exceeded the surface guideline for Th-230 but satisfied the applicable subsurface guideline. The fourth location exceeded the subsurface guideline and required BNI to perform additional remediation. Follow-up investigations of this location indicated that the radiological status of the property satisfied the guidelines for release for unrestricted use. However, it should be noted that the verification surveys did identify areas of residual contamination most likely due to BNI's post-remedial action sampling methods and insensitivity of field instrumentation to detect Th-230 at guideline levels. ESSAP had previously provided comments on the post-remedial action survey methods to BNI for their resolution. As a result of these concerns not being addressed, it is ESSAP's opinion that other small areas of residual Th-230 in excess of 15 pCi/g may remain on the property. A draft report will be prepared following the receipt of BNI's post-remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
E. Abelquist, ORISE/ESSAP
K. Albin, BNI
File/391

391-036 (2)

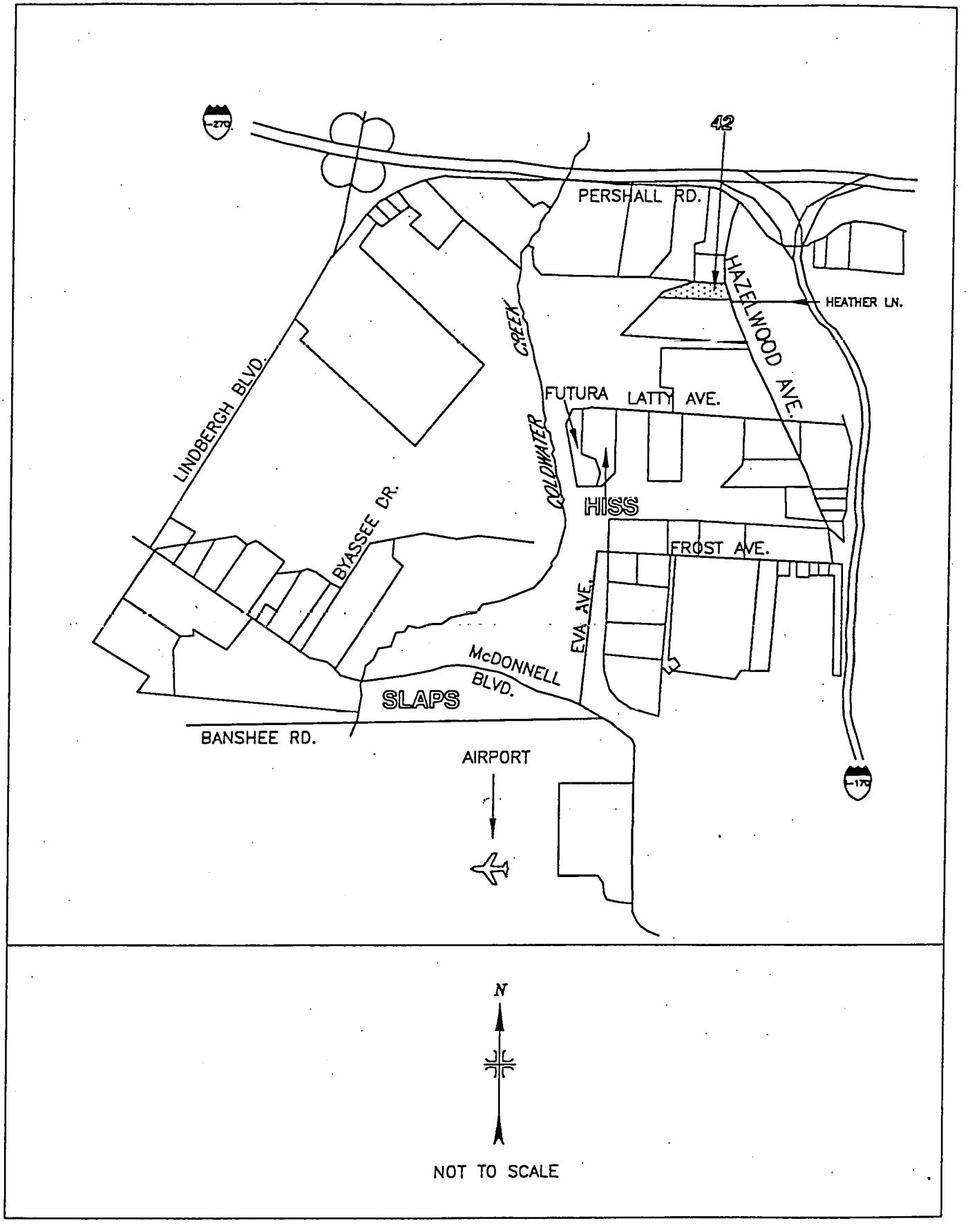

FIGURE 1: Location of SLAPS Vicinity Property Number 42

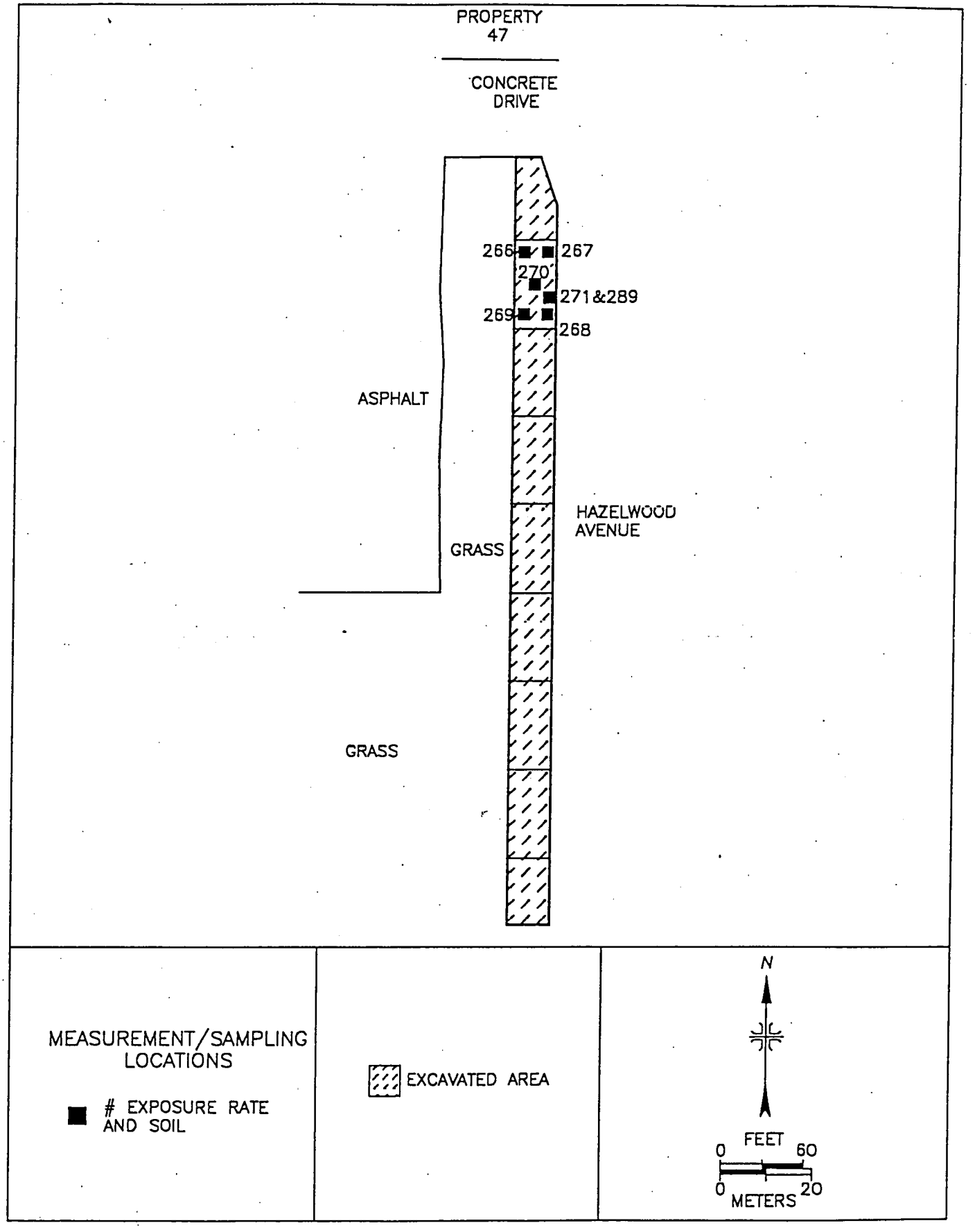

FIGURE 2: SLAPS Vicinity Properties, Property 42 – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 42
HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentration (pCi/g)[b]		
		Ra-226	Th-230	U-238
266	10	0.8 ± 0.1[c]	2.6 ± 3.3	<0.6
267	10	0.9 ± 0.1	<4.4	1.2 ± 0.4
268	11	1.3 ± 0.1	11.6 ± 4.2	1.6 ± 0.4
269	10	1.0 ± 0.1	8.3 ± 3.7	0.9 ± 0.5
270	10	1.0 ± 0.1	11.7 ± 4.3	1.4 ± 0.5
271	12	7.1 ± 0.5	400 ± 23	5.9 ± 0.9
289 (After additional remediation of Location 271)	7	1.4 ± 0.2	<4.2	<0.5

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Draft Reports-Verification Surveys of Properties 19, 20, 41, 43, 44, and 45, St. Louis Airport Site Vicinity Properties, Hazelwood and Berkeley, Missouri. Oak Ridge, TN; February 23, 1996.

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St. Louis, Missouri 63103

SUBJECT: INTERIM LETTER REPORT—VERIFICATION SURVEY OF THE ST. LOUIS AIRPORT SITE (SLAPS) VICINITY PROPERTY NO. 47, HAZELWOOD, MISSOURI

Dear Mr. Leake:

The Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) conducted verification survey activities at the SLAPS Vicinity Property (VP) No. 47 on August 6, 1997. Verification surveys were performed in support of the remedial actions that Bechtel National, Inc. (BNI), the Formerly Utilized Sites Remedial Action Program project management contractor, performed for a number of the SLAPS VPs during Fiscal Year 1997.

SLAPS was acquired by the Manhatten Engineer District (MED) and operated from 1946 to 1966. The site was used for storage of waste materials that were generated during uranium processing from 1942 until the late 1950s at the Mallinckrodt facility, located in downtown St. Louis. These processing wastes, which consisted of pitchblende raffinate residues, radium-bearing residues, and barium sulfate cake, were purchased by Continental Mining and Milling Company of Chicago in 1966 and, subsequently, transported to 9200 Latty Avenue for storage under an Atomic Energy Commission (AEC) license. During transit, some of the materials spilled onto the haul roads and contiguous properties, primarily collecting in the drainage ditches. The haul roads used for transport to the Latty Avenue storage site and other sites included McDonnell Boulevard (formerly Brown Avenue), Hazelwood Avenue, Pershall Road, Eva Avenue, Frost Avenue, and Latty Avenue.

VP 47 is located on Hazelwood Avenue in Hazelwood, Missouri (Figure 1). Soil contamination was confined to the right-of-way portion of the property and extended from the boundary with Hazelwood Avenue to approximately 5 meters west of the road. Figure 2 shows the remediated portions of VP 47. BNI remediated the contaminated soil from the property to a depth of approximately 0.5 meters below the surface. BNI then subdivided the excavated portion of the property into approximately 100 m^2 survey units and performed post-remedial action (post-RA) surveys and sampling of the excavation. The results of BNI's post-RA survey and sampling

indicated that contaminants had been reduced to levels below the acceptable residual contamination guidelines.

ESSAP performed independent verification surveys of VP 47 following the completion of remedial activities and upon the receipt of BNI's post-RA data. Independent verification is performed in order to provide independent survey and analytical data for use in determining the adequacy and accuracy of the BNI conclusions as to the remediated area's status. Verification activities included review of BNI's post-RA data, gamma surface scans using NaI scintillation detectors coupled to ratemeters with audible indicators, exposure rate measurements, and soil sampling.

Surface scans identified one location of slightly elevated direct gamma radiation on the west wall of the excavation. ESSAP personnel collected five systematic surface (0-15 cm) soil samples within the excavation. Samples were collected from the center and at four points equidistant from the center and the corners of a 100 m^2 area. Additionally, one sample was collected from the location of elevated gamma radiation. Sample locations are shown on Figure 2. Exposure rate measurements using a microrem meter were performed at 1 meter above the surface at each soil sampling location and results are presented in Table 1. Exposure rates ranged from 8 to 11 μR/h and were comparable to background exposure rates obtained during previous SLAPS vicinity property surveys, which ranged from 9 to 10 μR/h (ORISE 1996).

Soil samples were analyzed by solid-state gamma spectrometry and the spectra were reviewed for the contaminants of interest, which were Ra-226, Th-230, and U-238. Radionuclide concentrations in soil samples, including background, are summarized in Table 1. Concentration ranges were as follows: 0.9 to 1.0 pCi/g for Ra-226, less than 4.0 to 12.6 pCi/g for Th-230, and 0.8 to 1.3 pCi/g for U-238. The previously determined average background radionuclide concentrations in soil were 0.9 pCi/g for Ra-226, 1.31 pCi/g for Th-230, and 1.1 pCi/g for U-238 (ORISE 1996).

Sample results were then compared to the generic and site-specific soil concentration guidelines (DOE 1990a and 1990b). These guidelines are as follows:

Radionuclide	Soil Concentration Above Background
Ra-226, Th-230	5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g averaged over 15 cm thick layers of soil greater than 15 cm below the surface.
U-238	50 pCi/g

One soil sample exceeded the surface guideline for Th-230. Because the surface these samples were collected from was originally, and will be again following backfill, at a depth of greater than 15 cm, the subsurface guidelines are applicable. All residual radionuclide levels satisfied the subsurface guideline.

In summary, the radiological status of VP 47 satisfied the applicable guidelines for release for unrestricted use. A draft report will be prepared following the receipt of BNI's post-RA remedial action report. In the interim, please contact me at (423) 576-5073 or Eric Abelquist at (423) 576-3740 should you have any questions, comments, or require additional information.

Sincerely,

Timothy J. Vitkus
Survey Projects Manager
Environmental Survey and Site
Assessment Program

TJV/mdt

Enclosure

cc: W. Beck, ORISE/ESSAP
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391-033 (1)

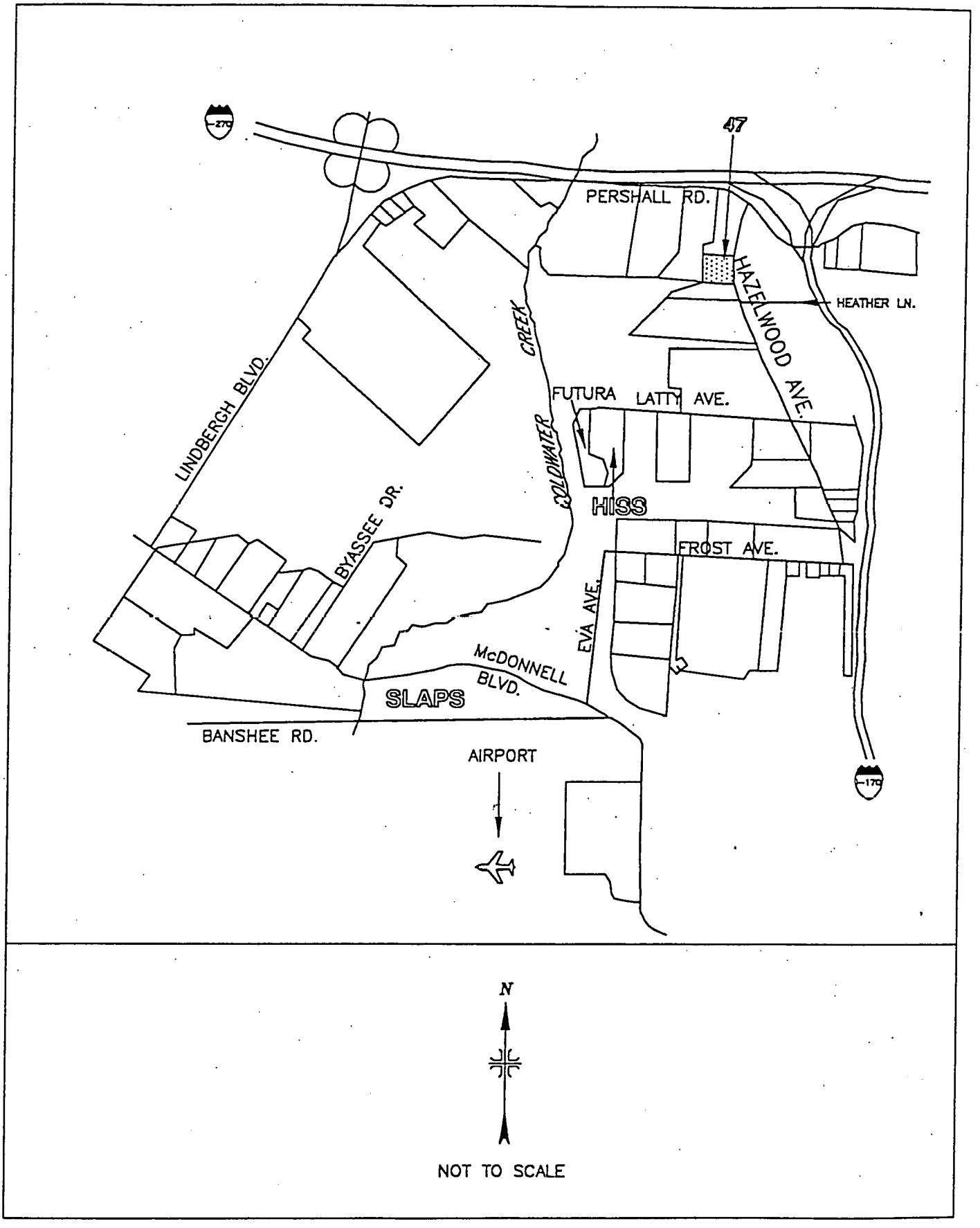

FIGURE 1: Location of SLAPS Vicinity Property Number 47

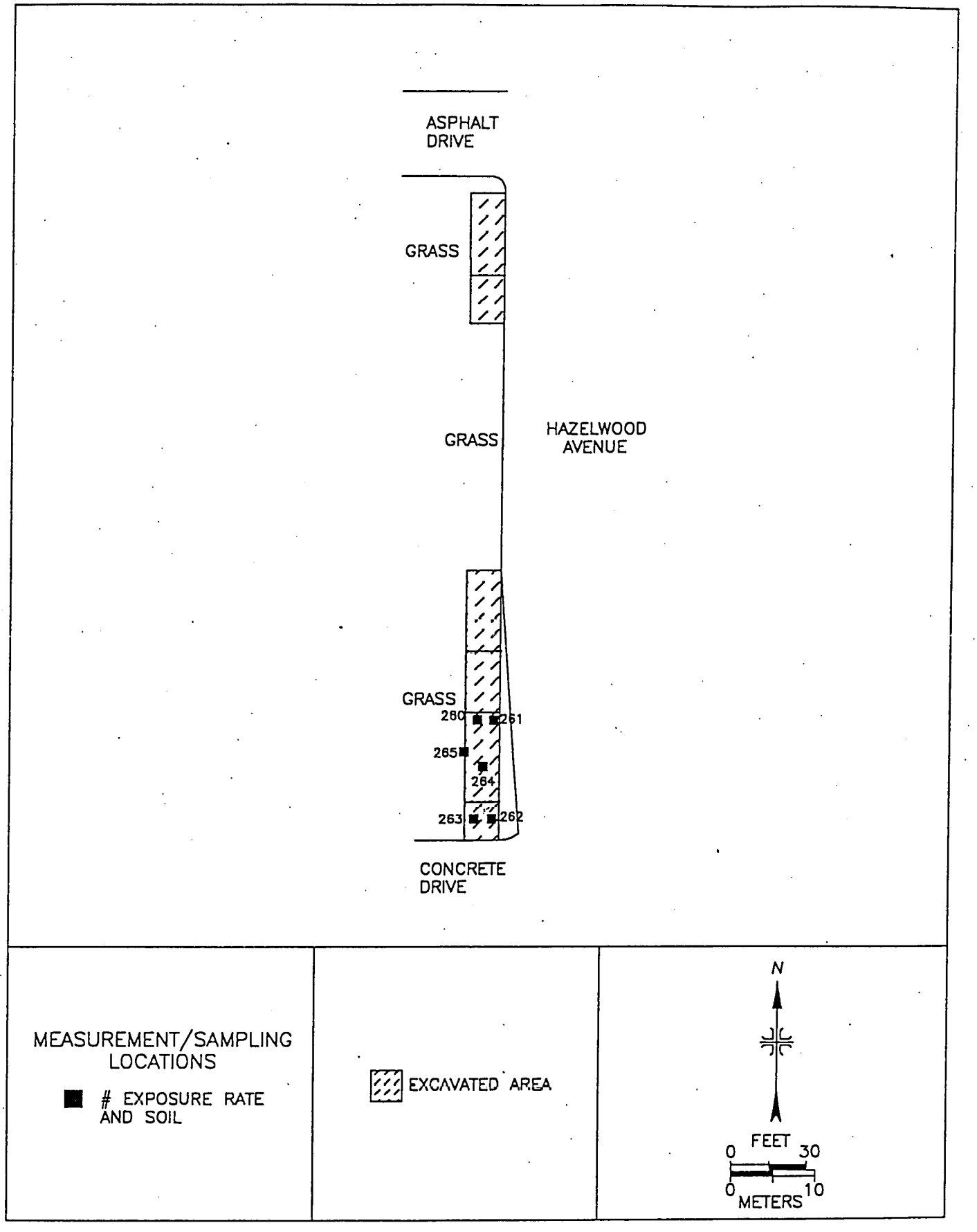

FIGURE 2: SLAPS Vicinity Properties, Property 47 – Measurement and Sampling Locations

TABLE 1

EXPOSURE RATES AND RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES ST. LOUIS AIRPORT SITE VICINITY PROPERTY NUMBER 47 HAZELWOOD, MISSOURI

Sample Location[a]	Exposure Rates at 1 m (μR/h)[b]	Radionuclide Concentrations (pCi/g)[b]		
		Ra-226	Th-230	U-238
260	8	0.9 ± 0.1[c]	<4.0	0.8 ± 0.3
261	9	1.0 ± 0.1	4.0 ± 2.8	1.3 ± 0.3
262	11	0.9 ± 0.1	6.4 ± 3.1	1.0 ± 0.4
263	10	1.0 ± 0.1	12.6 ± 3.3	1.2 ± 0.4
264	10	1.0 ± 0.1	6.3 ± 3.8	1.3 ± 0.4
265	10	0.9 ± 0.1	6.0 ± 3.6	1.0 ± 0.3

[a]Refer to Figure 2.
[b]Results include background.
[c]Uncertainties represent the 95% confidence level, based only on counting statistics.

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Formerly Utilized Sites Remedial Action Program (FUSRAP)

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