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NIOSH HEALTH HAZARD EVALUATION REPORT:

HETA #2002-0347-2910
Ocean Bank
Miami, Florida

August 2003

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

PREFACE

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (NIOSH) conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health (OSHA) Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HETAB also provides, upon request, technical and consultative assistance to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by John Cardarelli of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Graphic illustration support was provided by Chad Dowell of HETAB. Desktop publishing was performed by Ellen E. Blythe and Robin Smith. Review and preparation for printing were performed by Penny Arthur.

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For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Highlights of the NIOSH Health Hazard Evaluation

Evaluation of Magnetic Fields at Ocean Bank

A NIOSH representative conducted a health hazard evaluation at Ocean Bank in Miami, Florida, on August 15, 2002. He looked into concerns about exposures to high levels of magnetic fields coming from the power vault, which is below the bank office space.

What NIOSH Did

- Over 100 magnetic field measurements were made throughout the bank.
- Five workers wore devices that measured their personal exposures to magnetic fields.

What NIOSH Found

- The highest magnetic field exposures occurred in and around the old Branch Management office located above the power vault. The magnetic field levels in this area were at least 300 times higher than those typically found in an office environment.
- Personal measurements on five bank employees showed that their exposure depended on how long they spent in and around the old Branch Management office.
- Three of these five employees had average magnetic field exposures ranging between 6.8 milligauss (mG) and 15.8 mG. The other two employees's exposures were within the typical range found in an office environment. (0.5 mG to 4.5 mG).
- The NIOSH measurements were in general agreement with previous magnetic field surveys conducted by Florida Power and Light and independent engineers hired by the building owners.
- All of the magnetic field measurements were below the American Conference of Government Industrial Hygienists Threshold Limit Value of 10,000 mG, a recommended exposure limit.
- Based on epidemiological evidence, the measured exposures are not likely related to the health problems expressed by the employees.

What Bank Management Can Do

- Try to reduce or eliminate magnetic field exposures by:
  - requesting Florida Power and Light to rewire the vault;
  - relocating the main entrance directly over the electric vault;
  - increasing work space distance from the source, and;
  - reducing the time employees spend near or in the old Branch Management office.
- Move concerned personnel away from high magnetic field areas.
- Learn more about the health effects from magnetic field exposures by visiting the following websites:
  - NIOSH: http://www.cdc.gov/niosh/emfpg.html
  - OSHA: http://www.osha-slc.gov/SLTC/elfradiation/index.html
  - NIEHS: http://www.niehs.nih.gov/emfrapid/html/Q&A-Workplace.html

What Bank Personnel Can Do

- Learn more about the health effects from magnetic field exposures by visiting the websites listed above.
- Report any magnetic field concerns to your Bank Management.

What To Do For More Information:

We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for HETA Report #2002-0347-2910

Health Hazard Evaluation Report 2002-0347-2910
Ocean Bank
Miami, Florida
July 2003

John Cardarelli II, PhD, CIH, PE

SUMMARY

On July 7, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) at the Ocean Bank in Miami, Florida. The requesters were a bank manager and an employee who requested an evaluation of magnetic field exposures in the office spaces throughout the bank. Health concerns included dizziness, foot swelling, and cancer.

On August 15, 2002, a NIOSH investigator conducted a site visit at Ocean Bank and conducted a source characterization of the extremely low frequency (ELF) magnetic fields throughout the bank. Over 100 area measurements were collected with particular emphasis on the vacated Branch Management office because this area was identified as having elevated magnetic field levels from previous surveys. The area exposures measured outside the vacated office ranged between 0.4 and 125 milligauss (mG). The area exposures measured inside the vacated office ranged between 16 and 1,424 mG. Personal exposure meters were placed on five volunteer bank employees. Each employee wore these instruments for a period ranging between 2 hours, 15 minutes and 7 hours, 44 minutes; their average magnetic field exposures ranged from 2.3 to 15.8 mG. Neither the Occupational Safety and Health Administration (OSHA) nor NIOSH have exposure criteria in the ELF range (1 to 300 Hz). The American Conference of Governmental Industrial Hygienists (ACGIH) has published frequency-dependent Threshold Limit Values (TLV®s)[1]; the TLV® for the 60 Hz magnetic fields coming into the bank should not exceed 10,000 mG. The health and safety basis for this TLV® addresses only acute high-level magnetic field exposures that induce magnetophophenes in the visual system and produce induced currents in the body.

Research has been conducted over the past decade to determine if slightly elevated magnetic field exposures (greater than 2 mG) pose a health threat. The National Institute of Environmental Health Sciences (NIEHS) recently published a report that addressed this question.[2] The NIEHS report concludes "... the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm." However, the report also states that EMF exposures "cannot be recognized as entirely safe" and that efforts to encourage reductions in exposure should continue.

Magnetic field exposures were above those typically encountered in an office environment, but were below the ACGIH TLV® of 10,000 mG. The magnetic field exposure potential was directly related to the length of time spent near the vacated Branch Management office, which is situated above the electric vault. On the day of the evaluation, the area measurements were in general agreement with previous surveys conducted by Florida Power and Light (FP&L) and two independent engineers hired by the building owners. Recommendations were made to install magnetic shielding on the floor of the bank, increase the distance from the high magnetic field area by relocating employees, reduce the time workers spend in and near the high exposure areas, and request FP&L to rewire the vault to reduce magnetic field emissions.

Keywords: SIC Code: 6029 (Commercial Banks, Not Elsewhere Classified) Magnetic Fields, electromagnetic fields, EMF, extremely low frequency, ELF

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INTRODUCTION

On July 7, 2002, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) at the Ocean Bank office in Miami, Florida. A bank manager and an employee asked for an evaluation of magnetic field exposures in the office spaces throughout the bank. They reported that employees had experienced dizziness and foot swelling, and expressed concerns about cancer. On August 15, 2002, a NIOSH investigator conducted a site visit at Ocean Bank and completed a source characterization of the magnetic fields throughout the building.

BACKGROUND

The Ocean Bank building, located at 200 SE 1st Street, Miami, Florida, was originally constructed as a two-story building in 1958. A ten-story addition was completed in 1969. The building was purchased by Investment Equities Associates in 1999 and several improvements were added to the facility (sprinkler system and an additional power vault). The facility houses approximately 147,000 square feet of office space, of which about 50 percent was occupied in August 2002. The Ocean Bank business (about 7,700 square feet) is operated on the street level and provides financial services to the general public (Photos 1–4). The NIOSH evaluation consisted of magnetic field measurements at various locations within the bank and next to the original power vault in the basement, as well as personal exposure measurements on bank employees.

METHODS

This evaluation assessed occupational exposure to sub-radiofrequency fields in the range from 40 to 800 hertz (Hz) among workers during a typical daily work regiment. The primary frequency of concern was 60 Hz. The number and types of measurements performed in the evaluation were not intended to represent an in-depth investigation of exposure to all electric and magnetic fields present in the facility, but instead were intended to estimate occupational exposure levels from selected sources on the day of the measurements. Electric fields were not measured because they were not a concern due to the numerous routes for grounding.

The following instruments were used in this evaluation and were calibrated within the past year or were within acceptable limits when checked against a control source:

- EMDEX II: Area and personal magnetic field measurements were made with the EMDEX II exposure system developed by Enertech Consultants, under project sponsorship of the Electric Power Research Institute, Inc. The EMDEX II is a programmable data-acquisition meter which measures the orthogonal vector components of the magnetic field through its internal sensors. Measurements can be made in the instantaneous read or storage mode. This system was designed to measure, record, and analyze power frequency magnetic fields in units of milligauss (mG) in the frequency range from 40 to 800 Hz. The meter has the capability of displaying magnetic field values in 3 different frequency bandwidths: broadband, which measures from 40 to 800 Hz; harmonic, which measures from 100 to 800 Hz; and the fundamental bandwidth, which measures at 60 Hz.

- HI-3642 ELF Magnetic Field Meter: A Holaday Industries, Inc., model HI-3642A Extremely Low Frequency (ELF) Magnetic Field Meter is designed to measure the flux density of magnetic fields in the frequency range of 30 Hz to 2,000 Hz. This meter is especially useful for measuring magnetic fields associated with electric power lines, electrical appliances, and video display terminals. It directly displays the root-mean-square (rms) value of magnetic flux density on an analog meter. The sensor consists of a multi-turn loop connected to the instrument readout package via a one meter long cable. The separate loop sensor provides for orientation of the sensor relative to the various magnetic field polarization components. This allows quick assessment of the greatest flux density value in

large area surveys. The instrument is capable of measuring magnetic field strengths from 0.2 to 20,000 mG.

• HI-3627 ELF Magnetic Field Meter: A Holaday Industries Inc., model HI-3627 ELF Magnetic Field Meter is designed to measure the flux density of magnetic fields in the frequency range of 5 Hz to 2,000 Hz. Like the meter above, this meter is also useful for measuring magnetic fields associated with electric power lines, electrical appliances, and video display terminals. The HI-3627 is a 3 axis flux density meter, where the HI-3642 is only has a single axis. The instrument computes the rms value of magnetic flux density and directly displays it on an analog meter. The sensor consists of 3 multi-turn loops connected to the instrument via a 1.2 meter cable. The microprocessor in the meter continually computes the magnitude of the field independent of the probe orientation, allowing quick assessment of the actual flux density value in large area surveys. The instrument is capable of measuring magnetic field strength from 0.2 to 20,000 mG.

EMF measurements were made throughout the Ocean Bank facility and on a selected sample of employee volunteers. The sampling locations were determined based on previous ELF surveys conducted by the Florida Power and Light (FP&L) Company (report dated May 1, 2001)[3] and two independent engineers hired by the building owner (report dated July 1, 2002)[4]. The Branch Management office had been vacated by bank management and employees shortly after the second survey because of ELF exposure concerns and, as of June 2003, that office space remains vacant.

EVALUATION CRITERIA

Neither the Occupational Safety and Health Administration (OSHA) nor NIOSH have exposure criteria in the ELF range (1 to 300 Hz). Several organizations have established exposure limits for ELF, including the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers (IEEE), and the American Conference of Governmental Industrial Hygienists (ACGIH). Among these organizations, the ACGIH has published frequency-dependent Threshold Limit Values (TLV®s).[1] Since the bank's magnetic fields come primarily from the 60 Hz power lines entering the vault, the TLV® for 60 Hz magnetic fields (not to exceed 10 Gauss [equivalent to 10,000 mG]) is applicable in this situation. The TLV® can be increased by a factor of 10 for the hands and feet, and by a factor of 5 for the arms and legs. The health and safety basis for this TLV® addresses only acute high-level magnetic field exposures that induce magnetophophenes in the visual system and produce induced currents in the body.

The TLV® does not address potential health effects from chronic magnetic field exposures, such as those experienced by employees in the bank. Much research has been conducted over the past decade to determine if slightly elevated magnetic field exposures (greater than 2 mG) pose a health threat. The National Institute of Environmental Health Sciences (NIEHS) recently published a report that addressed this question.[2] The NIEHS report concludes "...that the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm." However, the report also states that EMF exposures "cannot be recognized as entirely safe" and that efforts to encourage reductions in exposure should continue.

RESULTS

Area Measurements

Over 100 area measurements were collected throughout the facility, with particular emphasis in the Branch Management office (Figures 1–3). The measurements were conducted at various heights depending on the purpose of the measurement. The majority of all measurements were obtained about 40 inches above the floor to represent the average exposures near the lower or upper torso area of

a worker in the standing or sitting position, respectively. Other measurements were collected at floor or desk heights. Floor measurements demonstrated the maximum exposure potentials to the extremities and how the magnetic field intensities decrease as the distance increases from the source.

The exposures measured outside the Branch Management office ranged between 0.4 and 125 mG (Figure 2). The highest exposures were measured nearest the Branch Management office which is also located above one of the two electrical vaults servicing this building. The vault below the office is the original vault to the building and the other vault is located on another floor within the building, contributing no EMF exposures within the Ocean Bank.

The exposures measured inside the Branch Management office ranged between 16 and 1,424 mG (Figure 3). The highest exposures were measured at the floor level and followed a pattern consistent with the location of the electrical vault and the connection line to the switchgear equipment.

Personal Measurements

EMDEX II meters were positioned on five volunteer bank employees that worked in various locations throughout the bank (Figures 1, 4–8). Each employee wore these instruments for a period of time ranging from 2 hours and 15 minutes to 7 hours and 44 minutes, and their average magnetic field exposures ranged from 2.3 to 15.8 mG (Table 1).

Operations Officer

The Operations Officer work location is designated as "B" on Figure 1. This work location is nearest the previous location of the Branch Management office and is also directly above the electrical vault. Area magnetic field measurements (40 inches above the floor) in this general work area ranged between 16 mG and 125 mG. The job activities on the day of measurements required that the Operations Officer float from the normal work location to other locations throughout the bank. The movement patterns during the monitoring period (7 hours and 40 minutes) are illustrated in Figure 4. The average personal magnetic field measurement was 15.8 mG, ranging between 0.14 mG and 313.6 mG. The personal exposure profile shows that the area and personal magnetic field measurements correlate when the worker was at the normal work station.

Personal Service Officer

The Personal Service Officer work location is designated as "C" on Figure 1 and is near the public entrance. Area magnetic field measurements (40 inches above the floor) in this general work area ranged between 0.7 mG and 1.4 mG. The Personal Service Officer activities were completed primarily at this work location and resulted in an average personal exposure of 4.48 mG, ranging between 0.31 mG and 266 mG. The movement patterns during the monitoring period (6 hours and 38 minutes) show that the area and personal magnetic field measurements correlate with the worker's normal work station (Figure 5).

Branch Management Secretary

The Branch Management Secretary work location is designated as "D" on Figure 1. Area magnetic field measurements (40 inches above the floor) in this general work area ranged between 0.4 and 0.5 mG. The Branch Management Secretary activities were completed primarily at this work location and resulted in an average personal exposure of 9.93 mG, ranging between 0.17 mG and 371.2 mG. The movement patterns during the monitoring period (4 hours and 53 minutes) show that the area and personal magnetic field measurements correlate with the worker's normal work station (Figure 6). During periods of high magnetic field exposures (9:30 to 10:00 a.m.), this individual met with the NIOSH investigator in the vacated Branch Management office. Other periods with smaller but elevated magnetic field exposures resulted from the worker's movement in or around the vacated Branch Management office.

Table 1: Magnetic Field Strength Measurements*
Ocean Bank, Miami, Florida (HETA # 2002-0347-2910)
Survey Date: August 15, 2002

Job Title	N**	Total Exp. Time	Minimum (mG)	Maximum (mG)	Average § (mG)
Operations Officer	18,419	7 hr 40 min	0.14	313.6	15.8
Personal Service Officer	15,933	6 hr 38 min	0.31	266.0	4.5
Branch Manage. Secretary	11,726	4 hr 53 min	0.17	371.2	9.9
Vice Pres./ Branch Mgr.	18,570	7 hr 44 min	0.10	272.0	6.8
Head Teller	5,413	2 hr 15 min	0.17	98.6	2.3

mG milligauss
* Measurement collected with an EMDEX II personal meter attached to the individual's waist area.
** A measurement was taken every 1.5 seconds.
§ For comparison purposes, magnetic field exposures found in a typical office environment range from 0.5 to 4.5 mG.

Vice President and Branch Manager

The Vice President and Branch Manager work location is designated as "E" on Figure 1. Area magnetic field measurements (40 inches above the floor) in this general work area ranged between 0.5 and 0.6 mG. The work activities were completed primarily at this work location and resulted in an average personal exposure of 6.8 mG, ranging between 0.1 mG and 272 mG. The movement patterns during the monitoring period (7 hours and 44minutes) show that the area and personal magnetic field measurements correlate with the worker's normal work station (Figure 7). During periods of higher magnetic field exposures, this individual met with the NIOSH investigator in the vacated Branch Management office. Other periods with smaller but elevated magnetic field exposures resulted from the worker's movement in or around the vacated Branch Management office.

Head Teller

The Head Teller work location is designated as "F" on Figure 1. Area magnetic field measurements (40 inches above the floor) in this general work area ranged between 0.6 and 1.0 mG. The work activities were completed primarily at this work location and resulted in an average personal exposure of 2.26 mG, ranging between 0.17 mG and 98.6 mG. The movement patterns during the monitoring period (2 hours and 15 minutes) show that the area and personal magnetic field measurements correlate with the worker's normal work station (Figure 8). During periods of higher magnetic field exposures, this individual met with the Operations Officer near the vacated Branch Management office. Other periods with smaller but elevated magnetic field exposures resulted from the worker's movement in or around the drive-through window office space.

DISCUSSION

Measurement Results

Data obtained at the Ocean Bank facility on the day of measurement indicate high levels of magnetic field exposure in certain areas of the bank. Specific findings are discussed below.

1. The dominant source of EMF exposure is from magnetic fields emanating from the electric vault.

2. The highest personal exposures occurred when individuals approached or occupied the vacated

Branch Management office which is above the electrical vault and switchgear equipment (Figures 1 and 2).

3. The measured exposure was highest for the Operations Officer who spent more time near the electrical vault. It should be noted that the movement patterns of the Operations Officer will have a significant impact on the average daily exposure to magnetic field intensities. On the day of the measurements, the average magnetic field exposure was 15.8 mG, which is virtually the same as the desk measurement of 16.0 mG. This suggests that the worker either spent their entire workday at their work station, or their time was spent in areas of higher or lower magnetic field intensities resulting in an average exposure about the same as the area measurement. The movement patterns of this worker can be identified via the magnetic field exposure profile illustrated in Figure 4. This figure illustrates that the worker did move throughout the bank during the day. Relative to the other work locations, this work station and the old Branch Management work station are better suited for jobs that are not stationary, since any movement away from these areas would result in lower magnetic field exposures. Even with the movement patterns of the Operations Officer, the average magnetic field exposure was 3.5 to 31.6 times higher than the typical magnetic field exposures found in an office environment.

4. The average magnetic field exposures for the Operations Officer, Branch Management Secretary, and Vice President/Branch Manager were above the typical magnetic field exposures found in an office environment (between 0.5 mG and 4.5 mG). Exposure levels were related to the length of time spent in or near the vacated Branch Management office.

5. The average magnetic field exposures for the Head Teller and Personal Services Officer were within the typical magnetic field exposures found in an office environment.

These findings show that the exposure potential is directly related to the length of time spent in close proximity to the vacated Branch Management Office, which is situated above the electrical vault. On the day of the evaluation, the area measurements were in general agreement with previous surveys conducted by FP&L and two independent engineers hired by the building owners.

Ways to Reduce Magnetic Field Exposures

Exposures to magnetic fields can be reduced by any combination of (1) time, (2) distance, (3) shielding, and (4) source cancellation. The two best methods to reduce magnetic field exposures are to *limit the time of exposure* and to *increase the distance* between the source and the worker. *Shielding material* can also be used to limit occupational exposures, especially in rooms or suites of rooms in commercial buildings. This option is feasible when there is a nearby field source, often an electrical vault full of transformers just under the floor, much like the situation in the Ocean Bank facility. However, costs can be excessive (>$10,000 per room), and there is a possibility that the shielding may only partially reduce the magnetic field intensities or divert the magnetic fields to another part of the bank.[5] Another technique to reduce magnetic field intensities is *source cancellation*, which can be achieved by reconfiguring the wiring to and from the transformers so the magnetic fields generated in one wire cancel the fields generated in the other. These wires can also be bundled (narrowing the distance between wires) to improve the cancellation efficiency.

CONCLUSIONS

1. All of the magnetic field measurements were well below the ACGIH TLV® of 10,000 mG.

2. Although the levels of magnetic field intensities were below the ACGIH TLV, they were at least

300 times higher than those typically found in an office environment.

3. The area magnetic field measurements obtained on August 15, 2002, indicate that the highest magnetic field exposures occurred in and around the vacated Branch Management office. This office is situated above the electrical vault which houses FP&L transformers, the likely source of the magnetic fields.

4. The personal magnetic field measurements obtained on five bank employees indicated that exposures were dependent on the amount of time they spent in and around the vacated Branch Management office.

5. Three of the five employees had average magnetic field exposures (ranging between 6.8 mG and 15.8 mG) above those typically encountered in an office environment (0.5 to 4.5 mG). The other two employees' exposures were within the typical range encountered in an office environment.

6. The area and personal magnetic field measurements were in general agreement with previous magnetic field surveys conducted by FP&L and independent engineers hired by the building owners.

RECOMMENDATIONS

NIEHS has concluded that magnetic field exposures cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. However, they also state that this finding was insufficient to warrant aggressive regulatory concern. Since virtually everyone in the United States uses electricity and receives daily exposures to magnetic fields, NIEHS supports a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures.

Considering the employee concerns expressed in the HHE request, the potential for above average magnetic field exposures within the bank, and the NIEHS recommendations which encourage continued reductions in exposures, it would appear prudent that the bank management should investigate reducing workers' magnetic field exposures originating from the electrical vault. These exposures may be reduced by:

1. Installing magnetic shielding on the floor of the bank.

2. Increasing the distance from, and reducing the time workers spend in the high magnetic field area by relocating employees to other work areas within the bank. This may result in unused office space which could be regained if the bank entrance was relocated above the electric vault. This recommendation may be more a reliable and cost effective approach toward reducing worker exposures than installing shielding.

3. Requesting FP&L to rewire the vault to reduce magnetic field emissions.

REFERENCES

1. ACGIH [2003]. Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinnati, Ohio. American Conference of Governmental Industrial Hygienists.

2. NIEHS [1999]. Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields. National Institute of Environmental Health Sciences, National Institutes of Health. (http://www.niehs.nih.gov/emfrapid/html/EMF_DIR_RPT/NIEHS_Report.pdf)

3. Perez R [2001]. Florida Power and Light Company Magnetic Field Measurement Form. May 1, 2001. Photocopy.

4. Fenster S [2002]. Letter of August 26, 2002, from S. Fenster, Investment Equities Associates, Inc., to John Cardarelli II, National Institute for Occupational Safety and Health, Hazard Evaluations Technical Assistance Branch.

5. Leeper EA [2001]. Silencing the fields. A practical guide to reducing AC magnetic fields. Symmetry Books, Boulder, Colorado. pp 203-206.

FIGURES

Figure 1. Ocean Bank Floor Plan. Area and personal magnetic field measurement locations. August 15, 2002.
★ = sampling locations.

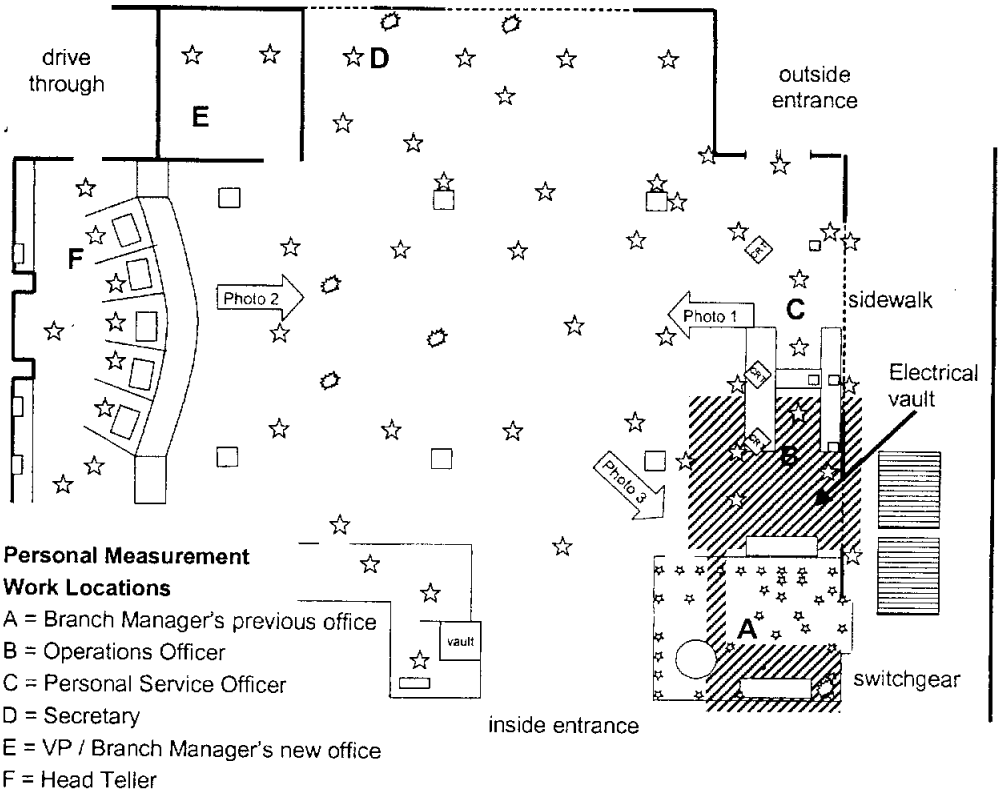


Figure 2. Ocean Bank Floor Plan. Area magnetic field measurement results (milligauss, mG). August 15, 2002. All measurements were obtained about 40 inches from the ground.

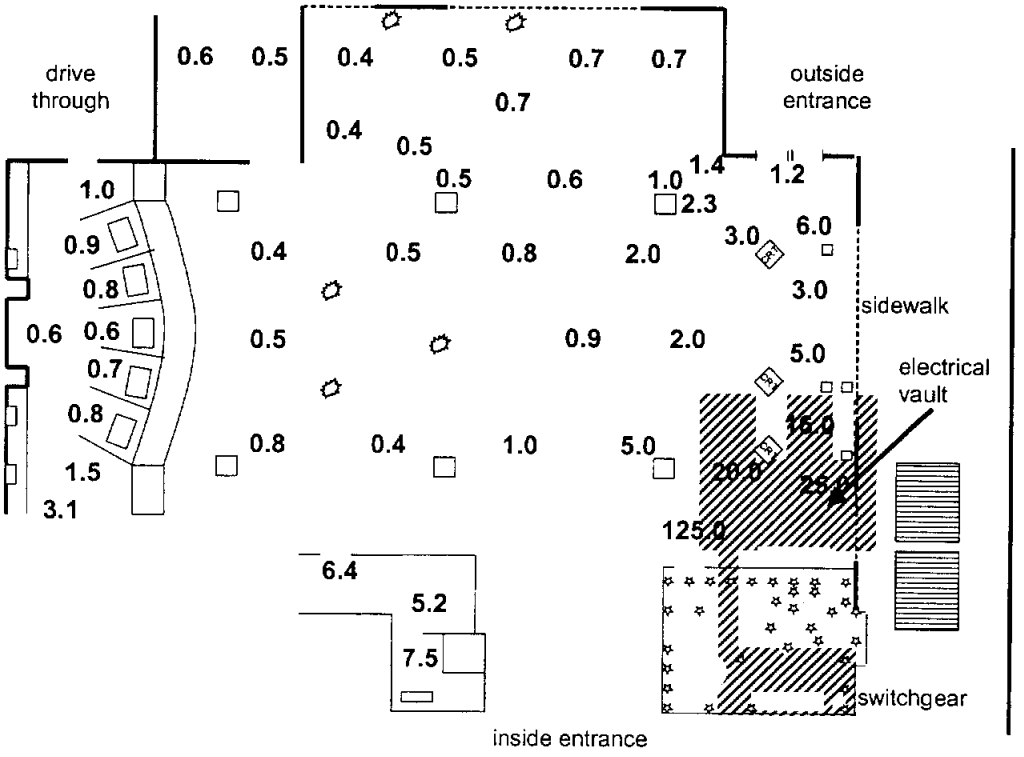
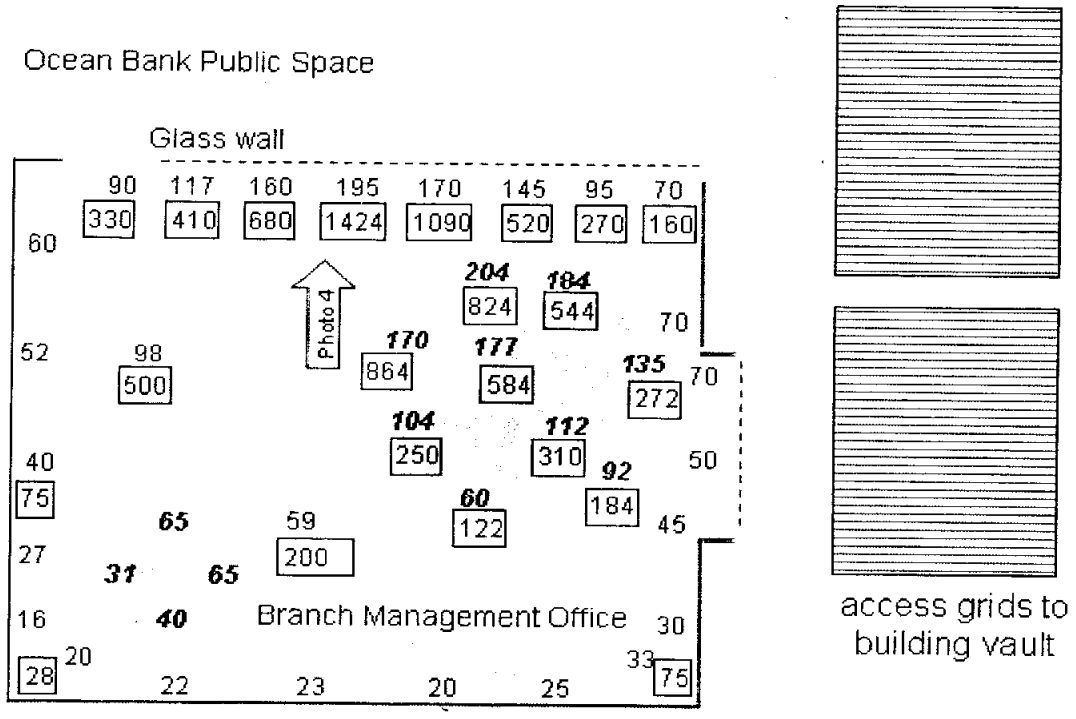


Figure 3. Ocean Bank, Branch Management Office magnetic field measurement results. August 15, 2002. HETA #20020347.



Magnetic field measurements (mG) were taken at a height of about 40 inches, ***bold italics*** illustrate results at desk height (about 28 inches), BOXED results illustrate results at the floor.

Figure 4. Time-magnetic field intensity relationship for Operations Officer. Work location is designated as B on Figure 1.

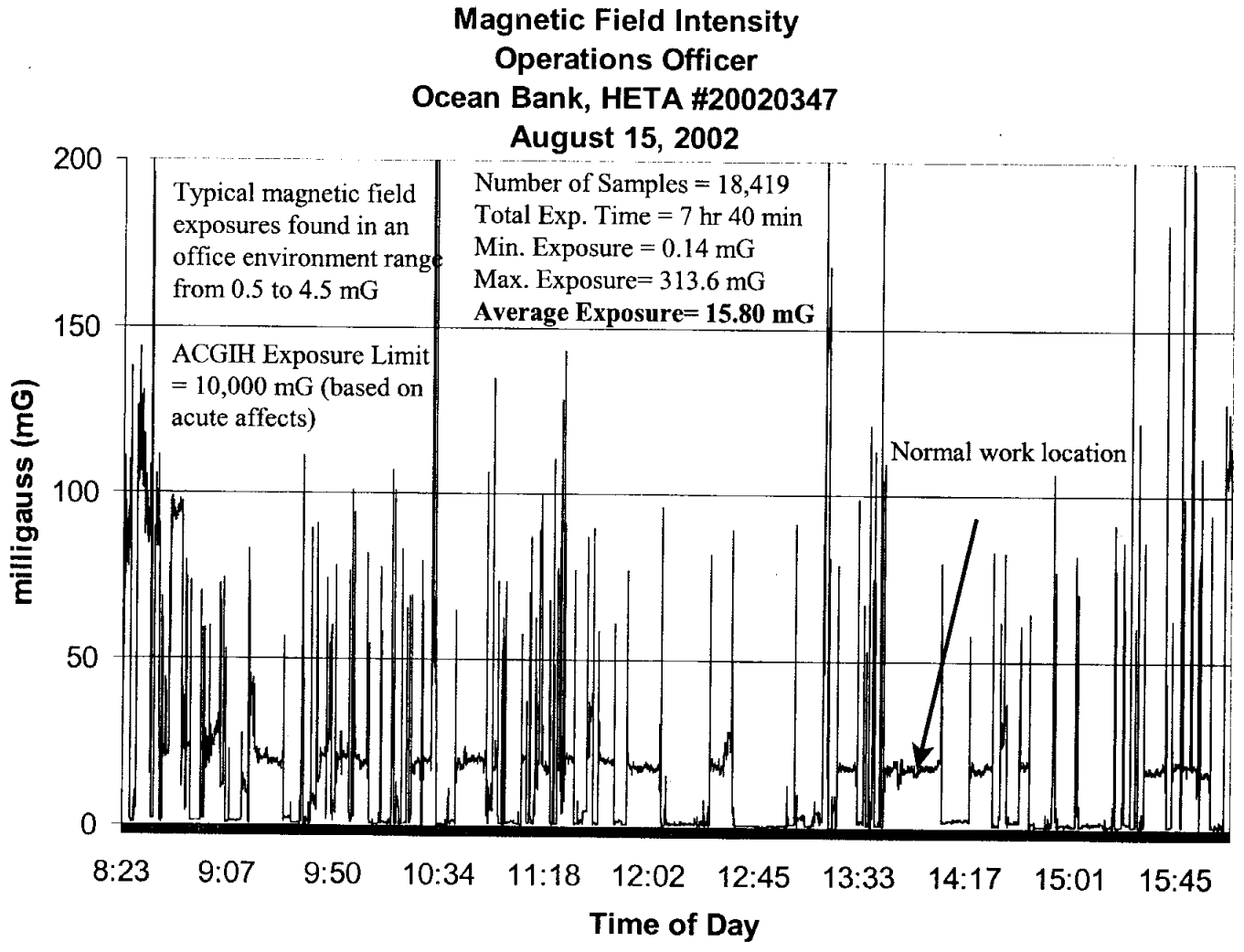


Figure 5. Time-magnetic field intensity relationship for Personal Service Officer. Work location is designated as C on Figure 1.

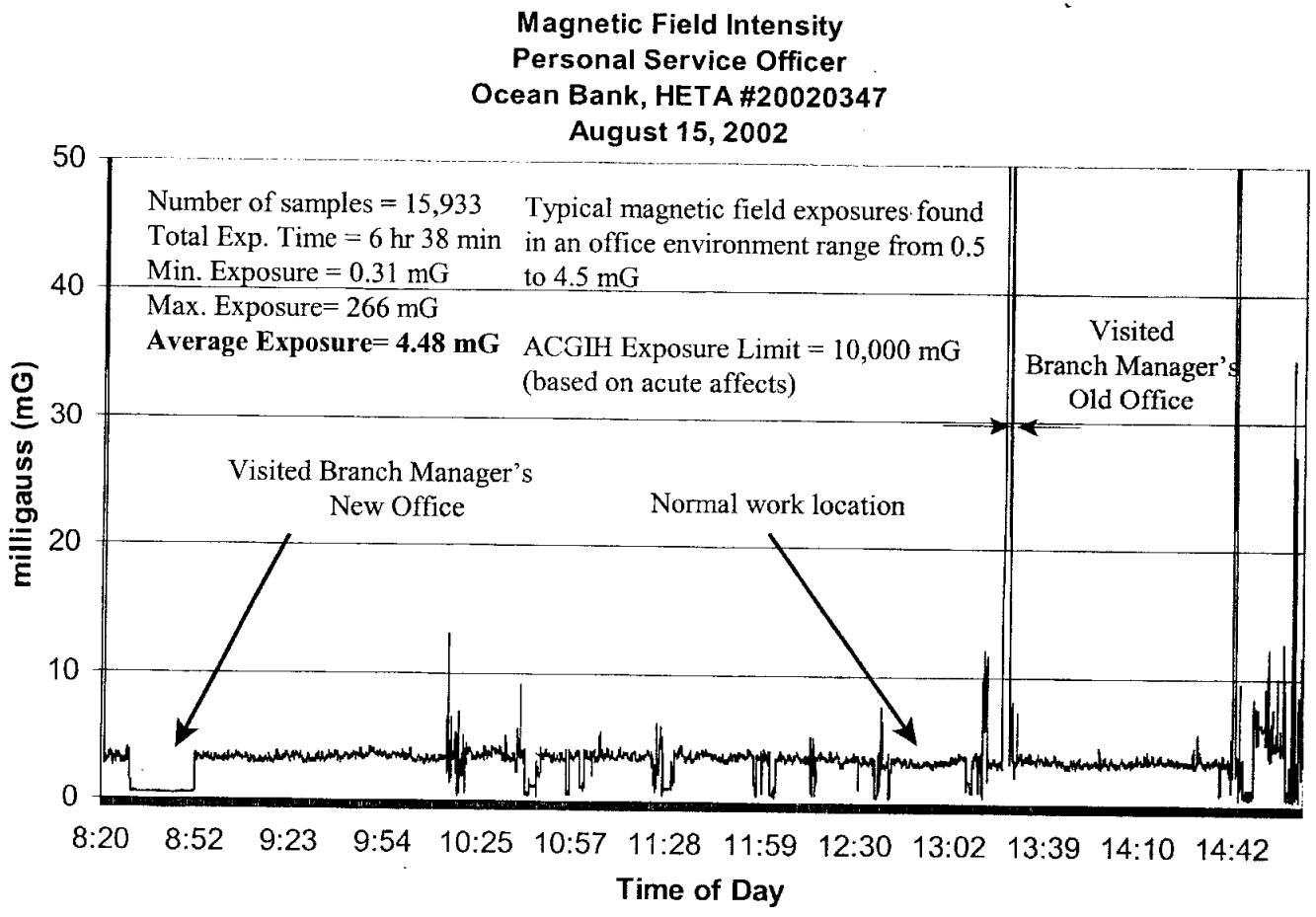


Figure 6. Time-magnetic field intensity relationship for Branch Management Secretary. Work location is designated as D on Figure 1.

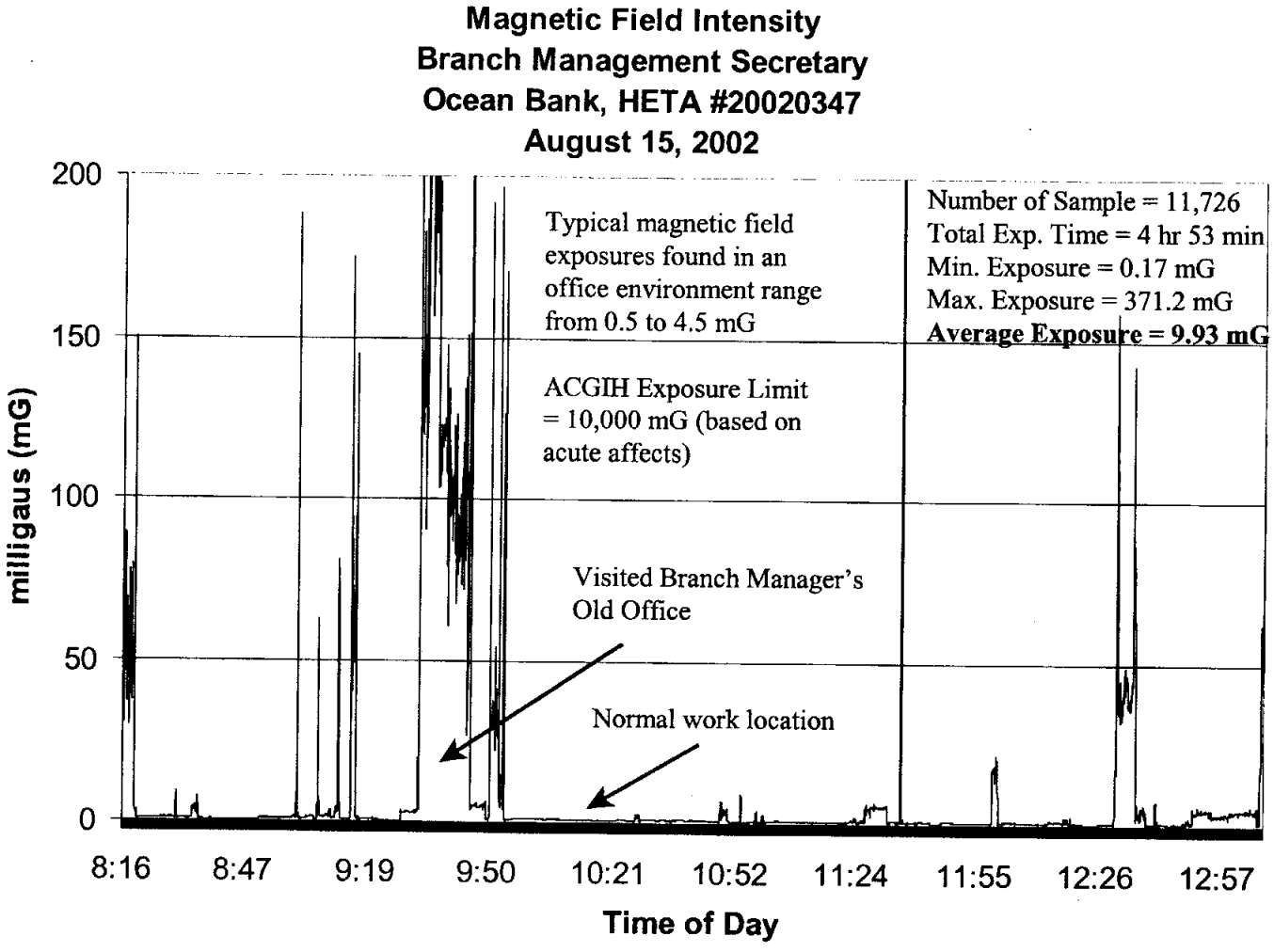


Figure 7. Time-magnetic field intensity relationship for Vice President and Branch Manager. Work location is designated as E on Figure 1.

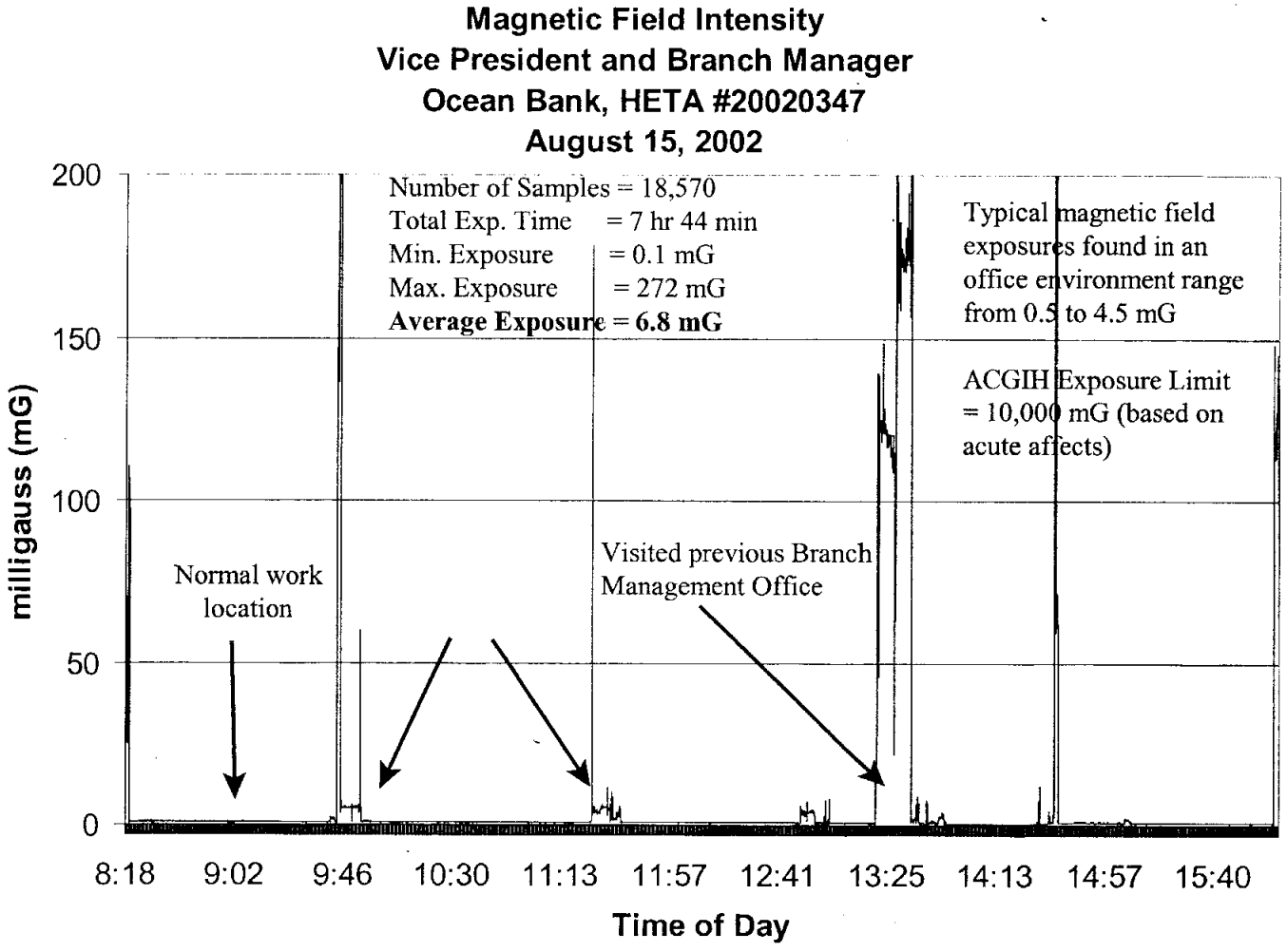
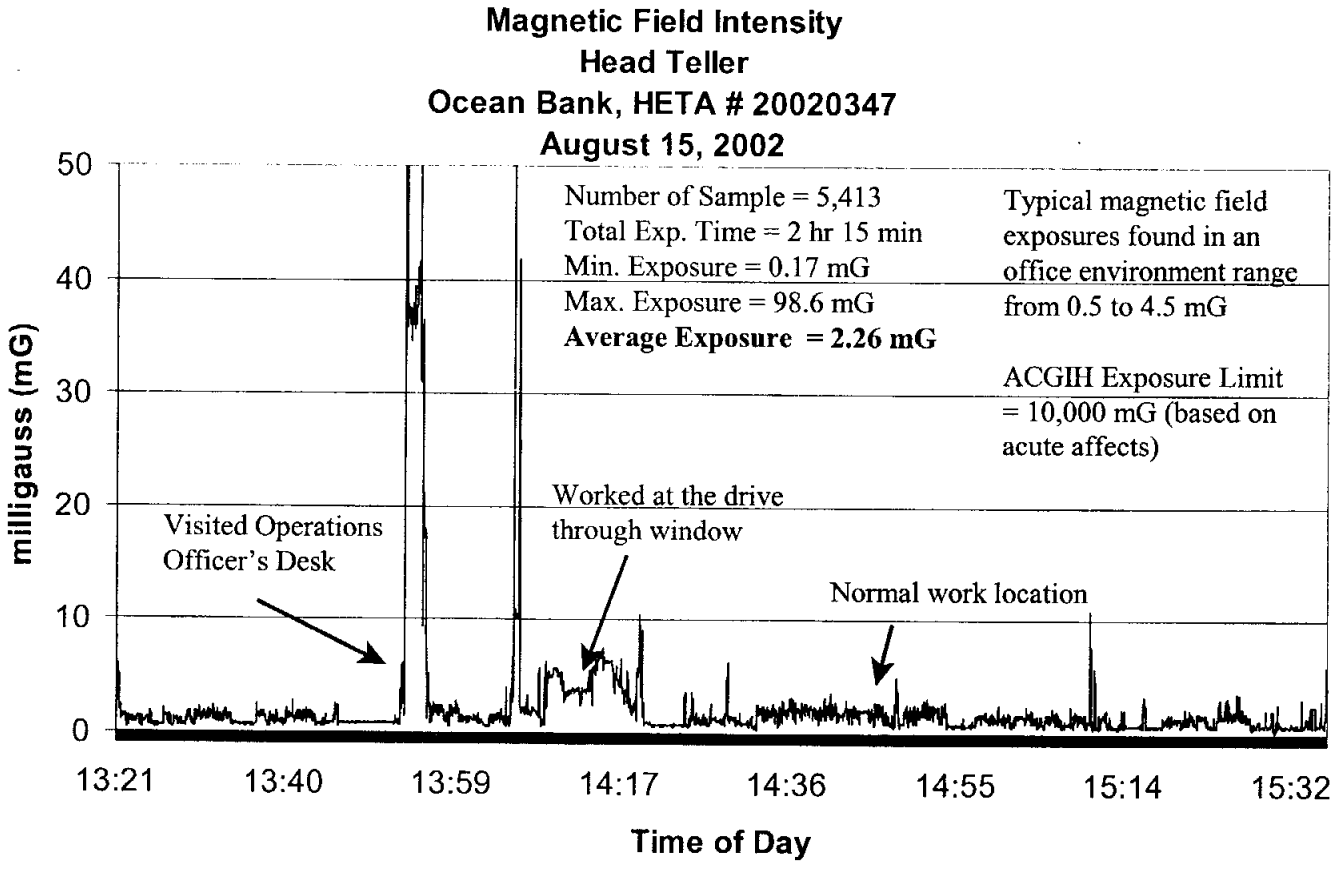


Figure 8. Time-magnetic field intensity relationship for Head Teller. Work location is designated as F on Figure 1.



PHOTOS

Photo 1. View of Ocean Bank looking toward the Teller Station. August 15, 2002. HETA # 2002-0347.

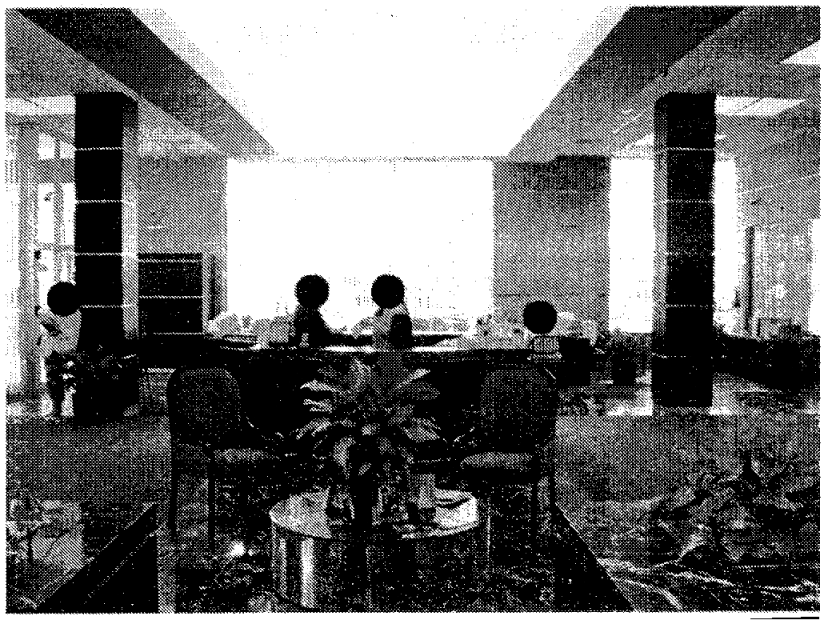


Photo 2. View of Ocean Bank looking from the Teller Station. Branch Manager's previous office is on the far right. Entrance from the street is on the far left. August 15, 2002. HETA # 2002-0347.

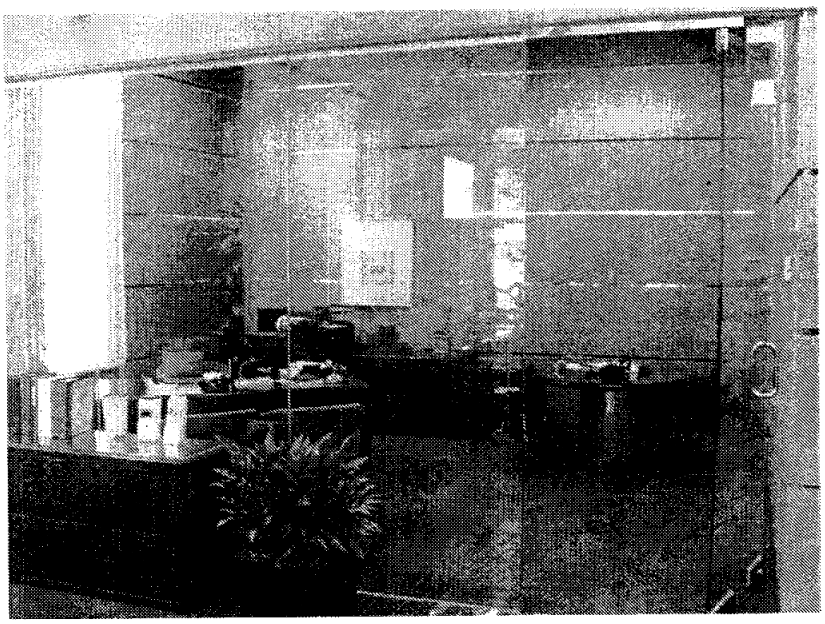


Photo 3. View looking into Branch Management Office. The electrical vault that services the building is below this space. August 15, 2002. HETA # 2002-0347.

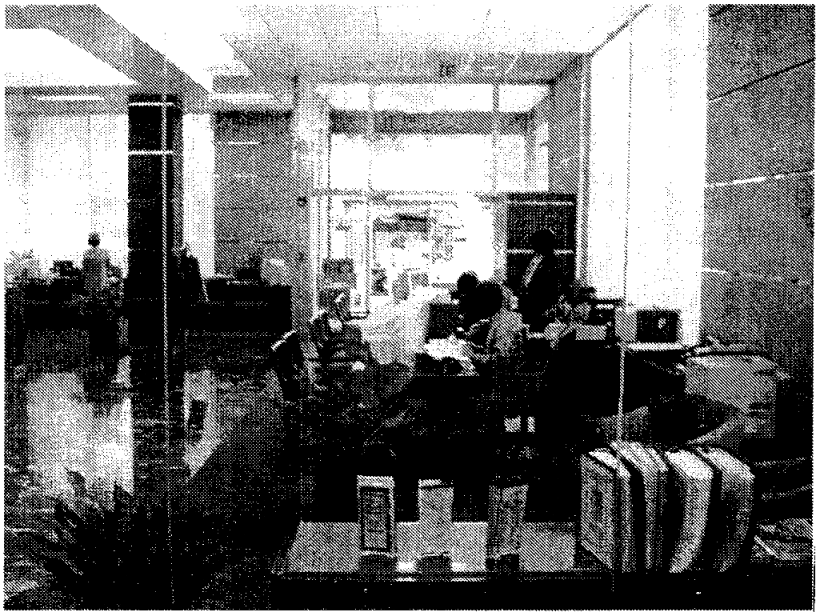


Photo 4. View from the Branch Management Office. August 15, 2002. HETA # 2002-0347.

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