Gamma Survey Data Evaluation Report

Rev 1

prepared for

Westinghouse

WESTINGHOUSE ELECTRIC COMPANY
Hematite, Missouri

prepared by

SAIC
An Employee-Owned Company

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
St. Louis, Missouri

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ACRONYMS	
^{99}Tc	Technicium-99
AOC	Area of concern
ATV	All terrain vehicle
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cm	Centimeter
cpm	Counts per minute
DQOs	Data quality objectives
ft	Feet
GIS	Geographic information system
GPS	Global positioning system
GWS	Gamma walkover survey
HSA	Historical Site Assessment
HEU	High enriched uranium
HF	Hydrogen fluoride gas
LEU	Low enriched uranium
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDNR	Missouri Department of Natural Resources
QA	Quality assurance
QC	Quality control
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SAIC	Science Applications International Corporation
UF_6	Uranium hexafluoride

1.0 INTRODUCTION

The Westinghouse Electric Corporation, LLC (Westinghouse) nuclear fuel manufacturing facility at Hematite, Missouri ceased operation in June 2001 after nearly 47 years under various owners and operators. Westinghouse now seeks to decommission the plant and release the property. The United States Nuclear Regulatory Commission (NRC) is the primary agency for the plant decommissioning. The Missouri Department of Natural Resources (MDNR) is the primary regulatory agency for the remedial investigation/feasibility study (RI/FS) that is being performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Both agencies are expected to provide critical roles in defining the regulatory path to decontamination and decommissioning, site assessment and remediation, and eventual release.

This gamma walkover survey was conducted as an initial phase of the RI/FS at the site and, as such, MDNR provided oversight for this work. MDNR representatives were on-site on a daily basis, attended the daily meetings, and observed work being performed. Typically there was only one representative present at a time and there were times when activities were occurring in more than one location.

The plant is located on approximately 228 acres of property (Property) that is currently owned by Westinghouse. The plant and production related activities are located on approximately 8 acres of the Property.

1.1 SURVEY PURPOSE

Science Applications International Corporation (SAIC) performed a Gamma Walkover Survey (GWS) at the Hematite Facility (Figure 1) during the period April 7-24, 2003 in accordance with the *Gamma Survey Plan for the Hematite Site* (Survey Plan (Rev 0)). The purpose of the GWS was to identify the presence of low level gamma radiation that could indicate the presence of uranium including natural uranium, low enriched uranium (LEU), high enriched uranium (HEU), and thorium 232 (Th-232) and progeny in surface soils. For the purposes of this report, surface soils are defined as the thickness of soil that can be measured using direct measurement or scanning techniques (MARSSIM). Typically, this layer is represented as the top 15cm (6 inches) of soil (40 CFR 192). This information will be used to aid in area classification and future characterization planning at the site.

The survey was conducted with the intent of maximizing the use of all data collected in future site evaluations, specifically the Remedial Investigation/Feasibility study (RI/FS). The GWS has been designed to follow the guidance for scoping surveys presented in Section 5.2 of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). Although this survey was conducted to aid in classification of site areas as impacted or non-impacted, all available data must be evaluated prior to classification of the site. The GWS detection ability is limited to the gamma signature of site specific radionuclides and is typically limited to surface soils.

1.2 SURVEY SCOPE

The GWS data will assist Westinghouse in verifying the conclusions of previous Historical Site Assessments (HSA) and provide input for identifying potential sample locations as part of the Remedial Investigation (RI). Other uses of the survey data include:

1. Determining the magnitude of surface contamination in the soils immediately surrounding the plant area.

2. Determining the lateral extent of surface contamination extending out from the plant.

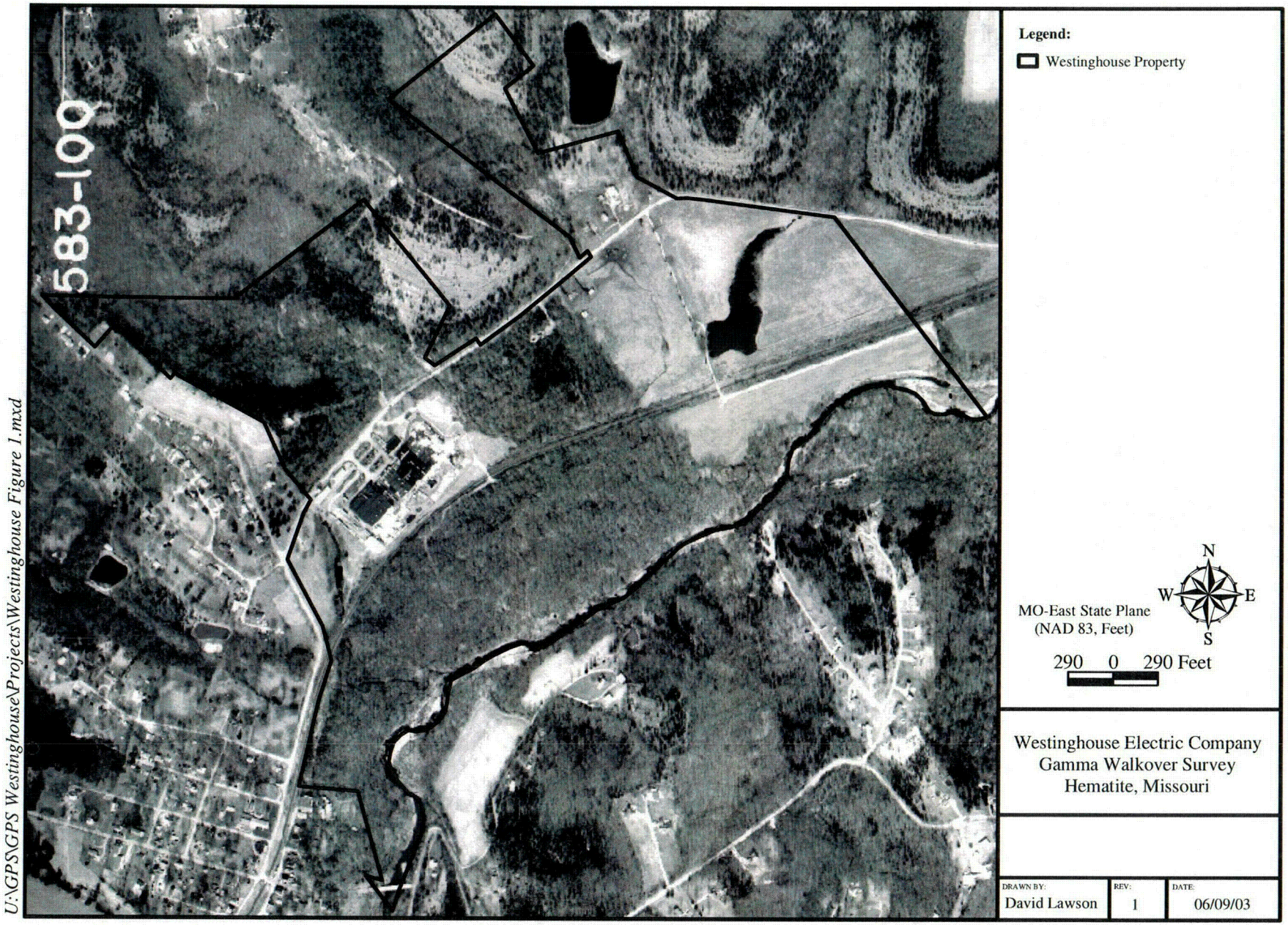

Figure 1. Westinghouse Property Map

3. Detecting, as is possible with surface gamma detectors, the presence of any burial pits and other areas of concern known or unknown to exist at this time.

4. Determining the extent, if any, of the spread of surface contamination by the existing natural migration pathways (ditches, streams, low points, surface water flow, etc.).

5. Identifying non-impacted areas that may be appropriate for obtaining reference areas samples to be used to estimate the background soil concentration for contaminants of concern at the site.

6. Providing input to future site evaluations to determine the risk posed by the uranium, and/or thorium contamination by locating areas and media impacted by the spread of contamination and determining the magnitude of the contamination present on the site.

2.0 SURVEY DESIGN AND METHODOLOGY

The survey was designed to cover 100% of the areas directly adjacent to the plant as shown on Figure 2, which includes the areas surrounding the buildings and other obstructions. It was expected that 70% of this area would be surveyed using a multi-pass conveyance and 30% by technician-conveyed global positioning system (GPS)/gamma detector assemblies. The multi-pass conveyance was planned for use over most of the grass-covered areas located outside the fence line. Technician-conveyed detectors were planned to survey the evaporation ponds, ditches, mounds, sedimentation pond, and drainages along or through the rail line, and in the densely wooded areas outside the fence line.

The survey was designed to cover approximately 10% of the remaining areas as shown on Figure 2. The survey was originally designed to be a roughly systematic survey of the remaining areas of the site. In densely wooded areas, the surveys were planned to maximize peak periods of satellite availability. The survey in the 10% coverage areas focused on locations with higher potential for detection of elevated gamma radiation levels, such as in drainage ditches, pond banks, and disturbed areas. It was expected that approximately 30% of these areas would be surveyed using a multi-pass conveyance and 70% by technician-conveyed GPS/gamma detector assemblies. The multi-pass conveyance was planned for use over the open farmland located on the eastern side of the site and the semi-open hilly site terrain located north of State Road P. The technician-conveyed GPS/gamma detector assemblies would be used to survey the remainder of these areas.

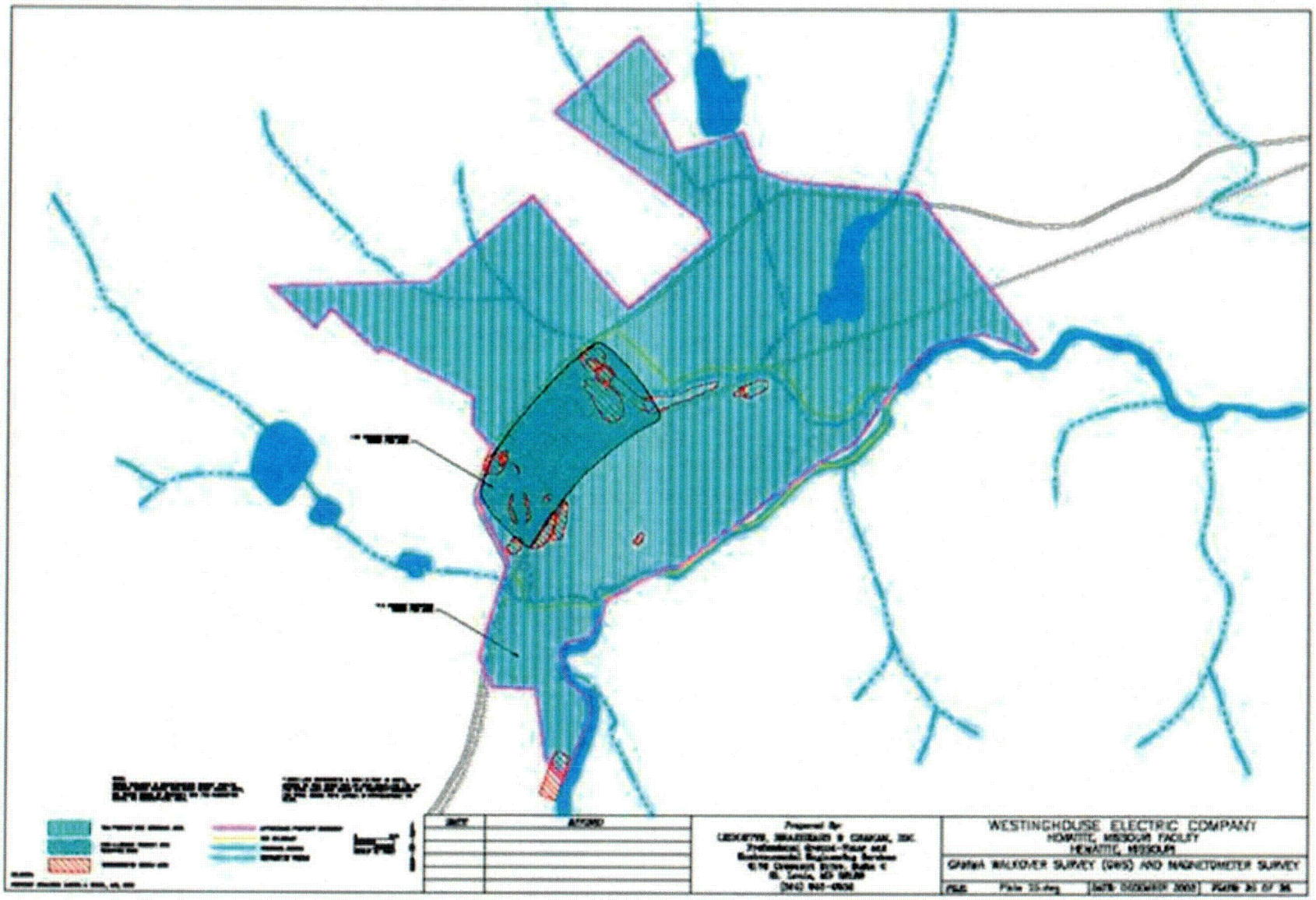

Figure 2. Initial Survey Plan

Uranium and its short-lived daughters (e.g., Th-234, Pa-234m, Th-231), as well as Thorium 232 (Th-232) short-lived daughters (e.g. Ac-228, Th-228) have associated gamma radiation. A sodium iodide scintillation detector (NaI 2"× 2") was selected to detect the gamma radiation. The NaI 2"x2" was coupled to a rate meter, which transfers detector count-rate data to a Trimble XRS (or equivalent) global positioning system (GPS) data logger. In addition, the scaler/ratemeter combinations were upgraded with Ludlum's "one-second count microchip" to achieve a gamma count for every one-second GPS position location. The 2"x2" NaI detector was selected over other radiological instrumentation for the following reasons:

- It is a multi-purpose detector capable of low and high energy gamma ray detection with no appreciable loss of low level gamma ray detection ability;
- It is rugged and durable and requires less instrument maintenance or surveyor downtime;
- It is a lighter detector resulting in less surveyor fatigue that would otherwise produce a less efficient survey;
- It can be equipped with Ludlum's "one-second count microchip" to achieve a gamma count for every one-second GPS position location;
- It allows an increased ability to pin point the source of elevated gamma signal;
- It is cost effective, less expensive to procure and maintain.

The 2"x2" NaI detector detects gamma levels from surface sources and indicates the presence of these levels in corresponding "cpm" (counts per minute) readings. The 2"x2" NaI detector has varying sensitivities to different gamma ray energies and does not distinguish the "cpm" readings for the various energies. The inability to discriminate between the different energies does not allow a direct correlation of "cpm" readings to activity in a mixed radionuclide field. Therefore, the results of the GWS are reported in "cpm".

Prior to site mobilization, Westinghouse and SAIC, with MDNR in attendance, conducted a kickoff meeting. The scope of the walkover was slightly modified as a result of the meeting in that the Property would be assessed as seven areas identified by surface water drainage boundaries or other physical features. The original 100% coverage area was slightly increased to provide coverage in areas that may have been affected by past activities at the plant. The 10% systematic coverage of the remaining portion of the Property was modified to allow for more investigational coverage. In those areas where plant related contamination was not expected, the area perimeter, disturbed areas, and any internal drainage ways were surveyed to provide data to verify the assumption that the areas were not impacted. In some areas, closer to the plant site, more systematic coverage was performed to provide data to assess potential impacts.

The modified survey areas are described below and are identified along with approximate property lines on Figure 3.

Area A – 100% Inside Fence
Area B – 100% Outside Fence
Area C – 10% South of Southern Drainage
Area D – 10% South of Rail
Area E – 10% South State Road P Between Drainages
Area F – 10% East Farm Area
Area G – 10% North of State Road P

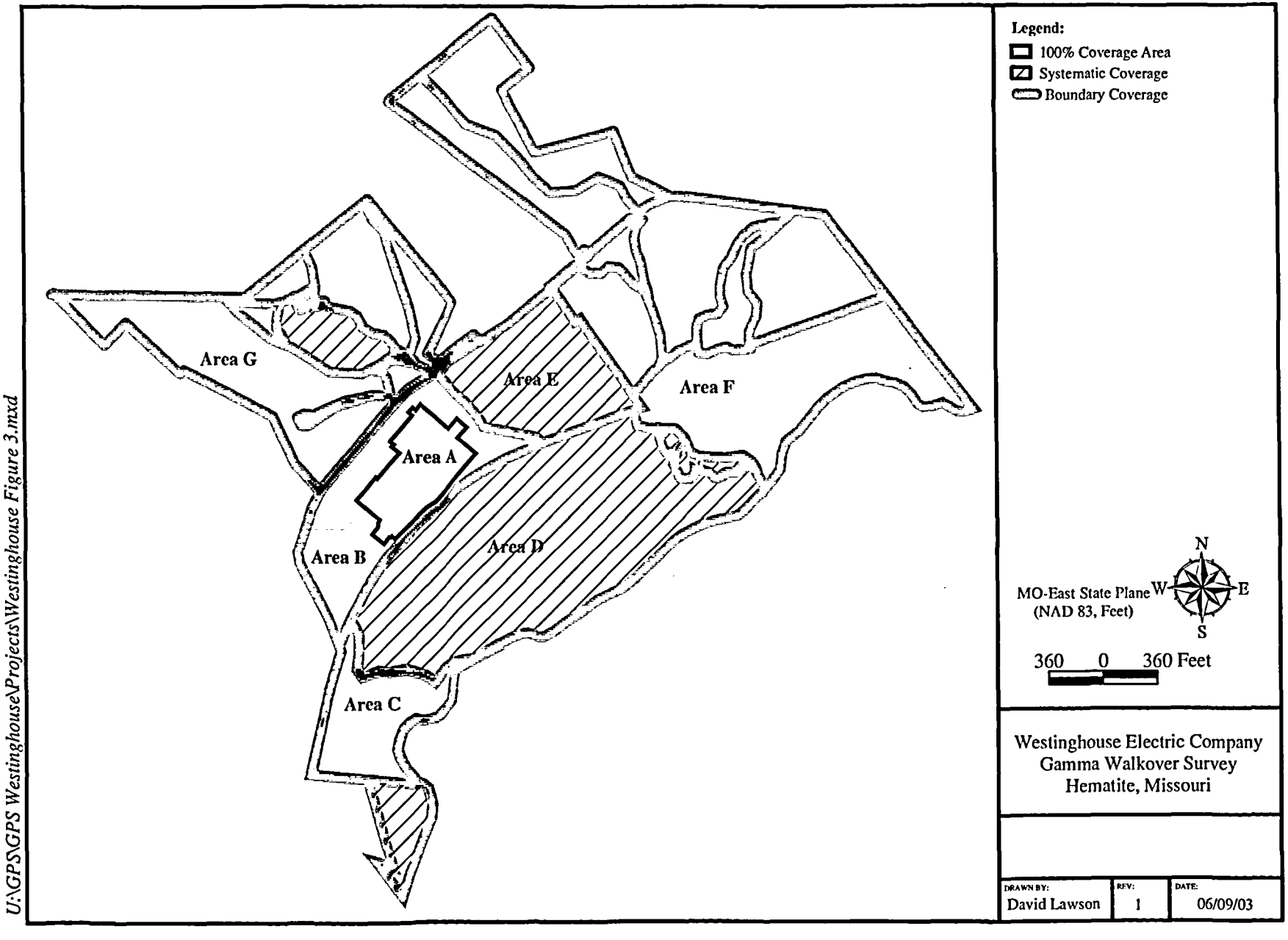

Figure 3. Final Survey Plan

During the kickoff meeting a decision was made to implement the survey by concentrating the technician-conveyed GPS/gamma detector assemblies in areas with pending overhead tree canopies. The survey team decided to conduct the technician-conveyed GPS/gamma detector survey in areas C, D, E, and G and, finally, A. This would concentrate most of the survey crew in densely wooded areas before the tree canopy developed. In addition, the survey was modified to concentrate the survey in the areas covered with the densest vegetation during times when the most satellites were available to minimize the need for manual recording of data. The all terrain vehicle- (ATV) mounted GPS/gamma detector assemblies would begin in Area B and the 100% coverage area outside the controlled area fence, followed by Areas F, G, and, finally, A.

The ATV-mounted GPS/gamma walkover was conducted by mounting three individual detectors with independent GPS assemblies to the front of the ATV. The detectors were mounted 10 centimeters (cm) from the surface, and 70 cm apart to allow for sufficient overlap of each detector's viewing window of 82 cm at the top of the detector crystal. The viewing window is defined as the area capable of contributing gamma levels to the detector in a specific geometry within acceptable scan minimum detectable concentrations. The viewing window of the 2"x2" NaI detector was based on a detector height of 10 cm, crystal dimension of 5 cm x 5 cm with the ability to accurately detect gamma radiation at a 70 degree angle to the source. The scan minimum detectable concentrations presented in the Survey Plan (Rev 0) were calculated on a postulated hotspot with a radius of 28 cm or diameter of 56 cm. If the postulated hotspot was located directly between any two detectors, each detector could detect or view the elevated gamma radiation. For the purposes of this report "hot spot" is defined as areas that have significantly different count rates than the surrounding area and require additional investigation. The data collected during this investigation will be reevaluated after a determination of the site specific radionuclide ratios. The collective gamma contributions from the site specific radionuclides will be evaluated, modeled and correlated to a site specific scan minimum detectable concentration (MDC). Once the scan MDC and gamma contributions from site specific radionuclides are known, a qualitative concentration to count rate comparison can be made. The ATV was driven at a speed that would roughly equate to 0.5 meter/second or less. The operator continuously monitored at least one of the instrument readouts with frequent monitoring/comparison of all instrument responses.

The technician-conveyed GPS/gamma walkover was conducted by the technician maintaining the detector approximately 10 cm from the surface progressing at a speed of 0.5 meters/second or less. The technicians moved the detectors in a slightly serpentine pattern, where possible, taking care to maintain the 10 cm distance from surface to detector. Frequently, the technicians substituted a controlled side-to-side pattern so the serpentine motion could maintain correct detector alignment with the survey surface. The technicians continuously monitored the audible instrument response.

Outside the 100% coverage area, the survey team was instructed on the general location of the required survey coverage and areas of interest. Technicians were instructed to use their experience to investigate the areas of highest contamination potential encountered in each area. The team used the Trimble mapping tool to maintain roughly parallel paths in areas requiring systematic coverage. Within the 100% coverage area, the survey team attempted to use the ATV-mounted GPS assemblies wherever possible. When technician-conveyed GPS assemblies

were necessary, the survey team used constant communication and the Trimble mapping tool to ensure adequate survey coverage.

Daily tailgate safety/planning meetings were held. The previous day's events, issues, and progress were discussed, in addition to the areas to be surveyed that day. Each technician was assigned to a specific area with coverage instructions, expected progress, and relative background, with an associated investigation level (a scanning response which is detectable above the background level) depending on the area to be surveyed. Upon completion of the survey, the survey team and Westinghouse conducted a daily debrief meeting. The daily debrief consisted of the survey progress, anomalies, issues, concerns, and a discussion of survey progress and areas to be surveyed the following day.

3.0 SURVEY QUALITY CONTROL

3.1 DATA QUALITY OBJECTIVES

Table 3-1 Data Quality Objectives

DQOs	DQO Attainment
The initial mean background count-rate for each NaI 2"x 2" will be within 10% of the mean background count-rate (at the same location) for all instruments used for the survey.	All instruments used for the survey were within 10% of the mean background count-rate (at the same location). Instrumentation QA records are included in Attachment 1.
All survey instruments will be calibrated at least annually using calibration sources traceable to the National Institute of Standards and Technology (NIST).	All instruments were calibrated at least annually in accordance with ANSI N323A, Radiation Protection Instrumentation Test and Calibration-Portable Survey Instruments (ANSI, 1997). Instrumentation QA records are included in Attachment 1.
All survey instruments will be performance checked at the beginning of each survey day to determine the usability of data collected. The established acceptance criteria for background and source response will be ±20% of the mean value determined during the initial instrument setup procedure.	All radiological field instruments were performance checked at the beginning and end of each day. All acceptance criteria checks for all field instruments were met as required by the plan. Instrumentation QA records are included in Attachment 1.

3.2 INSTRUMENTATION QUALITY ASSURANCE

Each GPS instrument was paired with a survey meter/detector and assigned a pack number. This was accomplished by giving all the GPS packs a letter from A to G and doing the same for the radiological instruments. The GPS packs were then matched up with the radiological instrument that had the same letter. The exception was GPS Pack A. It was paired with Meter H.

3.2.1 Radiological Instrumentation Quality Assurance/Quality Control

Gamma walkover survey instrumentation was calibrated annually in accordance with ANSI N323A, *Radiation Protection Instrumentation Test and Calibration – Portable Survey Instruments* (ANSI, 1997) for the spectrum of radiation energies expected at the Hematite facility.

Gamma walkover survey instrumentation was operated by qualified personnel in accordance with SAIC's Health Physics Procedure HP-30, *Radiological Instrumentation*, and Health Physics Instruction HPI-001, *Performance of a GPS Gamma Walkover Survey.*

All instruments were initially processed to determine if the general area gamma radiation levels would interfere with the initial instrument setup and the acceptance criteria determined prior to arrival. All instruments were within tolerance of the acceptance range. All instruments were verified to meet the established site-specific background acceptance criteria with the exception of instrument "A". Instrument "A" exceeded the background and source values on the high end during the initial on-site instrument check in. This instrument was tagged out of service and removed from the site. No data was collected with Instrument "A".

Table 3-2 Instrument Background Comparison

Instrument	Mean Background cpm
B	5,493
C	5,135
D	5,418
E	5,315
F	5,263
G	5,322
H	5,405
Site Mean	5,343
10% range	4,809-5,877

Daily performance checks were conducted on each instrument as defined in HP-30 and as summarized in the Survey Plan (Rev 0). Only data obtained using instruments that satisfied these performance requirements were accepted for use in this investigation.

3.2.2 Global Positioning System Quality Assurance/Quality Control

The daily QC check of the GPS units was performed and recorded for use post-survey. The accuracy of the GPS system is dependent on many factors, mainly the number of visible satellites, which will vary throughout the day. The manufacturer's stated accuracy is sub-meter; the actual accuracy or Position Dilution of Precision (PDOP) of the GPS units varies and is dependent on satellite visibility. Each data point collected has a PDOP value attached as a measurement of the coordinate accuracy. PDOP simply provides an indication of the expected accuracy of GPS positions based on the relative positions of the satellites. Lower PDOP values provide more accurate data. The accuracy of single data point can be determined by the PDOP value associated with the point.

The daily positions check on a known or identified location assists the project in determining if data files collected on a given day require post processing. The northern most monitoring well located just west of the Building 231 was used as the known location for this survey.

The data collected from each pack at the beginning and the end of each survey day is collected for use post-survey while the data is evaluated. The relative differences between the

pre- and post-survey check, the drift during check, and the relative differences between GPS units are all evaluated. This evaluation helps to quantify the degree of confidence in the reported coordinates for each data point across the project. In addition, the check pinpoints suspect coordinate data associated with a particular GPS unit, a particular GPS unit on a given survey day, or all GPS units on a given survey day.

If one of the GPS units indicates a significant difference in reported locations when compared to known or other GPS units, all position data collected that day with that unit is suspect and is evaluated. The evaluation will inspect the position of all data points in relation to property boundaries, known areas covered that day, and in relation to data points collected on other packs in the general vicinity. In addition, the corresponding radiological count rate for a reported area will be compared to known or collected radiological count rates from other instruments in the same area. If the above data checks indicate an unreasonable amount of error in the reported coordinate data, the specific data files are post-processed to increase coordinate position accuracy.

3.3 SURVEY QUALITY ASSURANCE

The survey team performed numerous performance, operation, and continuity quality checks during implementation of the survey. Instrument response is continuously checked in the field by referencing adjacent meter responses. The technicians, constantly monitoring the instrument response, periodically verify abnormal (either relatively high or low count rates) by comparing their instrument output with other instruments in the general vicinity. This check occurred frequently as the observed "relative background" count rate decreased as the technicians moved from the plant site toward the Joachim Creek. The technicians also perform an additional instrument response check during data evaluation. Instruments within the same general proximity should have recorded relatively similar count rates. All data were checked for erroneous data patterns that would suggest a faulty instrument response.

Position accuracy is checked upon completion of each day's survey. The collected data is downloaded and the data plotted on the site map. The site map, which was based on a February 2003 aerial flight by Sanborn and included a State plane grid prepared by Metropolitan Engineering, was provided by Westinghouse. Each technician verified that all the data they collected were captured and that the data were in the correct general area. The position is further verified during data evaluation by comparing data collected by adjacent technicians and instruments. This check is easily accomplished for the data collected with the ATV-mounted GPS assemblies. The three data streams are plotted and the plots are evaluated for erroneous or out-of-place data points. This check is more difficult to quantify for the data collected by the technician-conveyed GPS assemblies. The check, in this case, is performed by having the technician who collected the data review a plot of all collected data. Technicians check the location of their plotted data in relation to other data collected at the same time by other technicians. Technicians note the position of their data streams in relation to the adjacent data streams to determine if data is missing or erroneous coordinates have been recorded.

Data accuracy/reproducibility is checked during data evaluation. If relatively low or high-count rates that do not adhere to the surrounding data are identified in the data, additional

investigation is warranted in these areas. These areas are identified during data evaluation and performance of an additional gamma walkover to verify the abnormality is conducted.

Survey accuracy is checked by evaluating the entire data set for gamma radiation trends and patterns. If the patterns or trends do not make sense considering the topography, known operating history, field observations, or experience of the field team, additional investigation is warranted. For instance, high gamma radiation levels adjacent to a drainage ditch should indicate a high potential for elevated gamma radiation levels within the ditch. Conversely, small areas of elevated gamma radiation levels surrounded by large areas of background or near background gamma radiation levels with no obvious transport mechanism are suspect and are further investigated.

3.4 DATA MANAGEMENT

Pre-Survey

- Prior to the start of the survey, the site was divided into seven survey areas with common geographic features, such as roads, railroads, creeks, and drainages, which provide easily recognized boundaries. The survey areas are described below and are shown on Figure 3.

  A-Inside Fence
  B-100% Area Outside Fence
  C-South of Southern Drainage
  D-South of Rail
  E-South State Road P East of Drain
  F-East Farm Area
  G-North of State Road P

- Once the survey areas were designated and the equipment was labeled, the format for the file naming system was established. File names consisted of seven digits that included GPS pack letter (A-G), (W) for Westinghouse, Survey area letter (A-G), Media type letter, example (S) for soil and (G) for gravel, and a three-digit file number, example (001). An example of a filename follows:

  BWDS002

  B-GPS Pack 'B'
  W-Westinghouse
  D-Survey Area 'D'
  S-Soil
  002-File number

Post-Survey

- At the end of each day of field activities, all gamma walkover data was downloaded from the TDC1 data collector flash memory card to a site computer via Pathfinder software.

- The Pathfinder software was also used to export the raw field data into Microsoft Access. Microsoft Access was used to convert the data into a format that can be imported into Arc View Geographic Information System (GIS) software.

- Once formatted, the survey data was placed into an Arc View project file, and a survey map was created to be presented in the daily post-survey briefing.

Following each day of surveying, the GWS survey files were backed up by copying the data to CD-R disks. After each week, the data was copied to SAIC's St. Louis office server.

4.0 SURVEY RESULTS

Due to various backgrounds, as described below, encountered across the site, it is difficult to provide an accurate visual display of all the data on one map. Figure 4 shows the survey coverage of the entire Property with the data color-coded at 2,000 counts per minute (cpm) increments, starting with 10,000 cpm for soil and 5,000 cpm for gravel and asphalt. This map provides the greatest amount of detail for examining trends and general gamma radiation levels across the Property. Figure 5 shows the survey coverage for the entire Property with the data color-coded at 2,000 cpm increments, starting with 11,000 cpm for soil and 6,000 cpm for gravel and asphalt. This figure, when used in conjunction with Figure 4, provides evidence of a gradual decrease in count rate from the railroad south to Joachim Creek. Figure 6 shows the survey coverage for the entire Property with data color-coded at 3,000 cpm increments, starting with 10,000 cpm for soil and 5,000 cpm for gravel and asphalt. The figure proves that the majority of the collected data is between 10,000 – 13,000 cpm. The reference area average was approximately 10,500 cpm. Figure 7 shows the survey coverage of the entire Property in two colors, with the discriminator at 16,000 cpm. This figure is designed to show the areas of the Property that are significantly above background.

4.1 BACKGROUND VALUE DETERMINATION

SAIC used three types of background values: instrument, reference, and relevant, to fulfill the objectives of the survey. SAIC evaluated all the collected data to determine the background value to be applied during data evaluation.

Individual instrument background values were determined to verify that the gamma detectors being used for the survey are responding similarly to low gamma flux levels. All individual instrument mean background values were within 10% of the mean for all detectors, ensuring all data collected could be evaluated and depicted on one color-coded map without data misrepresentations resulting from variations in detector response.

SAIC performed this background check by collecting individual instrument background values prior to mobilization to the site. The average or mean value of all the individual instrument values was calculated, in addition to the 10% range around the mean. All instruments

were checked upon arrival at the site to verify not only that the instruments were still within 10% of each other but also to verify that the "site" instrument background was not significantly different than initial instrument background calculation. The "site" background was not significantly different upon initial check and all instruments were well within the 10% range of the mean, with the exception of Instrument "A", which was removed from service. The individual instrument background values were on average 1.67% of the mean with the largest deviation individual instrument background being 3.89% below the mean. All of the instruments were determined to be responding similarly within tolerance to low level gamma flux radiation, and as such, were acceptable for use on this project.

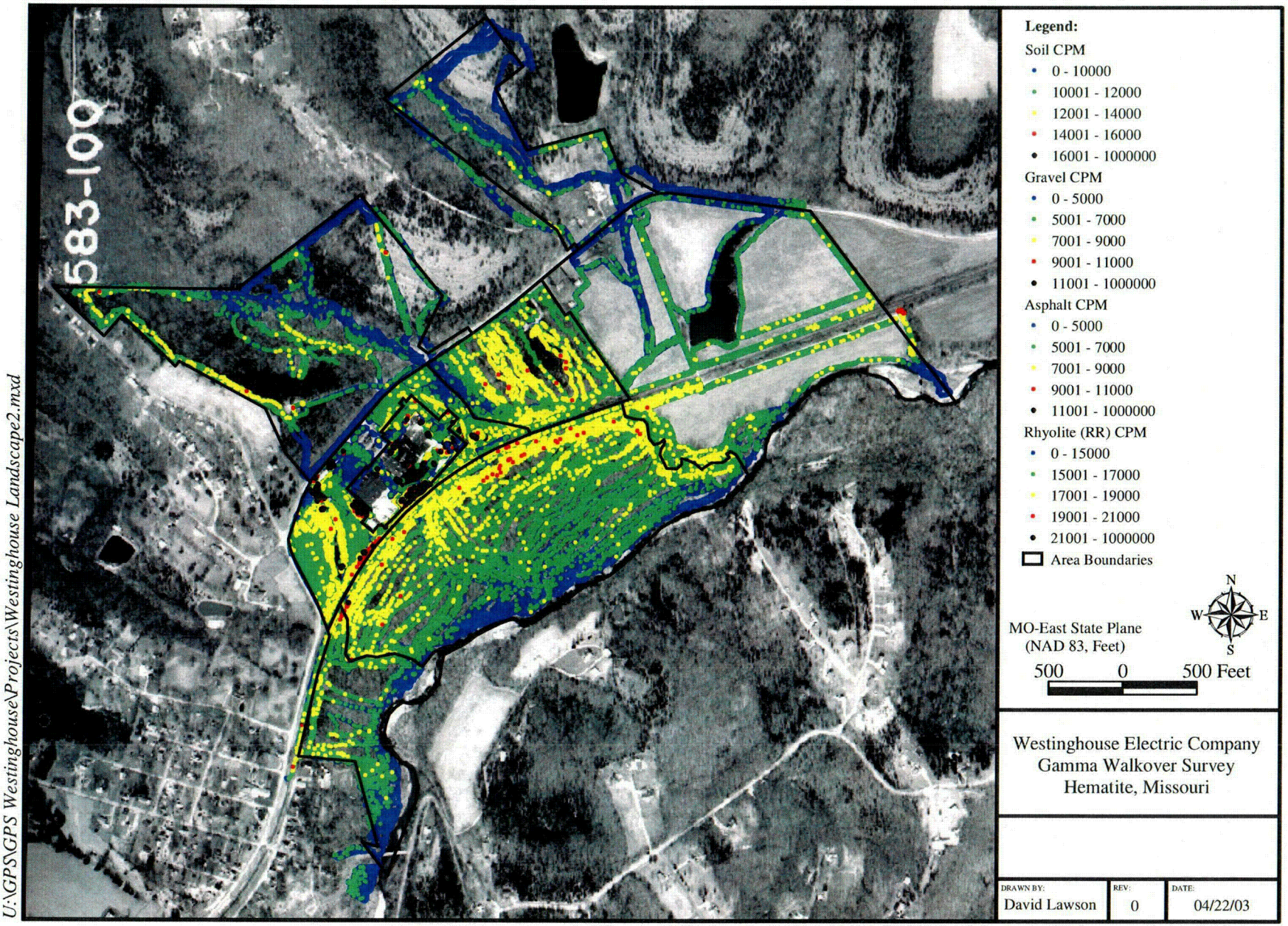

Figure 4. Westinghouse Gamma Walkover Survey (Soil Background 10001-12000 cpm)

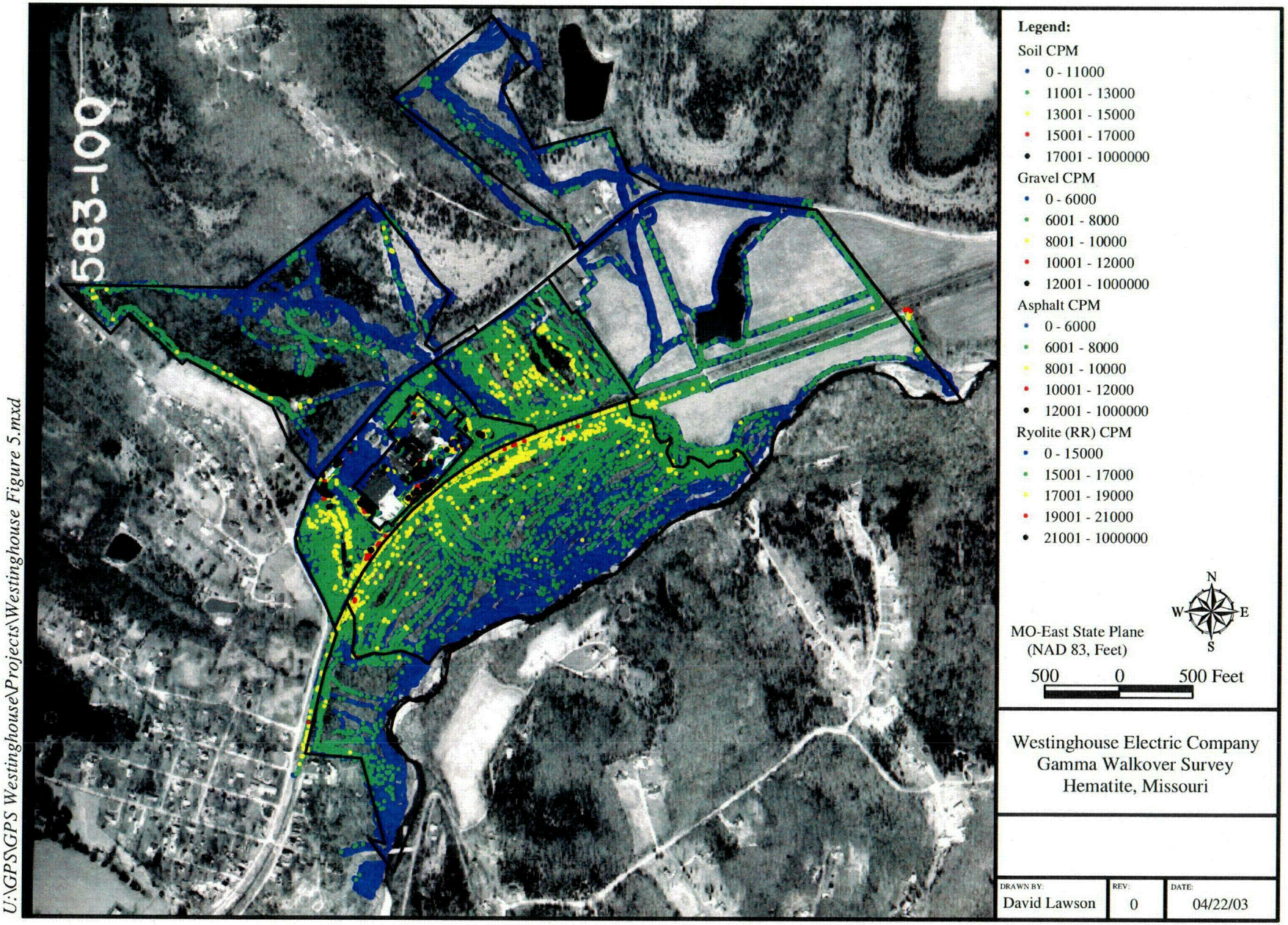

Figure 5. Westinghouse Gamma Walkover Survey (Soil Background 11001-13000 cpm)

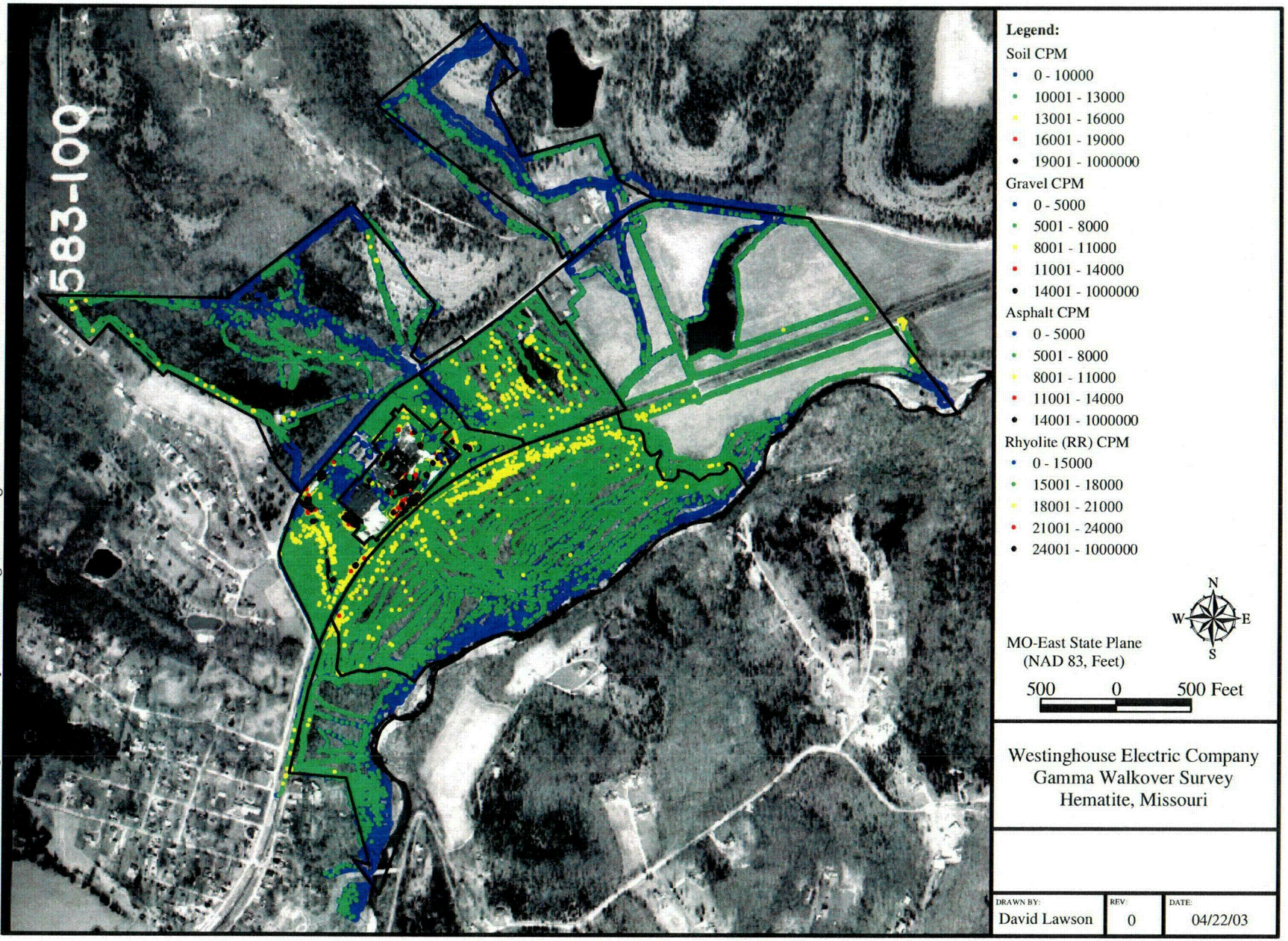

Figure 6. Westinghouse Gamma Walkover Survey (Soil Background 10001-13000 cpm)

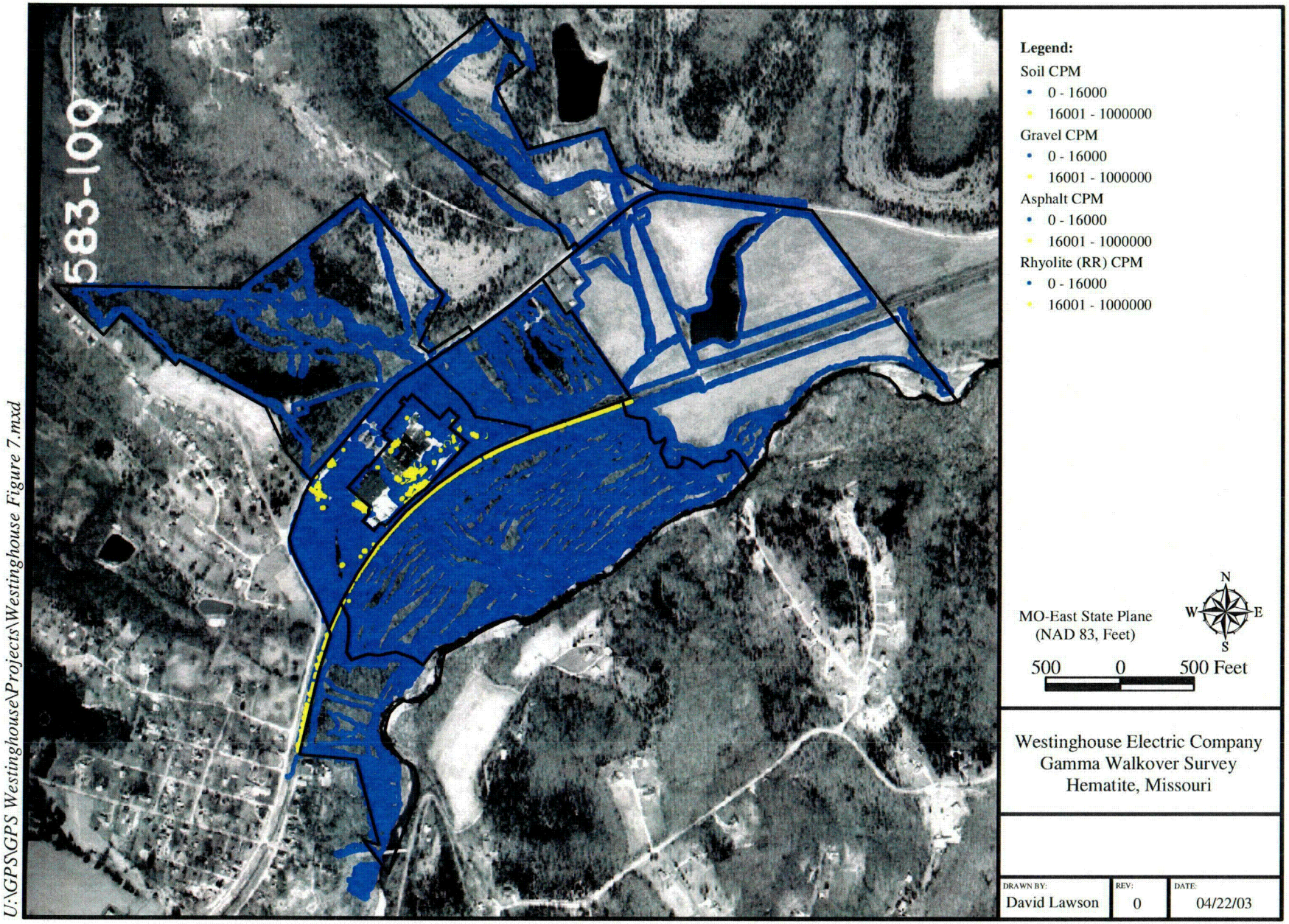

Figure 7. Westinghouse Gamma Walkover Survey (Two Color Illustration)

Reference background gamma count rates of soil and other media with similar physical and geological characteristics as the soil/material being investigated were collected in non-impacted areas surrounding the site. The reference background count rate was used to determine which areas on the Property had gamma count rates in excess of the local background gamma levels. No reference area measurements were initially going to be obtained unless media or background count rate fluctuations indicated that multiple background populations were present on the Property. We determined on the first day of surveying that reference area measurements would be beneficial and should be collected as time allowed. It was apparent that the background gamma flux radiation levels for the railroad rock, the asphalt, the gravel, the grassy soil, and the soil background in the tree-covered areas were all significantly different. There was an obvious difference in the count rates between the different media types, with gravel/asphalt being on the low end and the railroad rock being on the high end. It was also noted that the general trend of gamma count rates tended to decrease as the survey progressed from the site or railroad, down the hill toward Joachim Creek. There may be different soil background count rates present on the site due to the varying soil types. The gamma count rate was relatively low near the creek in the presence of coarse-grained soils (i.e. sand and gravel); the gamma count rate had a tendency to decrease in direct proportion to the amount of visible sand-like material in the surveyed soil.

After discussion with the project team, it was decided to attempt to locate a suitable reference area south of the site, preferably south of State Road P. The need for quick access and the ability to obtain the numerous media and soil type backgrounds limited the potential sites. A limited amount of effort was expended to locate a suitable reference area that met the initial criteria. No suitable area was identified that met all the criteria. The closest reference area that met most of the criteria was the U.S. National Guard Armory Site, located east and north of the site near the junction of State Road P and State Road A.

Access was requested and granted. SAIC mobilized two individuals to the site for reference area measurements to obtain at least 100 measurements in each media type: asphalt, gravel, soil adjacent to railroad under trees, uncultivated grass covered soil, and rhyolite (non-native rock used to support railroad tracks).

After obtaining these measurements, SAIC also gathered additional measurements adjacent to Joachim Creek at the bridge on State Road A. These measurements were obtained on the east side of the creek, just upstream of the bridge. Table 4-1 summarizes the results of these measurements.

Table 4-1 Reference Area Measurements

	Asphalt	Gravel	Grass Soil	Soil Adjacent to Railroad	Rhyolite Railroad Rock	Sandy Soil
# measurements	371	407	171	250	262	352
Mean	4,904	4,360	9,415	10,402	14,867	7,624
Std Dev	391	416	1,012	836	874	1,507

Further evaluation of this reference may be necessary during later sire investigations to verify that it is an appropriate reference area based on soil classification of on-site surfaces soils conducted during the Remedial Investigation. The evaluation of the gamma walkover data was performed primarily using relevant background not reference area background. The use of relevant background allows the evaluator to determine which locations with in an area exhibit higher gamma levels when compared to surrounding soils. The reference data collected was only used to establish the baseline count rate expected with in a given area.

Report results primarily addressed areas that contain elevated activity significantly above background. Reference area measurements were taken to provide a basis for comparison with gamma survey readings collected on-site.

The basis for acceptance of the area selected for reference area measurements was based on accessibility, like terrain the presence of most of the media encountered on the site (gravel, asphalt, rhyolite, grass covered soil, tree covered soil, and sandy soil) and may require further evaluation based on actual classification of on-site surface soils conducted during the Remedial Investigation.

The reference data collected was only used to establish the base line count rate expected within a given area.

Other locations were investigated for inclusion as potential reference areas within several miles surrounding the site; however, no other area was located that provided all media types, open access or similar terrain as compared to the area selected for reference area gamma measurements.

Survey area relevant background was used for evaluation of specific areas within the site. Relevant background is the comparison of count rates to count rates in the surrounding immediate area of impacted locations on site. Relevant background is used during performance of the gamma survey to alert the technician to isolated "hot spot" areas that are different from the surrounding area and require additional investigation.

Relevant background was used during this survey, primarily in the 100% covered area and to a limited extent on the remainder of the Property. All the surveyors consistently monitored their instrument's audible and visible response. The technician noted any appreciable increase or decrease in count rate and additional data were collected in the area of concern to investigate the abnormality.

Not all instruments were continuously monitored during the use of the ATV; however, the operator did monitor at least one instrument and periodically compare the readings of the instrument to adjacent meters. The data collected by the ATV-mounted instruments were evaluated in comparison to data collected by the adjacent instruments to detect deviation in relevant background.

The technicians performing the survey in the heavily vegetated areas monitored the audible response of their instruments as conditions allowed. There were times that the thorny vegetation, briars, tree limbs, or other obstructions removed the headphones from the technicians' range of hearing and some portion of the survey continued until it was possible to replace the headphones to within hearing range.

Relevant background was used during the evaluation of the collected data. Data points that were either relatively high or low were scrutinized to determine the deviation in background. If evidence could not be produced to explain the deviation, a survey team was mobilized back to the location to investigate the deviation in relevant background.

For the purposes of data evaluation, SAIC assigned the following background values for the various media types:

Gravel	5,000 cpm
Asphalt	5,000 cpm
Soil	10,000 cpm
Rhyolite	15,000 cpm

It should be noted that applying a single soil background count rate could potentially lead to misrepresentation of the soil data due to the various apparent fluctuations in the soil media background count rate.

4.2 AREA A

The gamma walkover survey in this area was designed to provided 100% coverage of all accessible areas that were not beneath buildings or covered with asphalt or concrete. Other ground covering includes gravel, soil, and water. This area consisted of all accessible areas within the outer boundary fence or controlled area. There were numerous areas of concern within Area A, including the evaporation ponds, Deul's Mountain, the fenced-off restricted area, the area surrounding the spent limestone piles, and drainage ditches.

Approximately 50% of the surveying was performed by the use of an ATV with three front-mounted GPS/gamma detector assemblies. The remaining 50% of the area was performed by technician-conveyed GPS/gamma detector assemblies.

The spent limestone piles were not surveyed as part of this walkover effort, although no significant readings were found in the vicinity of these features. Small drainages in this area that led under the fence were noted and surveyed as well, with no significant readings observed at the surface. Also, no elevated readings were observed in the northeast corner of Area A.

As expected, there were many areas of elevated gamma radiation identified within Area A. Areas with elevated gamma readings were centered within the restricted areas, around the evaporation ponds, and near the foot of Deul's Mountain. Although, the portion of Deul's Mountain that was covered with plastic was excluded from the effort, the highest reading obtained within Area A was collected at the foot of Deul's Mountain where a piece of sheet plastic was found protruding from the soil. Readings at this location were as high as 874,000 cpm.

Figure 8 depicts the survey coverage of Area A with the standard 2,000 cpm increment. Figure 9 depicts the survey coverage of Area A with a two-color coding, separated at 18,000 cpm. The purpose of Figure 9 is to show the areas that clearly have elevated gamma levels above background, additional investigation will be required in the other areas to determine if radiological contamination above background is present. Due to the relatively high levels of gamma radiation detected within this area, Figure 10 depicts Area A survey data with 20,000 cpm increments.

4.3 AREA B

This area is bounded to the north and west by Highway P, to the south by the railroad, and to the east by a tributary that separates it from Area E. Area B does not include anything located within the facility security fence, as this is designated as Area A. The terrain of Area B is relatively level and covered primarily by grass. Other surface features include trees, brush, buildings, trailers, an asphalt parking area, gravel roads, a small pond, ditches, monitoring wells, and air sampling stations.

Complete coverage was provided in Area B. Most of the surveying was performed by the use of an ATV with three front-mounted GPS/gamma detector assemblies. In areas where the use of the ATV was not practical, manual surveying was performed by technicians.

No significant areas of elevated gamma radiation were identified in the large grassy area to the west of the pond and east of Highway P. In fact, only one small area of elevated readings west of the pond was identified toward the northern end of the area. This location was less than 0.5 m^2 in size and was found to be approximately 24,000 cpm above local background.

The area just north of the pond and west of the Tile Barn had several areas of elevated readings. This was especially true around the cistern burn pit area. Areas of elevated readings ranged in size from less than 0.5 m^2 to several square meters. Two very small areas north of the Tile Barn and west of the silo were also found to show elevated readings. Although the glazing material used on the Tile Barn bricks is suspected to contain uranium, this did not appear to

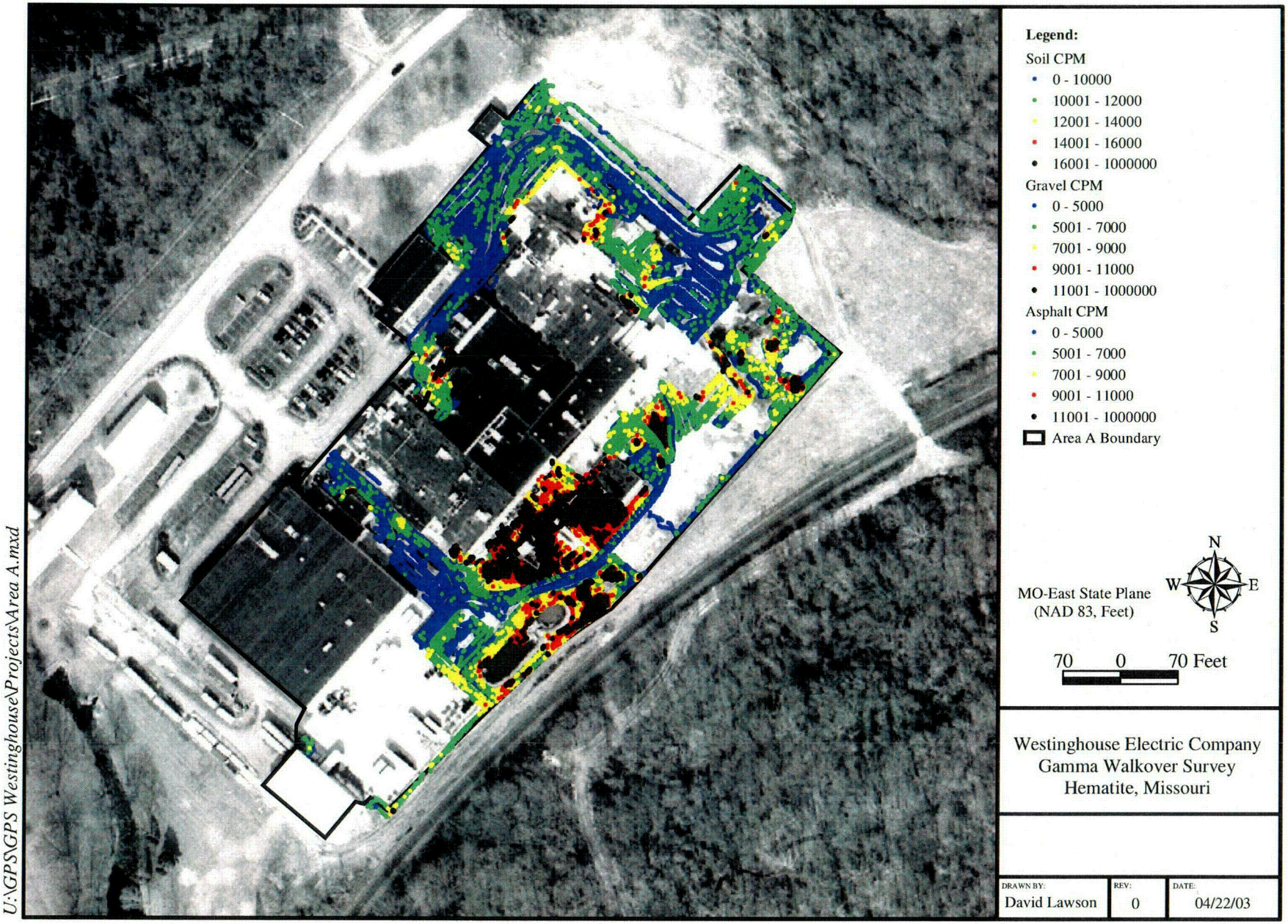

Figure 8. Area 'A' Gamma Walkover Survey (Soil Background 10001-12000 cpm)

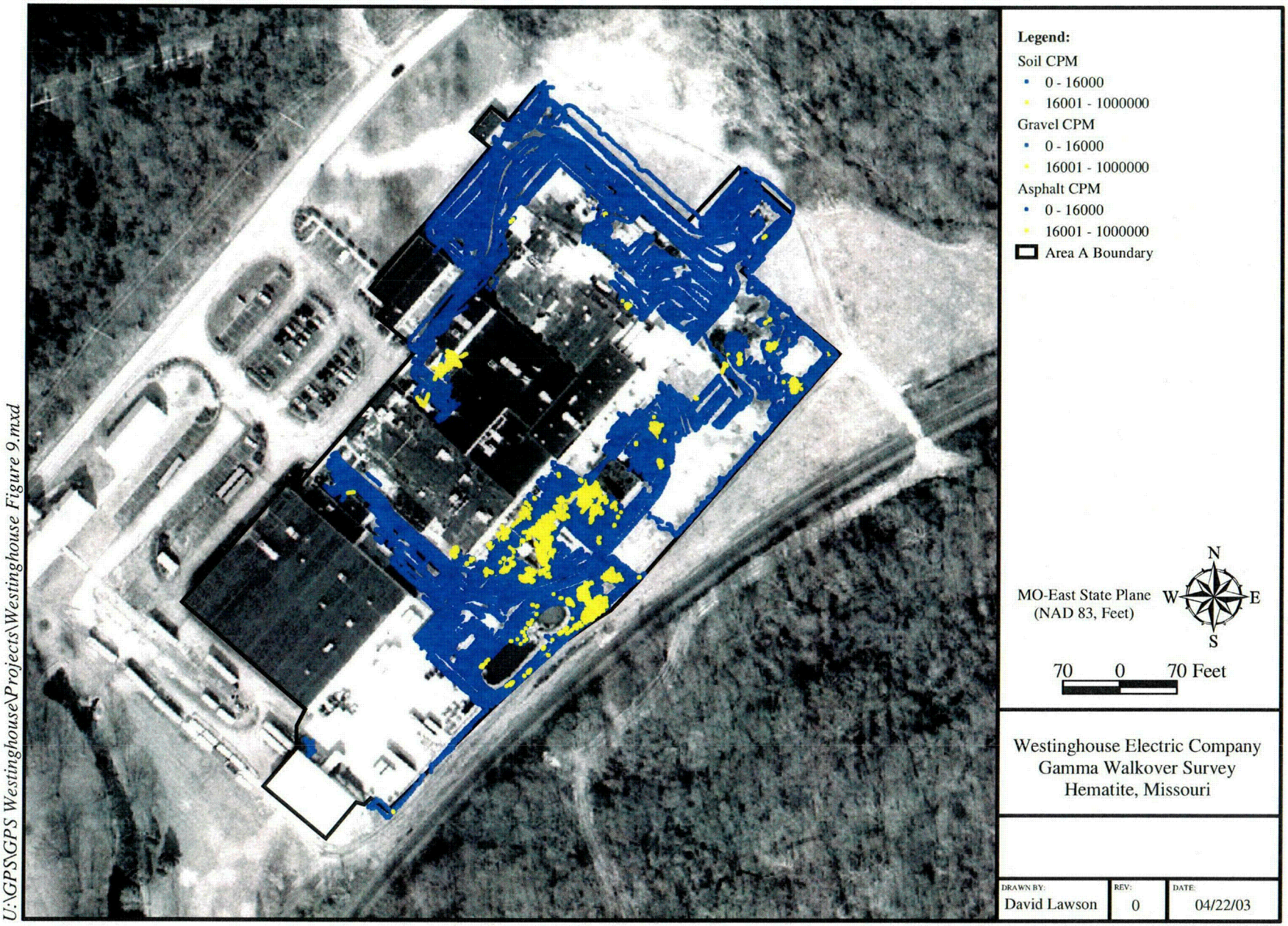

Figure 9. Area 'A' Gamma Walkover Survey (Two Color Illustration)

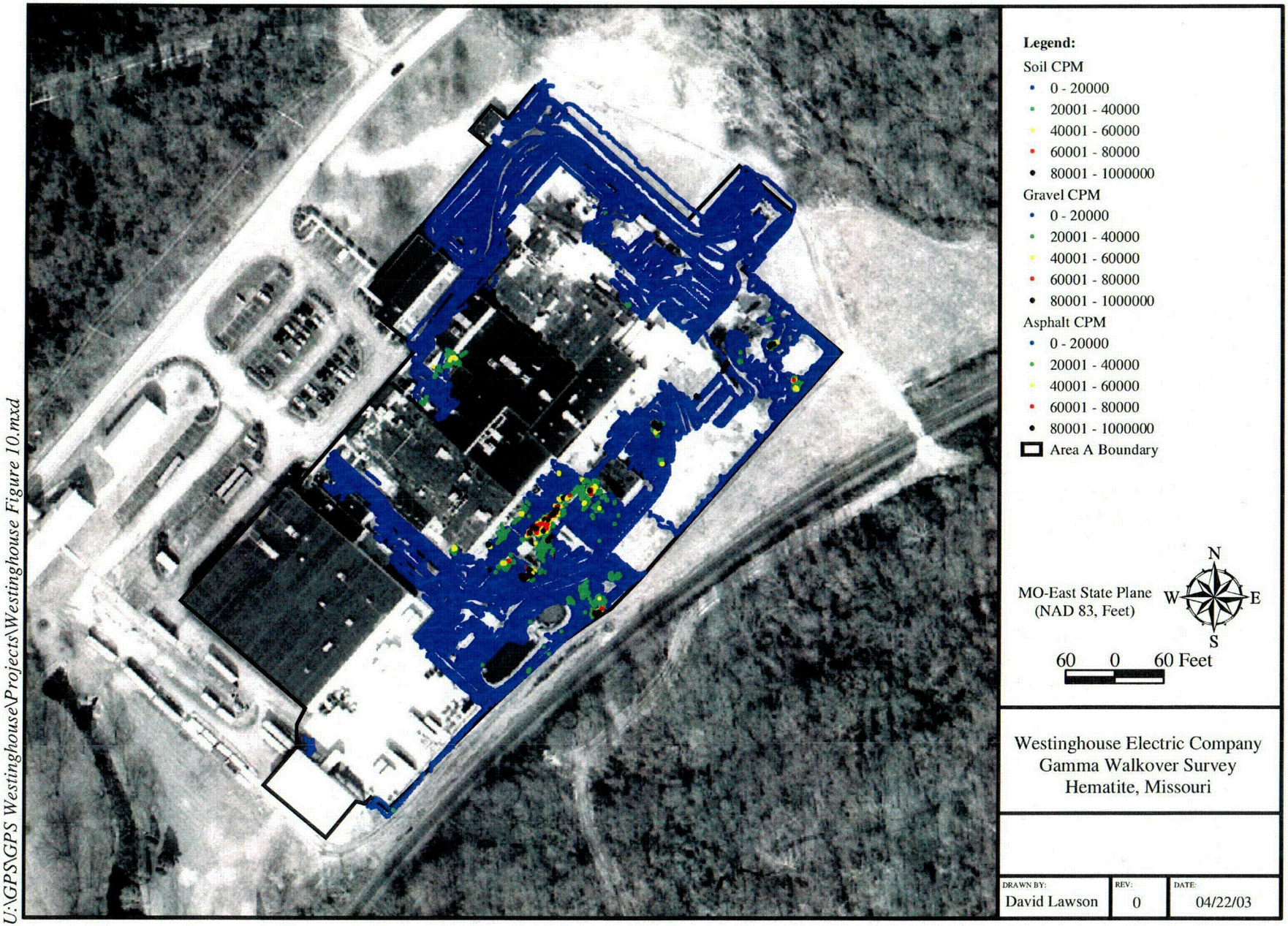

Figure 10. Area 'A' Gamma Walkover Survey (Modified Ranges)

increase background gamma radiation levels in the area immediately surrounding the barn at the plane where the gamma survey was conducted (10 cm above ground surface). A contact reading of the bricks was taken for informational purposes and only a slight increase of approximately 1,000 cpm was detected. Just a few inches away from the bricks the instrument readings returned to ambient levels of gamma radiation.

A grassy area between the barns was surveyed and found to contain several areas of elevated readings. This grassy area is surrounded to the east, south, and west by an asphalt walkway and to the north by a wooden fence. One small area less than 0.5 m^2 was identified just off the northeast corner of the east barn.

A ditch southwest of Building 231 and north of the rail line showed an increase in count rate at the bottom of the ditch. This ditch was surrounded in dense vegetation and the actual bottom was physically quite shallow; therefore, the increase in count rate is not expected to be caused by geometry issues between the detector and the soil surface. A section of old fencing ran along a portion of the north slope of this ditch. A small area less than 0.5 m^2 north of the fence was also identified.

An asphalt drive to the west of Building 230 was initially thought to have significantly elevated gamma radiation levels. Upon further investigation it was discovered that containers of radioactive material had been stored inside Building 230 in close proximity to the western wall. It cannot be determined, however, that these containers are the sole contributor to the increased gamma radiation levels outside of Building 230. Upon removal of the containers, additional investigation in this area is warranted to verify the actual gamma levels present.

A survey along the southern fence line of the facility revealed a narrow strip of elevated readings just east of the two evaporation ponds. A count rate of almost 200,000 cpm was noted in this area. Drainages originating from within the fenced area were noted along the southern fence line and also surveyed. No significant increase in gamma levels was noted in these drainages outside the fence.

In the area of the burial pits, east of the facility, several limited areas of elevated readings were identified as expected. Also, the wooded areas in the western portion of Area B contained several piles of debris such as concrete, wood, asphalt, and sheet plastic. A piece of metal protruding from the ground was found in this wooded area. The metal showed gamma radiation levels of approximately 24,000 cpm. This location was flagged for future reference and later Westinghouse employees retrieved this metal, which turned out to be what was left of a severely rusted metal bucket with soil residue. The bucket appeared to be painted white and showed no identifiable markings. Westinghouse performed a contamination survey of the bucket, which is included as Attachment 2. The area where the bucket was removed was resurveyed and found to contain residual gamma radiation levels of approximately 16,000 cpm.

Figure 11 depicts the survey data with the standard 2,000 cpm increment starting at 10,000 cpm for soil. Figure 12 depicts the survey data on a two-color map with the discriminator at 18,000 cpm. The purpose of this map is to show the areas that clearly have elevated gamma levels above background, additional investigation will be required in the other areas to determine if radiological contamination above background is present.

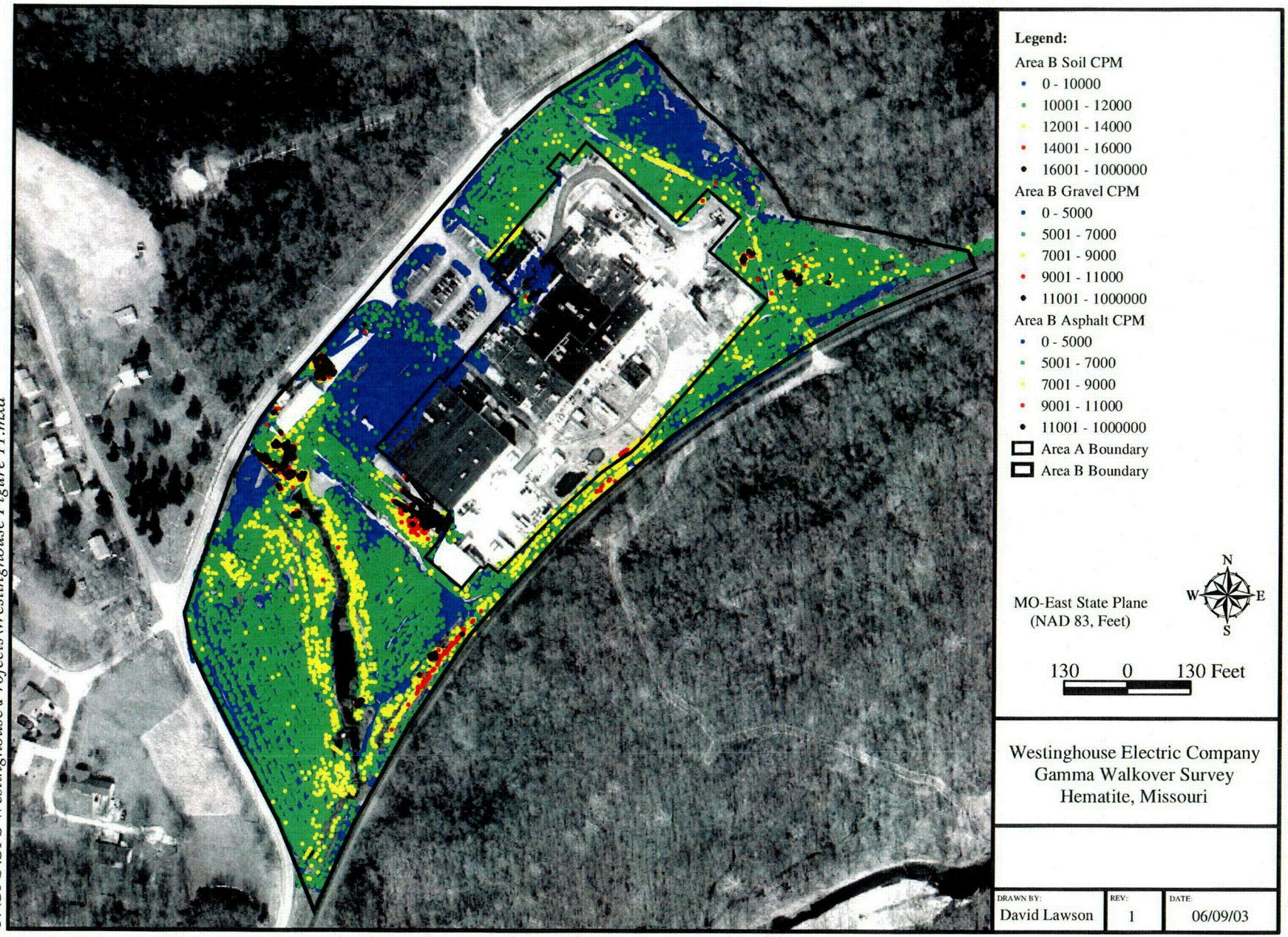

Figure 11. Area 'B' Gamma Walkover Survey (Soil Background 10001-12000 cpm)

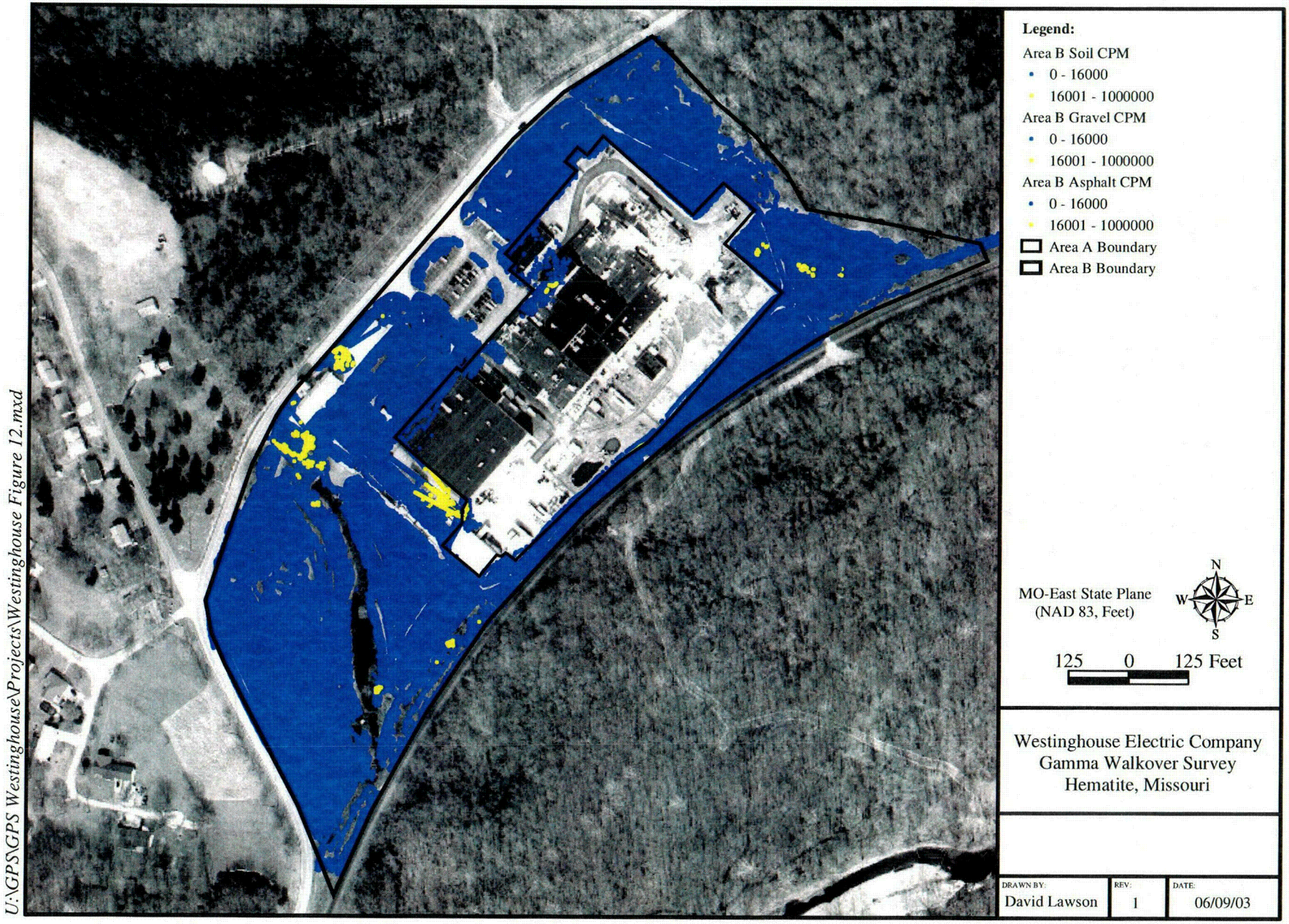

Figure 12. Area 'B' Gamma Walkover Survey (Two Color Illustration)

4.4 AREA C

This area is bounded to the north by a drainage ditch and to the east by Joachim Creek; the area extends south slightly past the bridge, then the Property boundary roughly follows a fence back north until it runs into a small drainage. The area boundary then turns at a right angle and heads due west to the railroad. The extreme western boundary of this area is the railroad. The terrain of Area C is generally wooded with limited underbrush; the brush, briars, and thickets tend to increase near the boundary in cleared areas, with some open areas located in the extreme southern part of Area C.

The gamma walkover of this area was designed to provide limited coverage in the areas of higher probability of contamination deposition. The survey was to provide coverage adjacent to all boundaries of the area with more concentrated coverage in the area near the bridge. Local citizens had reported that material might have been buried on or near the southwest portion of the property, in the vicinity of Joachim Creek bridge.

The survey was conducted initially by concentrating on the northern drainage. The team concentrated on benches, low areas of sedimentation deposits, erosion ditches, and potential areas for silt deposition during flooding. All areas of high probability were adequately covered in addition to varying distances (10-30 feet [ft]) from the drainage. An area surrounded by drainages and Joachim Creek was identified at the discharge of the northern drainage into Joachim Creek. This area was thought to have a high probability of contamination and was given thorough systematic coverage. The bank of Joachim Creek along the eastern boundary of this area is vertical in most places with a deep drop to the creek bottom. Limited coverage was used in this area, concentrating on the upper creek bank edge, drainage or erosion ditches going to Joachim Creek, and any areas of obvious flood deposition.

The exact site boundaries were not known to the survey team at the time of the survey, so a limited amount of coverage was conducted south of the bridge in potential dumping areas that are actually outside the Westinghouse property boundary. Concentrated systematic coverage was performed in the area just north of bridge in areas of obvious dumping. The concentrated coverage continued to the north until there was no further evidence of dumping that is, trash was not present. The survey continued along the perimeter fence, focusing the effort around a small drainage, once again concentrating on potential areas of contamination deposition as mentioned above. The survey team performed limited coverage adjacent to the railroad. This area is sparsely populated with mature trees and many briars, and follows the power lines. The extreme northern portion of Area C consists of a small triangle of land bounded on one side by the railroad and drainages on the other two sides. Gamma walkover coverage was concentrated in this area due to close proximity to the plant and relatively higher probability of contamination from flood deposition.

No significant areas of elevated gamma radiation were identified in Area C. The relative count rates did tend to decrease as the survey progressed east or downhill from the railroad to the creek. The decrease in count rate was noticeable but not significant during the transition. However, the count rate decrease was significant when comparing the relative count rates adjacent to the creek to the count rates adjacent to the railroad. The survey team verified the

count rate decrease across the three meters and commented on the obvious decrease. The gradual decrease could be due to a number of various reasons, but is most likely due to a change in soil type. Figure 13 depicts the survey data with the standard 2,000 cpm increments starting at 10,000 cpm for soil.

4.5 AREA D

Area D is located directly south and east of the main site facility. This area is bounded by the railroad to the north, Joachim Creek to the south, and on the east and west by drainages. The farm is located east of this area and Area C is located to the west. The terrain in this area was very similar to Area C. The northern portion of Area D is a gradual hill that flattens nearing Joachim Creek. The area adjacent to the railroad was heavily covered with briars and underbrush. The underbrush gradually decreased as the survey moved south toward Joachim Creek, giving way to mature trees with limited underbrush.

The gamma walkover of this area was designed to provide roughly systematic coverage of the entire area. The survey initially concentrated on the boundaries, with an emphasis on areas that were more likely to be contaminated. After the boundaries were established, the rest of Area D was adequately covered by surveying with varying distances (10-30 ft) between surveyors.

In general, the count rates observed in Area D ranged from 6,000 cpm to 14,000 cpm. The highest count rates were observed in the northern portion adjacent to the railroad and decreased in a roughly uniform pattern as the survey progressed south and east toward Joachim Creek. The most abrupt or noticeable count rate deviation was observed at the foot of the small hill that lies adjacent to the railroad in the north portion of Area D. The roughly uniform deviation in count rates tends to indicate a gradually changing background or potentially systematic windblown contamination. However, if the area had been contaminated by windblown contamination, localized elevated readings in the low areas where water tends to collect and evaporate would be expected. We identified many low areas and identified no localized elevated count rates.

There were two isolated areas within Area D that require additional investigation. The first area is located in the northwest corner of Area D at the culvert outlet from the site pond. The culvert allows for flow of water from the site pond under the railroad. The increase in gamma activity in this area could be due to the presence of Rhyolite rock that had fallen from the railroad roadbed. Rhyolite was observed and an increase in count rate was detected in the presence of this material; however, additional increases were noted without visible Rhyolite. It is possible that the increases were due to the presence of Rhyolite slightly beneath the surface, but this could not be confirmed in all cases. The second location requiring additional investigation is slightly southwest of the first location near the convergence of the two drainages. The spot is roughly in the middle of converging ATV paths prior the stream crossing. A sustained count rate of 14,000-15,000 cpm was identified in this area. The relative background in this area ranged from 11,000-13,000 cpm. This area with elevated gamma radiation readings was fairly small: 1-2 square meters, and is only slightly elevated above relative background. Figure 14 depicts the entire Area D with the standard 2,000 cpm increment starting at 10,000 cpm. Figure 15 depicts an enlarged view of the two local isolated elevated readings.

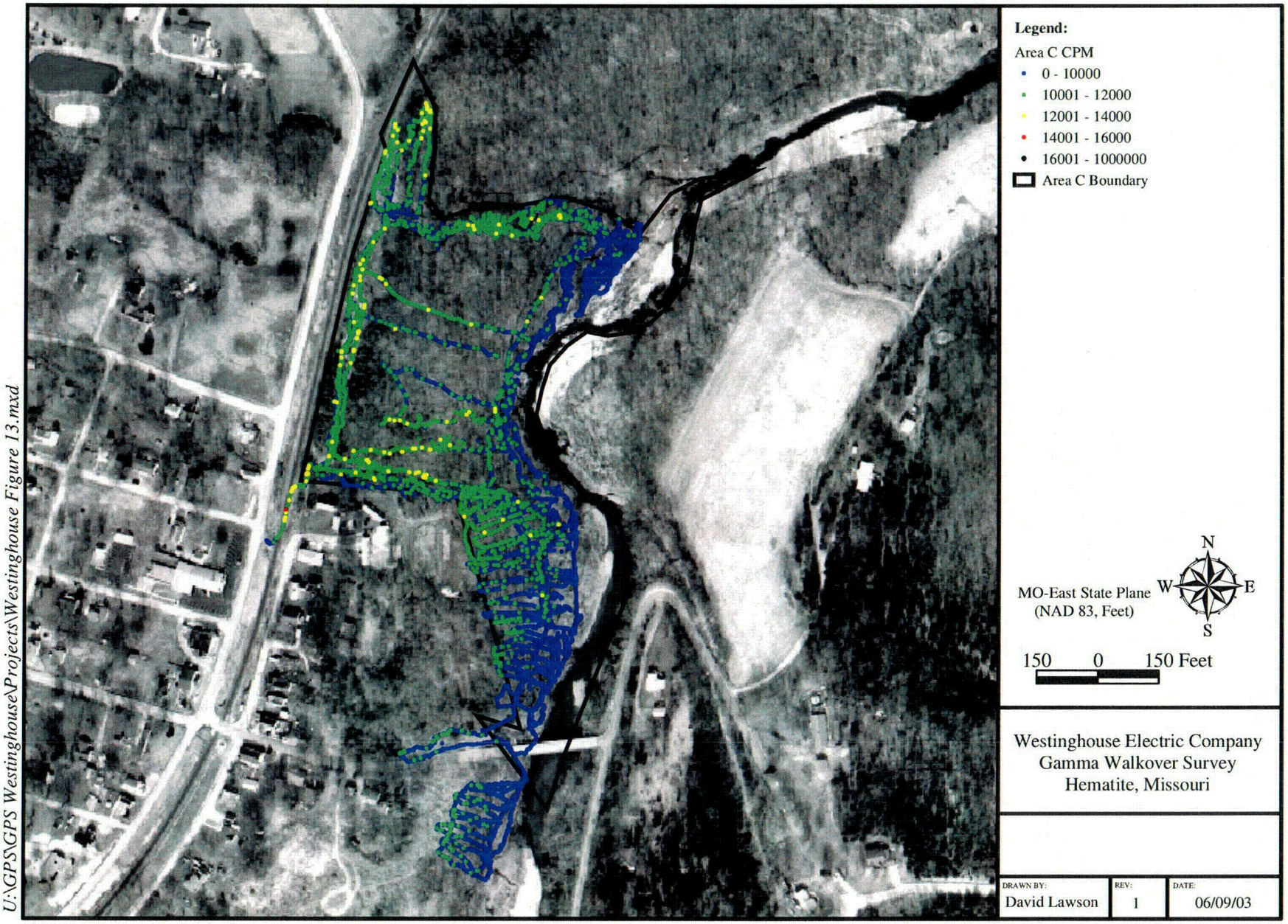

Figure 13. Area 'C' Gamma Walkover Survey

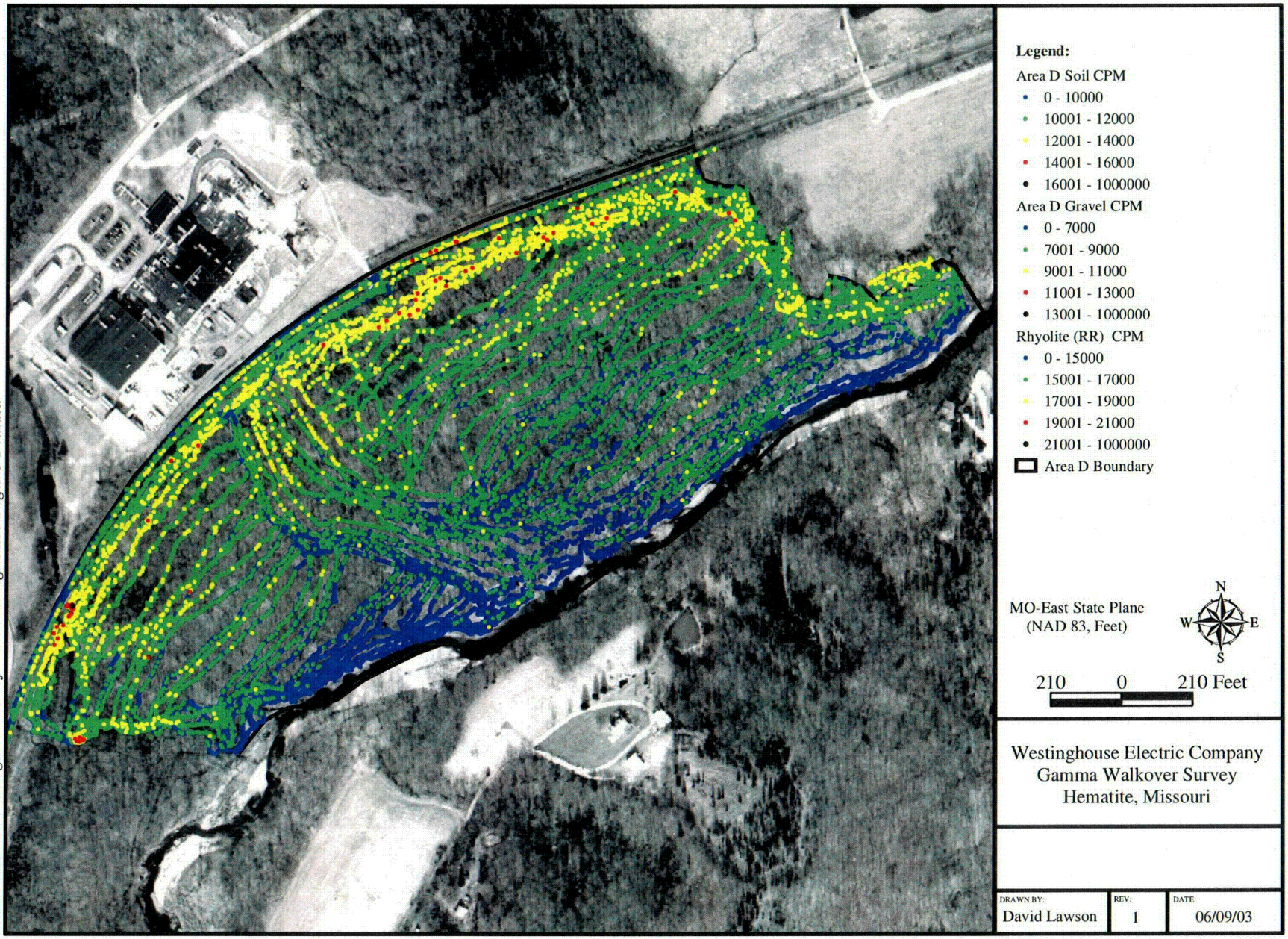

Figure 14. Area 'D' Gamma Walkover Survey

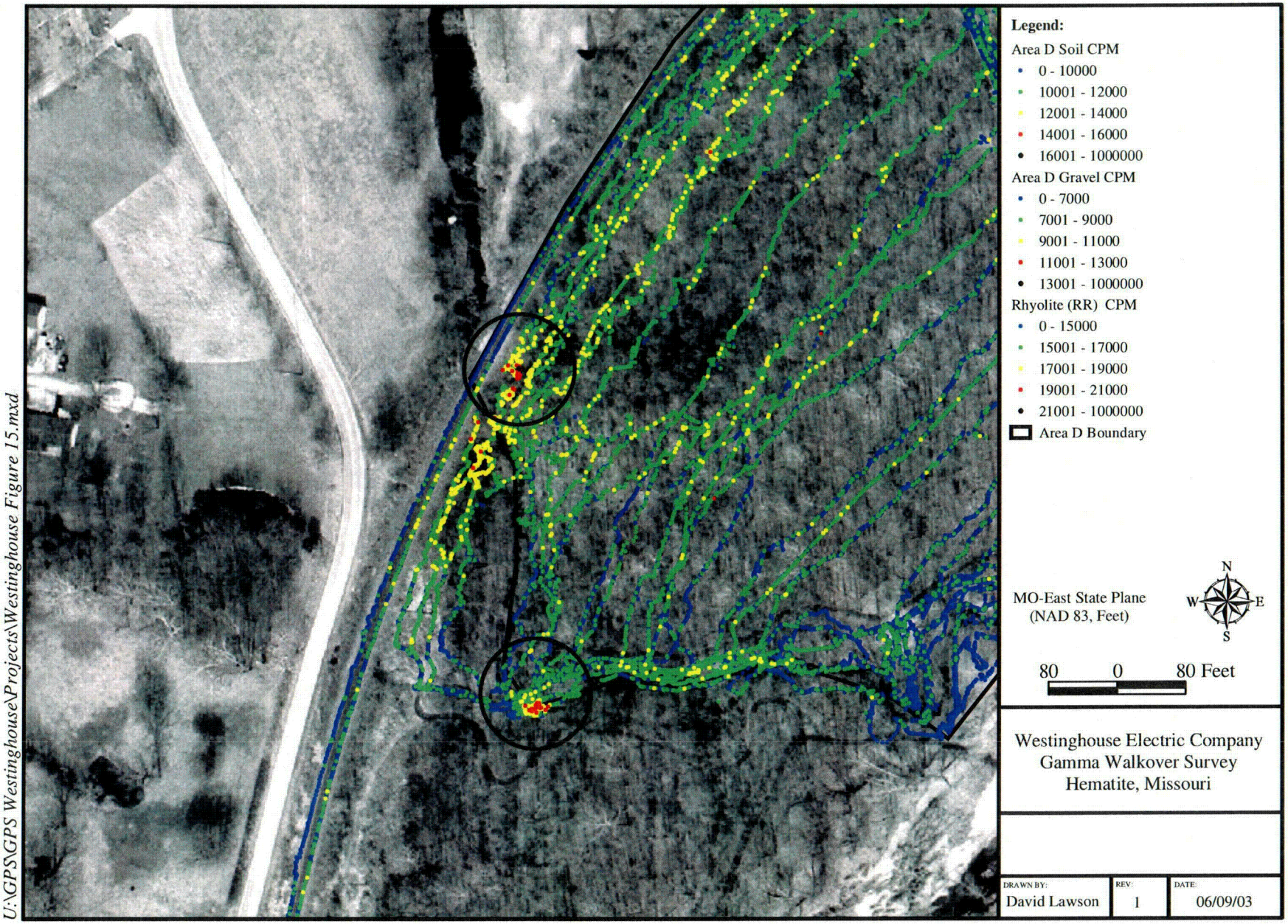

Figure 15. Area 'D' Isolated Elevated Areas

4.6 AREA E

Area E is the area located just east of the facility. Area E is bordered on the west and east by drainages, to the south by the railroad, and to the north by Hwy P. Area E was densely covered with trees, briars, and brush. This area was generally level, with intermittent ditches and drainages. The area did not appear to drain well, as evidenced by the presence of standing water in numerous locations and generally muddy terrain.

The gamma walkover of this area was designed to provide roughly systematic coverage of the entire area. The survey was conducted by initially concentrating on the boundaries, with an emphasis on areas that were more likely to be contaminated. After the boundaries were established, we attempted the survey of the remaining portion of Area E by surveying with varying distances (10-30 ft) between surveyors. Due to the very thick underbrush and briars, systematic coverage was difficult to obtain. The initial attempt failed to provide adequate coverage, the second attempt resulted in GPS cord damage, and the majority of the data from the walkover was not collected. If additional walkovers are to be conducted in this area, some limited amount of clearing and grubbing will be required.

In general, the gamma radiation levels in this area ranged from 8,000-14,000 cpm. The count rate was relatively lower adjacent to and around the western drainage. This was the area expected to have the highest probability of contamination due to its proximity to the site. Additional walkovers were performed adjacent to the drainage that verified the decreased count rate. One area, slightly south of the gravel-parking pad in the northeast portion of the area, indicated a single elevated data point. The count rate associated with this data point was not verified by the surrounding count rates of the surrounding data points. An additional gamma walkover was conducted in the vicinity of the original data point to verify the existence of elevated gamma radiation. No elevated gamma radiation was detected at the point or the area surrounding the original data point.

The map of this area indicates one isolated elevated reading adjacent to Area B along the bank of the west drainage of Area E. This location has been included in the Area B evaluation. It consists of the metal debris that was removed by Westinghouse.

Figure 16 depicts the data collected for Area E with the standard 2,000 cpm increment starting at 10,000 cpm.

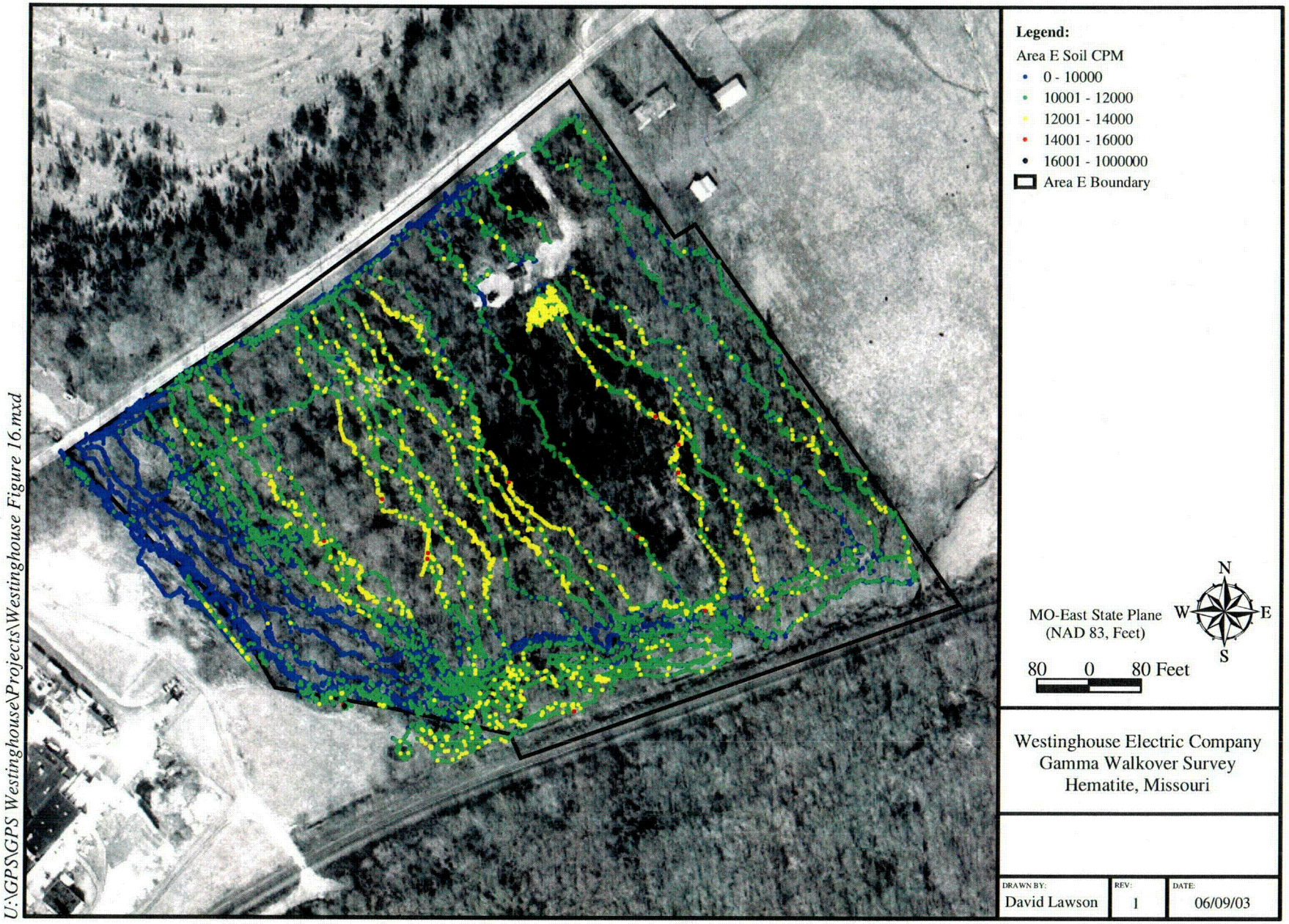

Figure 16. Area 'E' Gamma Walkover Survey

4.7 AREA F

Area F is comprised primarily of the farm that is to the east of Area E and the facility. Most of Area F consists of grassy grazing areas, a pond, and a small wooded area. The railroad splits this area in two. The area is bordered in the south by Joachim Creek. Hwy P is the boundary to the north. Area E and Area D make up the boundary to the west. Additional farmland, not part of the Property, is located to the east.

As in Area C and D, relative elevated count rates are identified just south of the railroad in areas covered with mature timber. A drainage ditch was identified during the survey on the far southeast portion of Area F. The survey of this ditch resulted in two areas of interest. The first area was further investigated and the increase in count rate was proved to be due to a change in the geometry of the survey. As the ditch deepened and sidewalls became closer to the detector, an increased count rate was observed. The survey identified elevated gamma radiation levels at the extreme northern portion of the same drainage. This apparent increase was investigated and determined to be due to the presence of Rhyolite.

Figure 17 depicts the data collected for Area F with the standard 2,000 cpm increment starting at 10,000 cpm.

4.8 AREA G

Area G is divided into two sections that are north of the facility. Both sections are mostly tree covered and are more elevated in topography than the rest of the areas.

The gamma walkover of this area was designed to provide limited coverage. The survey was to provide coverage adjacent to all boundaries, roads, and drainages within the area. Additional coverage was requested in the flat areas adjacent to the drainages in the western parcel.

In general, the survey of this area showed only a slight deviation in count rates. The largest deviation occurred due to changing media, switching between gravel, gravel/soil mixture, and soil. One area of interest was discovered on the power line road in the western parcel. This area exhibited count rates around 8,000 cpm with the relative background in this area ranging from 4,000-6,000 cpm. There was no logical explanation or recognized transport mechanism for contamination to have reached this location. The area was resurveyed and the original count rates were verified as accurate.

Figure 18 depicts the data collected for Area G with the standard 2,000 cpm increment starting at 10,000 cpm.

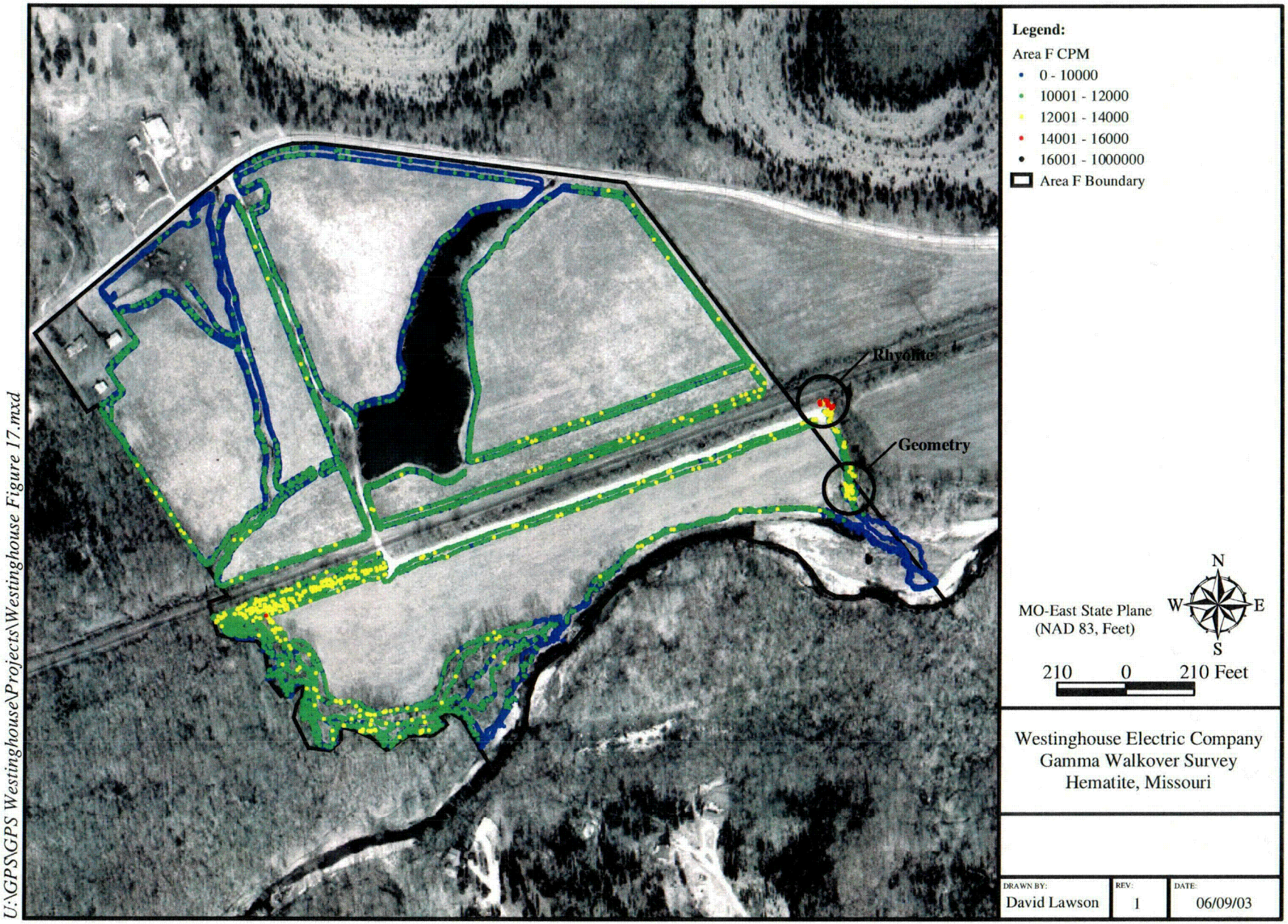

Figure 17. Area 'F' Gamma Walkover Survey

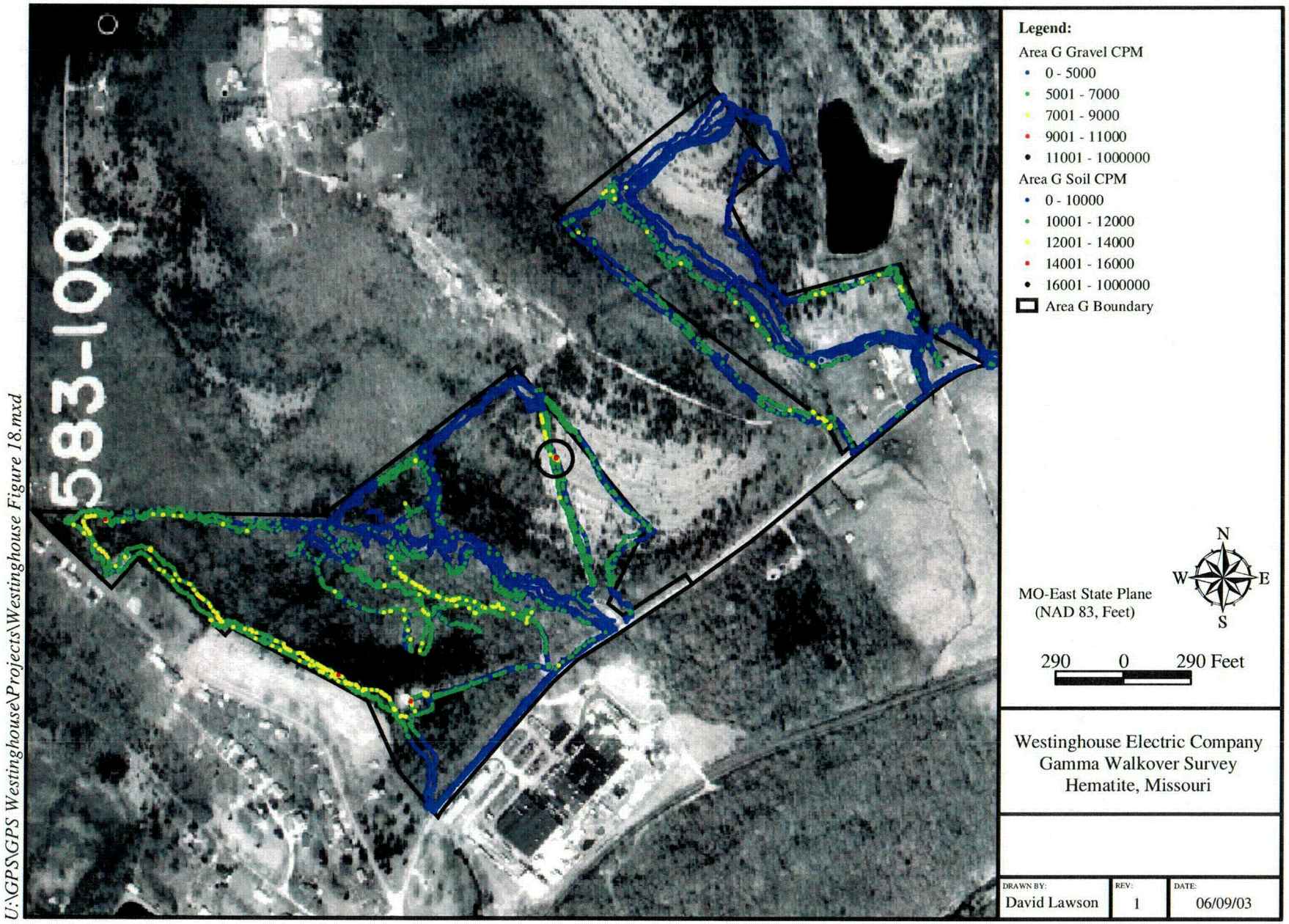

Figure 18. Area 'G' Gamma Walkover Survey

5.0 CONCLUSIONS/RECOMMENDATIONS

The survey progressed as planned with limited unexpected discoveries. The elevated gamma radiation identified within the 100% coverage area was not significantly greater in magnitude or extent than what was anticipated. Areas of interest or concern did in fact prove to have elevated levels of gamma radiation. The evaluation of the collected data did not reveal a significant amount of elevated gamma radiation beyond the anticipated area.

Areas of concern for the survey were identified in the plan and during the kickoff meeting. The areas of concern that were investigated follow:

Burial Pits

The burial pits were actively used from the late 1950s to 1970, and they are reportedly located to the east of the plant. Individual elevated count rates were identified and confirmed in the general vicinity of the area where the burial pits are expected to be located. Based on the equipment utilized for this survey, the burial pits cannot be confirmed to be present, but the locations of the elevated gamma radiation on the east side of the plant in Area B are potential starting points for the burial pits investigations.

Limestone Storage and Limestone Fill Areas

Limestone (calcium carbonate) was used to capture hydrogen fluoride gas (HF) from the uranium hexafluoride (UF_6) conversion facility. Spent limestone was generated from 1968 to 1998. Currently the spent limestone is stored in one pile within the fenced area of the plant. At least two other areas, one near the site spring and the other in the northeast section of the burial pits, may have been filled with the limestone. No indication of elevated gamma radiation was identified due to the existence of the spent limestone pile within the fenced area or in either location outside the fence. A gamma walkover survey was not specifically performed on the spent limestone pile within the fence, but only along the edges of the pile.

Outdoor and Shallow Surface Areas

Several areas around the site (soils within the fence line and soil adjacent to the barns) are known to have surface uranium contamination. Adjacent to the Tile Barn is an area that was used to store excess contaminated equipment. Several isolated areas of elevated gamma radiation were detected around the Tile Barn, adjacent to the fence line, and in drainage ditches located within Area B. The presence of these elevated gamma radiation measurements confirms the presence of gamma emitting radionuclides in excess of background values at these locations.

Railroad

The railroad easement that cuts through the site is not considered a potential AOC; however, a portion of the ballast used to construct the railroad is Rhyolite. The Rhyolite is known to have naturally occurring radioactivity. Increased gamma radiation levels were confirmed to be associated with the Rhyolite. The railroad easement that cuts through the site exhibited elevated count rates in the range of 14,000-16,000 cpm. In addition, the railroad adjacent to the United States National Guard Armory exhibited similar count rates. The

measurements from the Rhyolite in the vicinity of the site are consistent with those from the railroad adjacent to the armory.

Red Room Roof Burial Area/Cistern Burn Pit Area

The roof of the Red Room (Building 240) was reportedly buried in an area south of the Tile Barn. Elevated gamma radiation readings were identified south-southwest of the Tile Barn; however, we could not conclude that this was due to the presence of the Red Room roof burial. Additional investigation to determine the cause of the elevated gamma radiation is required to confirm or negate the presence of this burial. The elevated gamma radiation readings may be due to Cistern Burn Pit Area.

Deul's Mountain

During the construction of the Building 256 warehouse, a large area of potentially contaminated soil was removed and stored along the southeast corner of the fence line. No elevated gamma radiation levels were obtained during the walkover of part of Deul's Mountain; however, an area with elevated gamma radiation readings was identified at the foot of the mountain.

Joachim Creek Bridge

Citizens have reported that material may have been buried on or near the southwest portion of the property, in the vicinity of the Joachim Creek bridge. No abnormal or elevated gamma radiation levels were obtained during the investigation of this area.

Potential additional investigations that may be beneficial based on the results of this survey outside the 100% coverage area are to:

- Investigate the obvious difference in general gamma radiation levels south of the railroad tracks decreasing toward Joachim Creek. Although the "reference area" walkover did confirm a decrease in count rates with proximity to Joachim Creek, a few soil samples analyzed for gamma emitters would verify the actual gamma emitters present adjacent to the railroad. The analysis of these samples could confirm the gamma emitters as naturally occurring, or link them to potential contamination from site activities.

- Investigate the isolated spot identified in Area G on the power line road. This area should be sampled for gamma emitters. It may be prudent to obtain a soil sample in adjacent, lower reading areas to verify which gamma emitters are contributing to the difference between the two areas.

- Investigate and discover the cause of the elevated readings in the two isolated areas within Area D.

- Verify the area at the outlet of the culvert by physically removing all Rhyolite and performing an additional gamma survey, or obtaining a soil sample free of Rhyolite residue.

- Sample the area near the convergence of the drainages. The depth of the elevated gamma readings should be verified during the sampling to obviate subsequent field mobilizations.

Potential additional investigations that may be beneficial based on the results of this survey within the 100% coverage area are:

- Investigate a specific number of identified "hotspots" to determine magnitude and depth of contamination.

- Obtain soil samples at various "hotspot" locations with varying count rates. This sampling effort would attempt to quantify the range of contamination across the site, the deviation of the radionuclide ratio, and the resultant count rates associated with the various radionuclide ratios.

- Obtain samples at specific "hotspots" based on process knowledge to attempt to establish if the radionuclide ratios are significantly different between locations based on site historical uses.

- Use the information obtained from this survey with historical information to guide future subsurface investigation activities.

- Confirm that elevated gamma radiation readings adjacent to Building 230 are due to waste stored within the building. This could be accomplished by performing a gamma walkover survey upon removal of the waste.

In addition:

- A limited number of investigational samples may need to be obtained from the banks of the site evaporation ponds. All the soils surrounding the ponds tend to indicate slightly higher gamma radiation levels. This could be due to a number of reasons, but could be answered by obtaining soil samples in this area.

In general, contamination appears to be limited to the area in the vicinity of the plant site, which was investigated within the 100% coverage area. Contamination does not appear to have significantly migrated from the site by any of the normal transport modes (i.e. airborne release or migration with surface water). There is no general observable pattern of a decrease of gamma readings with distance from the plant. Joachim Creek does not indicate the presence of elevated gamma levels. With the exception of a few anomalies described herein, the survey data indicate that there is no obvious surficial contamination north of Hwy P, south of the railroad, in the farm area, or east of the first drainage.

6.0 REFERENCES

Westinghouse, 2003. *Gamma Survey Plan for the Hematite Site Rev 0.* St. Louis, MO, April 2003.

SAIC, 2002. Radiological Instrumentation HP-30 Rev 1. St. Louis, MO, December 2002.

ATTACHMENT 1

SURVEY INSTRUMENT QA RECORDS

	INSTRUMENT #	AVERAGE BKG	AVERAGE SOURCE
A	86306	5391	145052
B	117336	5493	146025
C	154232	5135	145862
D	117652	5418	135118
E	117634	5315	140510
F	105934	5263	143012
G	127217	5322	146113
H	154196	5405	129385

MEAN	5343	141385
10% RANGE	4809 - 5877	127246 - 155523

All readings in cpm.

Performed by: _____ Date: 4/5/03

Reviewed by: _____ Date: _____

Environmental Restoration Group, Inc.
12809 Arroyo de Vista, NE
Albuquerque, NM 87111
(505) 298-4224

EQUIPMENT PACKING SLIP

Company Name: SAIC
Contact Name: Bob French
Contact Telephone 314-486-6908

Order Number: 167
P.O. or Reference Number: 4500666160

Date Ordered: 4/1/2003
Date Shipped: 4/1/2003
Date of Delivery: 4/2/2003

Shipping Method: Fedex Standard Overnight
Shipping Number: 2458-3753-4

Ship To Information:
Bob French
9921 St. Charles Rock Rd.
St. Ann, MO 63074
314-486-6908

Billing Address:
SAIC
Central Accounts Payable
10260 Campus Point Dr., MS E-2
San Diego, CA 92121

Equipment Enclosed:

Instrument	*Serial Number*
Ludlum 2221r	86306
Ludlum 2221r	117336
Ludlum 2221r	117652
Ludlum 2221r	117634
Ludlum 2221r	105934
Ludlum 44-10	PR122628
Ludlum 44-10	PR118986
Ludlum 44-10	PR122613
Ludlum 44-10	PR154615
Ludlum 44-10	PR122612
Ludlum 44-10	PR150642
Ludlum 44-10	PR112840
Ludlum 44-10	PR150786
Eberline Cs-137	4054-02

Special Instructions:

Order continued on next page

Certificate of Calibration

Ratemeter / Scaler Certificate of Calibration

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Manufacturer: Ludlum Model: 2221 Serial No.: 86306

All Ranges Calibrated Electronically; Ludlum Pulser Generator S.N. 97743

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Reset ☑ Audio ☑ Mechanical ☑ Battery ☑ Window Operation ☑

High Voltage 500v ☑ 1000v ☑ 1500v ☑

Instrument found within tolerance (+/- 10%) Yes ☑ No ☐

Reference Setting	Ratemeter	Instrument "As found reading"
400 Kcpm	400 KCPM	+/- 10 %
100 Kcpm	100 KCPM	
40 Kcpm	40 KCPM	
10 Kcpm	10 KCPM	
4 Kcpm	4 KCPM	
1 Kcpm	1 KCPM	
400 cpm	400 CPM	
100 cpm	100 CPM	

Reference Setting	Integrated Counts (1-minute count)	Log Scale Count Rate	Instrument "As found reading"
400 Kcpm	40035-9	400 KCPM	+/- 10 %
40 Kcpm	40004	40 KCPM	
4 Kcpm	4001	4 KCPM	
400 cpm	400	400 CPM	

Calibrated By: Charles P. Zinn Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Bahr Date: 4/1/03

Certificate of Calibration

Environmental Restoration Group, Inc.
12809 Arroyo De Vista
Albuquerque, NM 87111
(505) - 298 - 4224

Manufacturer: LUDLUM Model: 2221 Serial No.: 117336
All Ranges Calibrated Electronically; Ludlum Pulser Generator S.N. 97743
Temp.: 70 F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

FUNCTION CHECKS:

Reset ✓ Audio ✓ Window Operation ✓ Mechanical ✓ Battery ✓
High Voltage 500v ✓ 1000v ✓ 1500v ✓

Instrument found within tolerance (+/- 10%) YES ✓ NO

COMMENTS:

Reference Setting	Ratemeter	Instrument "As found reading"
400 Kcpm	400 Kcpm	+/- 10%
100 Kcpm	100 Kcpm	
40 Kcpm	40 Kcpm	
10 Kcpm	10 Kcpm	
4 Kcpm	4 Kcpm	
1 Kcpm	1 Kcpm	
400 cpm	400 cpm	
100 cpm	100 cpm	

Reference Setting	Digital Readout	Log Scale	Instrument Received
400 Kcpm	400 790	400 Kcpm	+/- 10%
40 Kcpm	40057	40 Kcpm	
4 Kcpm	4002	4 Kcpm	
400 cpm	400	400 cpm	

Calibrated By: Charles P. Farr Calibration Date: 4/1/03
Calibration Due: 4/1/04
Reviewed By: Kenneth R Balo Date: 4/1/03

Certificate of Calibration

Environmental Restoration Group, Inc.
12809 Arroyo De Vista
Albuquerque, NM 87111
(505) - 298 - 4224

Manufacturer: LUDLUM Model: 2221 Serial No.: 117652
All Ranges Calibrated Electronically; Ludlum Pulser Generator S.N. 97743
Temp.: 70 F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

FUNCTION CHECKS:

Reset ✓ Audio X Window Operation ✓ Mechanical ✓ Battery ✓
High Voltage 500v ✓ 1000v ✓ 1500v ✓

Instrument found within tolerance (+/- 10%) YES ✓ NO

COMMENTS: AUDIO NOT VERY LOUD

Reference Setting	Ratemeter	Instrument "As found reading"
400 Kcpm	400 Kcpm	+/- 10 %
100 Kcpm	100 Kcpm	″
40 Kcpm	40 Kcpm	″
10 Kcpm	10 Kcpm	″
4 Kcpm	4 Kcpm	″
1 Kcpm	1 Kcpm	″
400 cpm	400 cpm	″
100 cpm	100 cpm	″

Reference Setting	Digital Readout	Log Scale	Instrument Received
400 Kcpm	399362	400 Kcpm	+/- 10 %
40 Kcpm	39908	40 Kcpm	″
4 Kcpm	3990	4 Kcpm	″
400 cpm	399	400 cpm	″

Calibrated By: Charles P. Zuo Calibration Date: 4/1/03
Calibration Due 4/1/04
Reviewed By: Kenneth R. Barker Date: 4/1/03

Certificate of Calibration

Environmental Restoration Group, Inc.
12809 Arroyo De Vista
Albuquerque, NM 87111
(505) - 298 - 4224

Manufacturer: LUDLUM Model: 2221 Serial No.: 117634

All Ranges Calibrated Electronically; Ludlum Pulser Generator S.N. 97743

Temp.: 70 F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

FUNCTION CHECKS:

Reset ✓ Audio ✓ Window Operation ✓ Mechanical ✓ Battery ____

High Voltage 500v ✓ 1000v ✓ 1500v ✓

Instrument found within tolerance (+/- 10%) YES ✓ NO ____

COMMENTS:

Reference Setting	Ratemeter	Instrument "As found reading"
400 Kcpm	400 KCPM	+/- 10 %
100 Kcpm	100 KCPM	
40 Kcpm	40 KCPM	
10 Kcpm	10 KCPM	
4 Kcpm	4 KCPM	
1 Kcpm	1 KCPM	
400 cpm	400 CPM	
100 cpm	100 CPM	

Reference Setting	Digital Readout	Log Scale	Instrument Received
400 Kcpm	400745	400 KCPM	+/- 10 %
40 Kcpm	39975	40 KCPM	
4 Kcpm	3999	4 KCPM	
400 cpm	400	400 CPM	

Calibrated By: Charles P. Fair Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Rueb Date: 4/1/03

Certificate of Calibration

Environmental Restoration Group, Inc.
12809 Arroyo De Vista
Albuquerque, NM 87111
(505) - 298 - 4224

Manufacturer: LUDLUM Model: 2221 Serial No.: 105934
All Ranges Calibrated Electronically; Ludlum Pulser Generator S.N. 97743
Temp.: 70 F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

FUNCTION CHECKS:

Reset ✓ Audio ✓ Window Operation ✓ Mechanical ✓ Battery ✓
High Voltage 500v ✓ 1000v ✓ 1500v ✓

Instrument found within tolerance (+/- 10%) YES ✓ NO

COMMENTS:

Reference Setting	Ratemeter	Instrument "As found reading"
400 Kcpm	400 Kcpm	+/- 10 %
100 Kcpm	100 Kcpm	
40 Kcpm	40 Kcpm	
10 Kcpm	10 Kcpm	
4 Kcpm	4 Kcpm	
1 Kcpm	1 Kcpm	
400 cpm	400 cpm	
100 cpm	100 cpm	

Reference Setting	Digital Readout	Log Scale	Instrument Received
400 Kcpm	399320	400 Kcpm	+/- 10 %
40 Kcpm	39935	40 Kcpm	
4 Kcpm	4001	4 Kcpm	
400 cpm	401	400 cpm	

Calibrated By: Charles F. Fuss Calibration Date: 4/1/03
Calibration Due: 4/1/04
Reviewed By: Kenneth R Bahr Date: 4/1/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR150786

Counter Mfg.: Ludlum Model: 2221 Serial No.: 86306

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
600	47360	
700	81460	
800	91596	
900	98708	
1000	99379	
825	93572	11683

Recommended Operating Voltage: 825 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Balk Date: 4/1/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR112840

Counter Mfg.: Ludlum Model: 2221 Serial No.: 117336

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
600	26181	
700	56800	
800	79600	
900	87779	
1000	93711	
1100	94676	12154
1200	96013	

Recommended Operating Voltage: 1100 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Balch Date: 4/2/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR150642

Counter Mfg.: Ludlum Model: 2221 Serial No.: 149938

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 μCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
600	23819	
700	56602	
800	83456	
900	92988	
1000	99617	
950	95131	11954

Recommended Operating Voltage: 950 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth E. Baker Date: 4/1/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR154615

Counter Mfg.: Ludlum Model: 2221 Serial No.: 149938

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
600	52245	
700	84124	
750	93013	11403
800	95218	
850	100075	
900	100944	

Recommended Operating Voltage: 750 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth Bahr Date: 4/1/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR122613

Counter Mfg.: Ludlum Model: 2221 Serial No.: 117652

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
700	44687	
800	72978	
900	83968	
1000	90457	
1100	92956	
→ 1200	94396	12295
1300	94023	
1400	113123	

Recommended Operating Voltage: 1200 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth Rahn Date: 4/4/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR118986

Counter Mfg.: Ludlum Model: 2221 Serial No.: 117634

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
500	3281	
600	49052	
700	79498	
800	88012	
900	94234	
1000	94783	12579
1100	95491	
1200	97678	

Recommended Operating Voltage: 1000 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Burke Date: 4/1/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR122628

Counter Mfg.: Ludlum Model: 2221 Serial No.: 105934

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other: _____

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
500	35818	
600	76338	
700	88480	
800	93538	
900	94449	12627
1000	95749	

Recommended Operating Voltage: 900 volts

Calibrated By: Charles P. Zamora Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth Balk Date: 4/1/03

Automated Engineering & Electronic Services Inc.

AEES Inc. 165 Deer Run Ridge Road Kingston TN 1-865-376-0220 www.radprobe-aees.com

Calibration Certificate

Received Within Tolerance

Instrument Model No. 2221 Instrument Serial No. 154232 Misc1 EDI Misc2 MB

Battery Check ☑ Batt.Voltage: 5.8

Scale Range Testing

Test Range	As Found 100	As Found 200	As Found 400	As Left 100	As Left 200	As Left 400
1	100	200	400	100	200	400
10	1000	2000	4000	1000	2000	4000
100	10000	20000	40000	10000	20000	40000
1000	100000	200000	400000	100000	200000	400000
10000						

High Voltage Test

Test Point	As Found	As Left
500	507	507
1000	1005	1005
1500	1508	1508
2000	2015	2015

Logarithmic Meter Test

Range	1	10	100	1000
As Found	400	4000	42500	400000
As Left	400	4000	42500	400000

Time Tests

Test Point	Count Results
0.1	100
0.2	200
0.5	499
1	999
2	1999
5	4997

Time base testing default = 1000 CPM

Functional Tests

- ☑ Fast/Slow
- ☑ Reset
- ☑ Lights
- ☑ Zero Push
- ☑ Count Push
- ☑ Hold Push
- ☐ Thermo Dynamic
- ☑ Geotropism
- ☑ HV Push Button
- ☐ Over Range
- ☐ Alarm Ack

Electronic Checks / Set Points

	As Found	As Left
Mechanical Zero:	0	0
High Voltage:	750	750
Threshold 1	8.5	10
Threshold 2	na	na
Threshold 3:	na	na
Over Load	na	na

Audio Tests

- ☑ AudioTest
- ☑ Audio Divide
- ☑ Audio Volume
- ☐ Audio Alarm
- ☑ HeadPhone

Parts Replaced during Calibration and or Repair.

Calibration Date: 4/2/03 Cal Cycle / Months 12

Calibration Due Date: 4/2/04

Calibrated By: K Murphy

Signature: Kenneth Murphy

Remarks: ESV#917231 Due 3-3-04

Certificate

Automated Engineering & Electronic Services

165 Deer Run Ridge RD. Kingston Tennessee 37763 1-423-376-0229 Fax 1-423-376-0229 www.radprobe-aees.com

Certificate of Calibration

For

Ratemeter/Scalar

Model Number: 2221 Serial Number: 127217 EDI# 232 Client : EDI

Probe No.: NA Serial Number: NA PO #: COLONIE

The subject instrument was calibrated to the indicated specifications using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constraints. This document certifies that the instrument met the following specifications upon its return to the submitter. Upon receipt the instrument was found: **Within Specs.**

AEES Inc. calibrations control system complies to the guides lines of ANSI N323-1997, ANSI/NCSL Z540-1-1994 and Mil Std 45662A

Electronic files are identified by MDL_SN_DATE_PROBE MDL_PROBE SN

Data

Scale / Range	Test Value	As Found Value	Variance 0.1 Max	As Left Value	Variance 0.1 Max.	Calib. Tol.
1	100	100	0.00	100	0.00	0.1
1	400	400	0.00	400	0.00	0.1
10	100	1000	0.00	1000	0.00	0.1
10	400	4000	0.00	4000	0.00	0.1
100	100	9900	-0.01	9900	-0.01	0.1
100	400	40000	0.00	40000	0.00	0.1
1000	100	99800	-0.00	99800	-0.00	0.1
1000	400	399000	-0.00	399000	-0.00	0.1

Log	Test Point	As Found	As Left
X1	400	400	400
X10	4000	4000	4000
X100	4000	40000	40000
X1000	40000	400000	400000

NA 1060 volts

NA

NA

ERR Voltage Increment 50 Volts

NA

Time Test Data

Time	Test Val.	As Found	Variance	As Left	Variance
0.1	1000	100	0.00	100	0.00
1	1000	998	-0.00	998	-0.00
5	1000	4998	-0.00	4998	-0.00
10	1000	9998	-0.00	9998	-0.00

HV As Found As Left

500	500	500
1000	995	995
1500	1495	1495
2000	1995	1995
2500		

NA

NA

ERR

NA

NA

ERR

PROS-100 Amplifier Calibrations						M&TE	SN.	Due Date.	M&TE	SN. Due Date
PROS-200 Counters Calibrations	Com Port tested:	No	Geotropic Tested:	Yes						
PROS-300 Support Circuits Tests	Repairs performed:	No	Thermo Tested:	No						
PROS-400 -- Not Required	Response Tests:	Yes	Functional Tests:	Yes		MP-1	132	8-12-2002		
PROS-500 Geotropic Tests	Speaker Tested:	Yes	Timer Tested:	Yes		ESV	917231	2-19-2003	Temperature in Deg. F	71
PROS-600 -- Not Required	Battery Level:	Good	Alpha threshold	100					Pressure in mm/hg	738.27
PROS-800 -- Not Required	Flow Rate [cc/min]	na	Beta threshold	800					Relative Humidity	85

Source	SN.	DPM	Cal Date	Source	SN.	DPM	Cal Date	Source	SN.	DPM	Cal Date
NA											

Remarks: HV as found @1020 HV as left @1050 Threshold as found 10 mv =100 Threshold as left 10 mv = 100

05-06-2002 (a)

Not Used/No/NA = Not Req. or needed

Performed By: Carol Duff Date: 05-07-2002

Reviewed By: [illegible] Date: [illegible]

Certificate

Automated Engineering & Electronic Services

165 Deer Run Ridge RD. Kingston Tennessee 37763 1-423-376-0229 Fax 1-423-376-0229 www.radprobe-aees.com

Certificate of Calibration

For

Ratemeter/Scalar [Type]

Model Number: 2221 Serial Number: 154196 Client : EDI

Probe No.: NA Serial Number: NA PO #: CISS

The subject instrument was calibrated to the indicated specifications using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constraints. This document certifies that the instrument met the following specifications upon its return to the submitter. Upon receipt the instrument was found: **Within Specs.** [As Found]

AEES Inc. calibrations control system complies to the guides lines of ANSI N323-1997, ANSI/NCSL Z540-1-1994 and Mil Std 45662A

Electronic files are identified by: MDL_SN_DATE_PROBE MDL_PROBE SN

Analog Cal Data

Scale / Range	Test Value	As Found Value	Variance 0.1 Max	As Left Value	Variance 0.1 Max	Calib Tol
.1	100	100	0.00	100	0.00	0.1
1	400	400	0.00	400	0.00	0.1
10	100	1000	0.00	1000	0.00	0.1
10	400	4000	0.00	4000	0.00	0.1
100	100	10000	0.00	10000	0.00	0.1
100	400	40000	0.00	40000	0.00	0.1
1000	100	100000	0.00	100000	0.00	0.1
1000	400	400000	0.00	400000	0.00	0.1

Not Required

Efficiency

NA ERR

NA ERR

NA ERR

Voltage Increment: 50 Volts [Simple Plateau] [Dual Plateau]

Digital Cal

Time	Test Val	As Found	Variance	As Left	Variance
0.1	1000	100	0.00	100	0.00
1	1000	997	-0.00	997	-0.00
5	1000	4999	-0.00	4999	-0.00
10	1000	9998	-0.00	9998	-0.00

HV As Found As Left

500	490	490
1000	1000	1000
1500	1500	1500
2000	1995	1995
2500	NA	NA

	Procedures		Test		M&TE	SN	Due Date	M&TE	SN	Due Date
PROS-100 Amplifier Calibrations	Com Port tested:	No	Geotropic Tested:	Yes						
PROS-200 Counters Calibrations	Repairs performed:	No	Thermo Tested:	No						
PROS-300 Support Circuits Tests	Response Tests:	Yes	Functional Tests:	Yes	MP-1	132	1-8-2003			
PROS-400 -- Not Required	Speaker Tested:	Yes	Timer Tested:	Yes	ESV	917231	2-19-2003	Temperature in Deg F		75
PROS-500 Geotropic Tests	Battery Level:	7.5	Alpha threshold	100				Pressure in mm/hg		749
PROS-600 -- Not Required	Flow Rate [cc/min]	na	Beta threshold	NA				Relative Humidity		61
PROS-800 -- Not Required										

Sources

Source	SN	DPM	Cal Date	Source	SN	DPM	Cal Date	Source	SN	DPM	Cal Date

Non Required

Remarks: HV As Found @ 985 As Left @ 900

Threshold As Found @ 100 As Left @ 100

Not Used/No/NA = Not Req or needed

Performed By: [signature] Date: 9-12-03

Reviewed By: [signature] Date: 9-12-03

EBERLINE SERVICES

CERTIFICATE OF CALIBRATION

Gamma Standard

S.O.# 3951
P.O.# N/A

Description of Standard:

Model No. CS-7AS Serial No. 4054-02 Isotope Cs-137

The source of gamma radiation is mounted on a 2.54 cm diameter PLASTIC disc, 3 mm thick and sealed in a PLASTIC RESIN.

Measurement Method:

The gamma ray emission rate was compared with a similar standard, which was calibrated by NIST S/N 2752-91. The comparison of relative gama ray emission rates was accomplished using a high resolution gamma-ray detector (nominal active volume 100 cm^3) and a multichannel pulse height analyzer.

Measurement Result:

The gamma ray activity of the standard on 10-03-2002 was 8.5 μCi.

The uncertainty of the measurement is 5 %, which is the sum of the uncertainty assigned to the NIST reference (2.2 %), random counting error at the 99% confidence level, and the estimated upper limit of systematic errors.

Calibrated by: ART REUST Reviewed by:

Calibration Technician: Art Reust Q.A. Representative: Anthony W. Roth

Calibration Date: 10-03-2002 Reviewed Date: 10-4-02

Analytical Services
7021 Pan American Freeway NE

Initial 44-10 A Instrument Check In

Meter Number:	86306	Detector Number:	PR150786
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/1/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 825V

Source GCPM	BKG CPM
146277	5430
144275	5321
145516	5281
145180	5420
145093	5221
145525	5478
145118	5461
143585	5392
144740	5392
145209	5516

Average Bkg. (CPM):	5391		
Average Source (GCPM):	145052		
Average Net Source (NCPM):	139661		
Source Range (GCPM):	116041	to	174062
Background Range (CPM):	4313	to	6469

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 B Instrument Check In

Meter Number:	117336	Detector Number:	PR112840
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/1/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 1100V

Source GCPM	BKG CPM
146655	5440
146217	5412
146755	5542
146289	5416
145407	5569
146713	5512
145978	5494
145590	5561
145272	5487
145373	5494

Average Bkg. (CPM):	5493		
Average Source (GCPM):	146025		
Average Net Source (NCPM):	140532		
Source Range (GCPM):	116820	to	175230
Background Range (CPM):	4394	to	6591

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 C Instrument Check In

Meter Number:	154232	Detector Number:	PR150642
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/2/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 750V

Source GCPM	BKG CPM
145727	5178
145126	5193
145614	5203
145834	5147
146496	5135
145830	5175
146327	5121
145854	5037
145861	5010
145955	5146

Average Bkg. (CPM):	5135		
Average Source (GCPM):	145862		
Average Net Source (NCPM):	140728		
Source Range (GCPM):	116690	to	175035
Background Range (CPM):	4108	to	6161

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 D Instrument Check In

Meter Number:	117652	Detector Number:	PR122613
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/1/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 1200V

Source GCPM	BKG CPM
134929	5443
134724	5476
135007	5495
135621	5317
135311	5458
135739	5410
135221	5403
135216	5457
134847	5331
134568	5389

Average Bkg. (CPM):	5418		
Average Source (GCPM):	135118		
Average Net Source (NCPM):	129700		
Source Range (GCPM):	108095	to	162142
Background Range (CPM):	4334	to	6501

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 E Instrument Check In

Meter Number:	117634	Detector Number:	PR118986
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/1/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 1000V

Source GCPM	BKG CPM
139891	5484
140502	5238
140522	5349
139748	5186
140562	5485
141236	5314
141288	5539
141016	5049
140205	5392
140133	5110

Average Bkg. (CPM):	5315		
Average Source (GCPM):	140510		
Average Net Source (NCPM):	135196		
Source Range (GCPM):	112408	to	168612
Background Range (CPM):	4252	to	6378

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 F Instrument Check In

Meter Number:	105934	Detector Number:	PR122628
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	4/1/2004	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 900V

Source GCPM	BKG CPM
141240	5199
140742	5381
143372	5214
143729	5407
143413	5066
143394	5293
143679	5169
143269	5293
143576	5317
143702	5293

Average Bkg. (CPM):	5263		
Average Source (GCPM):	143012		
Average Net Source (NCPM):	137748		
Source Range (GCPM):	114409	to	171614
Background Range (CPM):	4211	to	6316

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 G Instrument Check In

Meter Number:	127217	Detector Number:	PR154615
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	5/6/2003	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 1050V

Source GCPM	BKG CPM
144708	5247
144713	5328
144991	5536
144434	5196
144733	5559
144865	5375
147546	5214
147775	5323
149591	5053
147774	5385

Average Bkg. (CPM):	5322		
Average Source (GCPM):	146113		
Average Net Source (NCPM):	140791		
Source Range (GCPM):	116890	to	175336
Background Range (CPM):	4257	to	6386

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

Initial 44-10 H Instrument Check In

Meter Number:	154196	Detector Number:	PR122612
Meter Model:	2221	Detector Model:	44-10
Cal. Due:	9/12/2003	Cal. Due:	4/1/2004

Source=Cs 137
S/N-4054-02

Threshold = 10mV
High Voltage = 900V

Source GCPM	BKG CPM
129217	5354
129351	5433
128991	5493
129534	5419
129035	5436
129555	5577
129554	5401
129713	5442
129388	5105
129514	5390

Average Bkg. (CPM):	5405		
Average Source (GCPM):	129385		
Average Net Source (NCPM):	123980		
Source Range (GCPM):	103508	to	155262
Background Range (CPM):	4324	to	6486

Source Range +/- 20%
Background Range +/- 20%

Performed By: _____ Date: 4/5/03

Reviewed By: _____ Date: 4/7/03

SCALER/RATEMETER ELECTRONIC CALIBRATION CERTIFICATE

Customer: SAIC Order No.: SAIC0718021
Mfg.: Ludlum Model: 2360 Serial No.: 168050
Cal. Interval: 1 yr. Meterface: 202-855
T. 70 °F RH 68 % Alt 660 ASL

☒ Instrument Received: ☒Within Toler. +-10% ☐10-20% ☐Out of Tol. ☐Requiring Repair ☐Other –See comments

☒Mechanical ck. ☒Meter Zeroed ☐Background Subtract ☐Input Sens. Linearity
☐F/S Resp. ck. ☒Reset ck. ☒Window Operation ☒Geotropism
☒Audio ck. ☐Alarm Setting ck. ☒Batt. Ck.
☒Calibrated in accordance with SAIC HP-30 and manufactures calibration instructions.

Instrument Volt Set 635 V Input Sens. comments mV Det. Oper. 635 V at comments mV
☒HV readout (2 points) Ref./Inst. 500 / 521 V Ref./Inst. 2000 / 1960 V

COMMENTS: For input sensitivities see detector calibration form

RANGE/MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT "AS FOUND READING"	INSTRUMENT "AS LEFT READING"
X 1000	400 K cpm	400 K cpm	400 K cpm
X 1000	100 K cpm	100 K cpm	100 K cpm
X 100	40 K cpm	40 K cpm	40 K cpm
X 100	10 K cpm	10 K cpm	10 K cpm
X 10	4 K cpm	40 K cpm	4 K cpm
X 10	1 K cpm	1 K cpm	1 K cpm
X 1	400 cpm	400 cpm	400 cpm
X 1	100 cpm	100 cpm	100 cpm

*Uncertainty within ± 10% C.F. within ± 20%

ALL Ranges(s) Calibrated Electronically

	REFERENCE CAL. POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
Digital Reading	400 K cpm	40034 (0)	40029 (0)
	40 K cpm	4004 (0)	4003 (0)
	4 K cpm	401 (0)	401 (0)
	400 cpm	40 (0)	40 (0)
	40 cpm	4 (0)	4 (0)

Reference Instruments and/or Sources;
☒ Multimeter S/N AA00153723 ☒ m 500 S/N 154177
☐ Oscilloscope S/N ☐ Other

Calibrated By: [signature] Date: 7/18/02
Reviewed By: [signature] Date: 7/23/02
Calibration Due Date: 7/18/03

FUSRAP Detector Calibration Form

Customer: SAIC

Section 1: General Information

Date: 7/18/02	Location: Holtwick	Technician: B. French
Manufacturer: Ludlum		Model: 43-89 "N"
Serial #: 179856		Last Calibrated: 6/29/01

Reason for re-calibration: X Due for Calibration _____ Repair Other (Enter in remarks)

Equipment used for Calibration:

Type	Identification	Date due for calibration
Model 2360	168050	7/18/03

Sources:

Isotope:	Identification:	Current Activity:	Assay Activity	Date of Assay:
Th-230	SAIC-0053	20300	20300	11/16/00
SrY-90	SAIC-0054	16059	16700	11/15/00

Section 2: As Found / As Left Data

Physical Condition (SAT/UNSAT)

As Found BKG. Alpha	As Found BKG. Beta	As Left BKG. Alpha	As Left BKG. Beta
5- 10 MIN. BKG. COUNTS	5- 1 MIN. BKG. COUNTS	5- 10 MIN. BKG. COUNTS	5- 1 MIN. BKG. COUNTS
1. 0.4	1. 141	1. 0.3	1. 153
2. 0.7 Avg. 0.36	2. 134 Avg. 139	2. 0.1 Avg. 0.34	2. 188 Avg. 167
3. 0.3	3. 134	3. 0.3	3. 164
4. 0	4. 146	4. 0.5	4. 186
5. 0.4	5. 141	5. 0.5	5. 146

As Found Source Alpha	As Found Source Beta	As Left Source Alpha	As Left Source Beta
5- 1 MIN. Source Counts	5- .1 MIN. Source Counts	5- 1 MIN. Source Counts	5- 1 MIN. Source Counts
1. 3374	1 4084	1. 3470	1. 4386
2. 3124	2. 4124	2. 3380	2. 4434
3. 3222 Avg. 3276	3. 4197 Avg. 4107	3. 3474 Avg. 3430	3. 4411 Avg. 4404
4. 3313	4. 4115	4. 3364	4. 4379
5. 3346	5. 4016	5. 3463	5. 4408
Calculated Eff.: 16.14%%	Calculated Eff.: 24.71%%	Calculated Eff.: 16.90%%	Calculated Eff.: 26.38%%

Section 3:

HV SET: 635V Remarks: H.V. SET W/PROBE ATTACHED

Alpha Threshold: 120mV

Beta Threshold: 3.5mV

Beta Window: 30mV

Date Calibrated: 7/18/02 Date Calibration Due: 7/18/03

Preformed by: [signature] Date: 7/18/02

Reviewed by: [signature] Date: 7/23/02

Designer and Manufacturer of Scientific and Industrial Instruments

CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.
POST OFFICE BOX 810 PH. 915-235-5494
501 OAK STREET FAX NO. 915-235-4672
SWEETWATER, TEXAS 79556, U.S.A.

CUSTOMER SAIC ORDER NO. 286250

Mfg. Ludlum Measurements, Inc. Model 2929 Serial No. 180850

Mfg. _____ Model _____ Serial No. _____

Cal. Date 6-Dec-02 Cal Due Date 6-Dec-03 Cal. Interval 1 Year Meterface 202-014

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 76 °F RH 23 % Alt 710.8 mm Hg

☑ New Instrument Instrument Received ☐ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical ck. ☑ Window Operation

☑ Audio ck.

☑ Meter Zeroed Alpha Sensitivity 175 mV Beta Sensitivity 4 mV Beta Window 50 mV

☑ Calibrated in accordance with LMI SOP 14.8 rev 12/05/89. ☐ Calibrated in accordance with LMI SOP 14.9 rev 02/07/97.

Instrument Volt Set 900 V = 3.63 on High Voltage dial. High Voltage set with detector connected.

☑ HV Readout (2 points) Ref./Inst. 500 / 500 V Ref./Inst. 2008 / 2000 V

COMMENTS:

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

Alpha Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm		400357
40K cpm		40039
4K cpm		4005
400 cpm		400
40 cpm		40

Beta/Gamma Channel Digital Readout

REFERENCE CAL POINT	INSTRUMENT RECEIVED	INSTRUMENT METER READING*
400K cpm		400296
40K cpm		40029
4K cpm		4002
400 cpm		400
40 cpm		40

*Uncertainty within ± 10% C.F. within ± 20%

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Reference Instruments and/or Sources:

Cs-137 Gamma S/N ☐ 1162 ☐ G112 ☐ M565 ☐ 5105 ☐ T1008 ☐ T879 ☐ E552 ☐ E551 ☐ Neutron Am-241 Be S/N T-304

Alpha S/N _____ ☐ Beta S/N _____ ☐ Other _____

Ludlum 500 S/N 141244 ☐ Oscilloscope S/N _____ ☑ Multimeter S/N 68160950

Calibrated By: [illegible] Date [illegible]

SACE FUSRAP Detector Calibration Form | **Customer: SAIC**

Section 1: General Information

Date: 2/19/03	Location: Holtwick	Technician: B. French
Manufacturer: Ludlum		Model: 43-10-1
Serial #: 194703		Last Calibrated: NEW

Reason for re-calibration: Due for Calibration _____ Repair x Other (Enter in remarks)

Equipment used for Calibration:

Type	Identification	Date due for calibration
Model 2929	180850	12/6/03

Sources:

Isotope:	Identification:	Current Activity:	Assay Activity	Date of Assay:
Th-230	SAIC-0053	20300	20300	11/16/00
SrY-90	SAIC-0054	15833	16700	11/15/00

Section 2: As Found / As Left Data

Physical Condition (SAT)/UNSAT

As Found BKG. Alpha	As Found BKG. Beta	As Left BKG. Alpha	As Left BKG. Beta
5- N/A MIN. BKG. COUNTS	5- N/A MIN. BKG. COUNTS	5- 10 MIN. BKG. COUNTS	5- 1 MIN. BKG. COUNTS
1. N/A	1. N/A	1. 0	1. 42
2. N/A Avg. N/A	2. N/A Avg. N/A	2. 0.2 Avg. 0.12	2. 41 Avg. 41
3. N/A	3. N/A	3. 0.2	3. 40
4. N/A	4. N/A	4. 0.1	4. 39
5. N/A	5. N/A	5. 0.1	5. 41

As Found Source Alpha	As Found Source Beta	As Left Source Alpha	As Left Source Beta
5- N/A MIN. Source Counts	5- .N/A MIN. Source Counts	5- 1 MIN. Source Counts	5- 1 MIN. Source Counts
1. N/A	1 N/A	1. 6925	1. 6894
2. N/A	2. N/A	2. 7122	2. 6969
3. N/A Avg. N/A	3. N/A Avg. N/A	3. 6968 Avg. 6977	3. 6936 Avg. 6905
4. N/A	4. N/A	4. 6970	4. 6836
5. N/A	5. N/A	5. 6900	5. 6889
Calculated Eff.: N/A%	Calculated Eff.: N/A%	Calculated Eff.: 34.37%%	Calculated Eff.: 43.35%%

Section 3:

HV SET: 675V Remarks: - NEW INSTRUMENT RECEIVED.

Alpha Threshold: 175mV

Beta Threshold: 4mV

Beta Window: 50mV

Date Calibrated: 2/19/03 Date Calibration Due: 2/19/04

Performed by: [signature] Date: 2/19/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "B"	Source #:	4054-02
#:	117336			Detector #:	PR112840	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	1100 V
ue:	4-1-04			Cal. Due:	4-1-04	Threshold:	10 mV

MB 4/16/03

	BKG RANGE	4394 - 6591	SOURCE RANGE	116820-175230			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0850	4703	6235	143095	138929	SAT	SAT	JCM	JCM	(Y) N
0647	5396	4713	138292	137592	SAT	SAT	JCM	JCM	(Y) N
0648	4675	4557	138708	140781	SAT	SAT	JCM	JCM	(Y) N
0651	5568	5022	138626	140353	SAT	SAT	JCM	[illegible]	(Y) N
0706	5724	5324	138478	138551	SAT	SAT	R	R	(Y) N
0650	5459	4817	139749	137793	SAT	SAT	R	JCM	(Y) N
0700	5336	5329	138379	137663	SAT	SAT	D.L.	D.L.	(Y) N
0639	5319	5019	139252	139783	SAT	SAT	R	R	(Y) N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

NB

ved By: [signature] Date: 4/16/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "C"	Source #:	4054-02
#:	154232			Detector #:	PR150642	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	750 V
ue:	4-2-04			Cal. Due:	4-1-04	Threshold:	10 mV

MD 4/2/03

	BKG RANGE	4108 - 6161	SOURCE RANGE	116690-175035			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0908	4429	4915	139637	141436	SAT	SAT	JCM	JCM	(Y) N
0653	4933	4323	140823	143544	SAT	SAT	JCM	JCM	(Y) N
0655	4782	4278	143218	144106	SAT	SAT	JCM	JCM	(Y) N
0653	4456	~~5179~~ 4378	142208	142562	SAT	SAT	JCM	MD	(Y) N
0700	4909	4385	142261	142343	SAT	SAT	JCM	MD	(Y) N
0652	5214	4527	144764	142071	SAT	SAT	JCM	JCM	(Y) N
0710	4881	4121	143911	141759	SAT	SAT	D.L.	D.L.	(Y) N
0641	4412	⊙	141450	⊙	SAT	SAT	R		Y (N)
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

MD

Issued
ved By: [signature] Date: 4/16/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "D"	Source #:	4054-02
#:	117652			Detector #:	PR122613	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	1200 V
ue:	4-1-04			Cal. Due:	4-1-04	Threshold:	10 mV

AHR 4/2/03

	BKG RANGE	4334 - 6501	SOURCE RANGE	108095-162142			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0907	4685	5392	1314481	133089	SAT	SAT	JCM		(Y)/N
0650	5380	5051	133278	134219	SAT	SAT	JCM	JCM	(Y)/N
0643	5093	4495	132765	132818	SAT	SAT	JCM	JCM	(Y)/N
0655	4903	4645	132458	131331	SAT	SAT	JCM		(Y)/N
0700	5185	4703	131983	134737	SAT	SAT	JCM	JCM	(Y)/N
0653	5602	4729	133133	132758	SAT	SAT	JCM	JCM	(Y)/N
0717	5109	4690	133281	135677	SAT	SAT	D.L.	D.L.	(Y)/N
0642	4893	⊙	133813	⊙	SAT	SAT	R		Y/(N)
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

lsed
ved By: [signature] Date: 4/16/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "E"	Source #:	4054-02
#:	117634			Detector #:	PR118986	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	1000 V
ue:	4-1-04			Cal. Due:	4-1-04	Threshold:	10 mV

MB 4/7/03

	BKG RANGE	4252 - 6378	SOURCE RANGE	112408-168612			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0850	4436	5191	136128	136462	SAT	SAT	JCM	JCM	(Y)/N
0650	5652	4678	136890	137207	SAT	SAT	JCM	JCM	(Y)/N
0644	5108	4617	138559	138882	SAT	SAT	JCM	JCM	(Y)/N
0654	5179	4657	137423	137447	SAT	SAT	JCM	JCM	(Y)/N
0703	5227	~~4385~~ 4675	138456	138174	SAT	SAT	JCM	JCM	(Y)/N
0653	5518	4740	138417	136815	SAT	SAT	JCM	JCM	(Y)/N
0714	5137	5181	138975	140772	SAT	SAT	D.L.	D.L.	(Y)/N
0642	4873	①	137073	①	SAT	SAT	R		Y/(N)
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

NB

lsed
ved By: Ruby J Old Date: 4/16/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "F"	Source #:	4054-02
#:	105934			Detector #:	PR122628	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	900 V
ue:	4-1-04			Cal. Due:	4-1-04	Threshold:	10 mV

MB 4/2/03

	BKG RANGE	4211 - 6316	SOURCE RANGE	114409-171614			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0909	4763	4865	136875	141669	SAT	SAT	JCM	JCM	(Y) N
0642	5384	5090	138470	138682	SAT	SAT	JCM	JCM	(Y) N
0655	5275	4955	139509	138993	SAT	SAT	JCM	JCM	(Y) N
0652	5366	5286	138905	140393	SAT	SAT	JCM	JCM	(Y) N
0707	5397	4987	139224	138638	SAT	SAT	R	R	(Y) N
0650	5628	5355	138491	139357	SAT	SAT	R	JCM	(Y) N
0707	5616	5482	140399	143467	SAT	SAT	D.L.	D.L.	(Y) N
0641	4850	⊙	139809	⊙	SAT	SAT	R		Y (N)
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

MB

USED
ved By: Ricky J Gill Date: 4/16/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "G"	Source #:	4054-02
#:	127217			Detector #:	PR154615	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	1050 V
ue:	5-6-03			Cal. Due:	4-1-04	Threshold:	10 mV

MB 4/8/03

	BKG RANGE	4257 - 6386	SOURCE RANGE	116890-175336			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0910	4872	5392	148790	150330	SAT	SAT	JCM	[illegible]	(Y) N
0654	5426	4867	148549	150017	SAT	SAT	JCM	[illegible]	(Y) N
~~0656~~	~~5361~~							dm 4.9.03	Y/N
0656	5361	5259	150061	150575	SAT	SAT	JCM	JCM	(Y) N
0652	5288	5390	150614	153289	SAT	SAT	JCM	[illegible]	(Y) N
0707	5814	5010	151010	150560	SAT	SAT	R	R	(Y) N
0651	5638	4884	151379	153028	SAT	SAT	JCM	JCM	(Y) N
0702	5665	4901	149988	148977	SAT	SAT	D.L.	JCM	(Y) N
0640	4994	5149	150620	151250	SAT	SAT	R	R	(Y) N
0647	5018	5125	150135	151241	SAT	SAT	R	JCM	(Y) N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

ved By: [signature] Date: 4/10/03

Daily Check-In of Gamma Scan Instruments

:	APRIL	YR:	2003		44-10 "H"	Source #:	4054-02
#:	154196			Detector #:	PR122612	Source Type:	Cs-137
#:	2221			Model #:	44-10	HV:	900 V
ue:	9-12-03			Cal. Due:	4-1-04	Threshold:	10 mV

MB 4/7/03

	BKG RANGE	4324 - 6486	SOURCE RANGE	103508-155262			INITIALS	INITIALS	CONFIRM
TIME	INTL BKG CPM	POST BKG CPM	INTL SOURCE CPM	POST SOURCE CPM	BAT CHECK	HV CHECK	INTL CHECK	POST CHECK	Y/N
0855	4637	5023	127604	125619	SAT	SAT	JCM		(Y) N
0649	5326	4631	126637	128797	SAT	SAT	JCM		(Y) N
0658	4984	4337	126411	128225	SAT	SAT	JCM	JCM	(Y) N
0652	5652	4597	127240	131225	SAT	SAT	JCM		(Y) N
0708	5205	4551	126182	128898	SAT	SAT	R		(Y) N
0652	6170	4343	127684	126253	SAT	SAT	JCM	JCM	(Y) N
0704	5335	4725	128053	127049	SAT	SAT	D.L.	JCM	(Y) N
0640	4773	5368	128211	129120	SAT	SAT	R	R	(Y) N
0647	4876	5035	127589	128214	SAT	SAT	R	JCM	(Y) N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N
									Y/N

MB

ved By: Randy J Ables Date: 4/17/03

Certificate of Calibration

Voltage Plateau Form

ERG
Environmental Restoration Group, Inc.
12809 Arroyo De Vista NE
Albuquerque, NM 87111
(505) 298-4224

Detector Mfg.: Ludlum Model: 44-10 Serial No.: PR122612

Counter Mfg.: Ludlum Model: 2221 Serial No.: 149838

Temp.: 70 °F Rel. Humidity 18 % Bar. Pressure 30.1 in. of Hg

Counter Threshold Setting: 10 mV Geometry / Distance to source: 6-inches

Source : ☐ Th230 @ 13,500 dpm sn: 4098-03 ☐ Tc99 @ 18,100 dpm sn: 4099-03

☑ Cs137 @ 8.5 µCi sn: 4054-02 ☐ Other:

Count Time: 1 minute(s)

High Voltage	Gross Source Counts	Background Counts
700	51281	
800	75637	
900	83689	
1000	91020	
1100	93454	
1200	94529	12916
1300	95111	
1400	117421	

Recommended Operating Voltage: 1200 volts

Calibrated By: Charles P. Farr Calibration Date: 4/1/03

Calibration Due: 4/1/04

Reviewed By: Kenneth R Barker Date: 4/1/03

ATTACHMENT 2

CONTAMINATION SURVEY RECORD

Westinghouse FFCF Radiological Survey Form

Survey Desc.:	Special--Black Can Per: C. Horton								Log Number	0435 S 30417 WEC
Surveyed by:			Date:	4/17/03	Time:	13:03	Smear Area	~ 100 cm2	Batch #: 1454	Reviewed By:
Instrument	Serial Number	Calibration Due	Probe	Probe Area (cm2)	Alpha Bkgd	Alpha Efficiency	Alpha MDA	Beta Bkgd	Beta Eff.	Beta MDA
Tennelec LB	4	9/3/03	GFPC	2 in. dia.	0.8	26.38%	5.95	2.7	45.15%	8.6
ASP-2	527	8/17/03	HT-270	GM-Tube	N/A	N/A	N/A	N/A	N/A	N/A
Lud 2224	125609	9/8/03	43-89	100	6.0	20.00%	70.53		0.00%	0.00
Ludlum 3	171199	9/8/03	44-9	15	N/A	N/A	N/A	44.0	15.00%	223.82

#	Description	Loose Alpha		Loose Beta		Fixed Alpha		Fixed Beta		βγ Dose Rate		Limit Exceeded
		Net CPM	DPM / 100 cm²	Net CPM	DPM / 100cm²	Gross CPM	DPM/ 100cm²	Gross CPM	DPM/ 100cm²	Contact uRad/hr	3 Ft. uRad/hr	
1	Pc #1 Inside of can	4.13	15.6	13.73	30.4	40.0	170.0	1000.0	42488.9	40.0		42 ϕβ
2	Pc #1 Inside of can	13.06	49.5	29.41	65.1	40.0	170.0	1000.0	42488.9	40.0		42 ϕβ
3	Pc #1 Outside of can	3.18	12.1	1.87	4.1	6.0	ND	142	4355.6	19.0		4 ϕβ
4	Pc #1 Outside of can	10.14	38.4	10.84	24.0	6.0	ND	142	4355.6	19.0		4 ϕβ
5	Pc #2 Insid of can	46.86	177.6	72.38	160.3	30.0	120.0	2684	117333.3	30.0		117 ϕβ
6	Pc #2 Inside of can	16.09	61.0	20.95	46.4	30.0	120.0	2684	117333.3	30.0		117 ϕβ
7	Pc #2 Outside of can	9.15	34.7	7.99	17.7	6.0	ND	120	3377.8	20.0		3 ϕβ
8	Pc #2 Outside of can	21.13	80.1	14.20	31.5	6.0	ND	120	3377.8	20.0		3 ϕβ
9	Pc #3 Inside of can	10.15	38.5	9.84	21.8	12.0	30.0	686	28533.3	35.0		28 ϕβ
10	Pc #3 Outside of can	10.16	38.5	7.84	17.4	12.0	30.0	120	3377.8	22.0		3 ϕβ
11	Bottom of can inside	59.52	225.6	144.49	320.0	48.0	210.0	880	37155.6	105.0		37 ϕβ
12	Bottom of can inside	45.93	174.1	56.52	125.2	48.0	210.0	880	37155.6	105.0		37 ϕβ
13	Bottom of can outside (Rim)	10.13	38.4	13.84	30.7	22.0	80.0	4472	196800.0	240.0		196 ϕβ
14	Bottom of can outside (Rim)	14.14	53.6	11.24	24.9	22.0	80.0	4472	196800.0	240.0		196 ϕβ

Limit Exceeded: α indicates loose alpha
β indicates loose beta, and δ indicates fixed readings