EXTENT OF MERCURY CONTAMINATION IN BUILDING 252

WORKING DRAFT

Prepared for

McCLELLAN AIR FORCE BASE

Prepared by

CH2M HILL
3840 Rosin Court, Suite 110
Sacramento, California 95834

July 1990

SAC/T98/100.51

CONTENTS

APPENDIXES

CONTENTS (Continued)

TABLES

FIGURES

Section 1
INTRODUCTION

McClellan Air Force Base Building 252 was previously the location of instrument repair and testing operations. In early 1990, many of these operations were moved to other locations and building renovation activities were initiated to convert the facility to office space. In May 1990, during removal of construction materials from the second floor, mercury was found in some vacuum lines that apparently had been used to vacuum up mercury spilled during instrument service and testing.

The Base Bioenvironmental Group (SGB) conducted a sampling effort to determine if mercury was present throughout the building. Mercury was detected in all swipe (wipe) samples taken, with many of the results undetermined due to concentrations greater than the calibrated range of the analytical instrument.

On this basis, the Base determined that more extensive sampling and analysis should be completed to further characterize the concentration and extent of mercury contamination in and around Building 252. In addition, potential decontamination and remediation methods should be evaluated. Finally, the volumes of affected building elements should be inventoried. This report presents the results, conclusions, and recommendations of a sampling and analysis program conducted by CH2M HILL in Building 252.

In late May, CH2M HILL was tasked to conduct a facility inspection and develop a sampling and analysis plan (SAP). A facility inspection was conducted on May 30, 1990. Two McClellan Air Force Base employees and two CH2M HILL scientists equipped with a Jerome Mercury Vapor Analyzer walked through the facility and recorded mercury vapor concentrations at various locations, noting building conditions and possible sampling locations.

Using the results of the SGB swipe sampling program and the results of the facility inspection, CH2M HILL developed a Sampling and Analytical Plan for evaluating the extent and concentration of mercury in and around the facility, and methods for testing potential decontamination procedures. This SAP, including a Health and Safety Plan, was completed on June 27, 1990 and forwarded to the California Department of Health Services (DHS) for review and comment. Based on comments received, an addendum to the (SAP) was completed on July 3, 1990.

Building sampling began on July 2, 1990 and continued through July 6, 1990. Sample analyses were conducted by Chemwest Analytical Laboratories on a priority turnaround basis with final results completed on July 12, 1990.

As indicated previously, this report discusses the results of sampling, analysis, and decontamination testing activities completed to date, as well as recommendations for future activities.

Section 2
BUILDING HISTORY AND PREVIOUS ACTIVITIES

The Sacramento Air Logistics Center (ALC) is a key part of the Air Force Logistics Command, lifeline of the aerospace team. The command is headquartered at Wright-Patterson AFB, Ohio; the Sacramento ALC is one of five such facilities located at strategic points around the country. Each of these centers provides support to the Air Force's other major commands in key areas of management, procurement, supply distribution, transportation, maintenance, and repair. Each center supports certain aircraft, weapon systems, and various items and commodities.

At Sacramento ALC, aircraft such as the F/EF/FB-111, A-10, F-4, and C-12A/D are maintained and kept combat-ready. In addition, surveillance and warning systems, radar sites, space systems (such as the Space Shuttle), missile tracking stations, and airborne and ground power generators are maintained and repaired. The Sacramento ALC has been in operation for more than 50 years. (Ref. 1)

BUILDING HISTORY

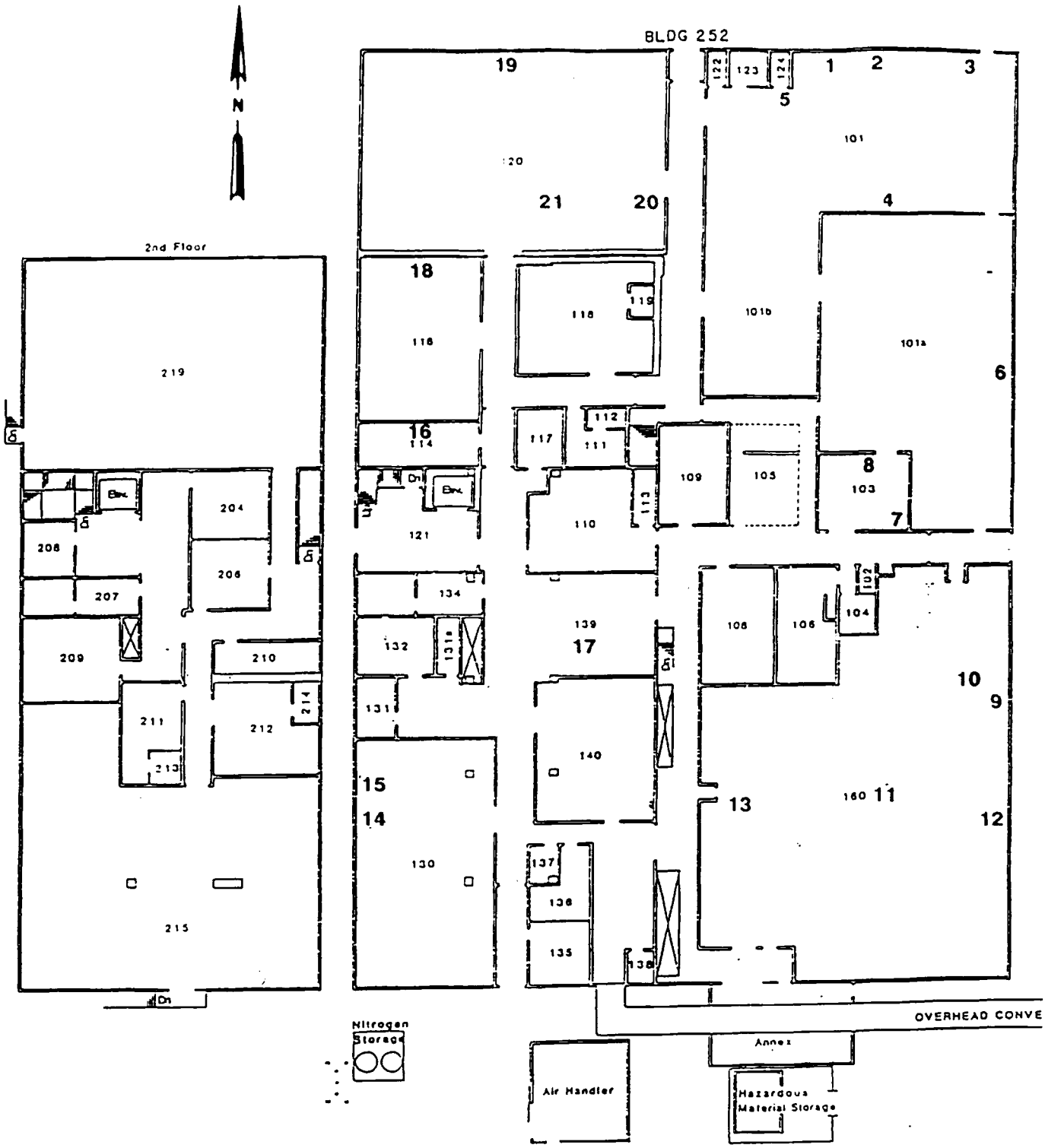
In support of Sacramento ALC's mission, Building 252 housed maintenance and repair operations for various aircraft and ground support instrumentation. These operations apparently resulted in occasional spills of mercury. Spills were cleaned up through direct recovery and/or vacuuming.

In early 1990, most of the Building 252 operations were relocated, and renovation activities were initiated to convert the building to office space. During initial stages of the renovation, mercury was discovered in some of the vacuum line piping. This prompted the collection of swipe (wipe) samples by the Base and closure of the building. Currently, the area of concern is Building 252 and areas immediately outside of Building 252 on McClellan Air Force Base.

PREVIOUS STUDIES

McClellan Air Force Base undertook an initial sampling and analytical effort on May 22, 1990, to investigate the presence of mercury contamination. Swipe (wipe) samples were taken at various locations within Building 252. The locations of these samples are shown in Figure 2-1.

Mercury was found in all swipe samples (see Table 2-1). The highest reading was found inside Room 101 (greater than 3,300 ug/swipe). The indication from these results was that mercury was present in most parts of Building 252. Further, the possibility existed for mercury contamination outside Building 252 along migration routes.



DRAFT

SOURCE: McCLELLAN AIR FORCE BASE

FIGURE 2-1

LOCATION OF McCLELLAN AIR FORCE BASE
BIOENVIRONMENTAL (SGB) SWIPE SAMPLING ON 22 MAY 1990

CH2M HILL

Table 2-1
Results of Mercury Swipe Samples Taken Within Building 252 on 22 May 1990 By McClellan Air Force Base Bioenvironmental (SGB)

Location Number[a]	Location	Mercury Concentration (ug/swipe)[b]	SGB Number[c]
1	Room 101 workbench	29.72	WW-90-422
2	Room 101 north wall	>0.50[d]	WW-90-423
3	Room 101 northeast corner	53.33	WW-90-424
4	Room 101 south wall	0.21	WW-90-425
5	Room 101 baseboard	3312.44	WW-90-426
6	Room 101A east wall	0.48	WW-90-427
7	Room 103 southeast corner	>0.50[d]	WW-90-428
8	Room 103 north wall	0.42	WW-90-429
9	Room 160 supply cabinet	>0.50[d]	WW-90-430
10	Room 160 supply air vent	>0.50[d]	WW-90-431
11	Room 160 wall cabinet	>0.50[d]	WW-90-432
12	Room 160 exhaust vent	>0.50[d]	WW-90-433
13	Room 160 AC diffuser	>0.50[d]	WW-90-434
14	Room 130 light fixture	0.02	WW-90-435
15	Room 130 vacuum	>0.50[d]	WW-90-436
16	Room 144 north wall	4.87	WW-90-437
17	Room 139 break room vent	>0.50[d]	WW-90-438
18	Room 116 north wall air vent	>0.50[d]	WW-90-439
19	Room 120 north wall	>0.50[d]	WW-90-440
20	Room 120 south wall vent	>0.50[d]	WW-90-441
21	Room 120 work table	>0.50[d]	WW-90-442

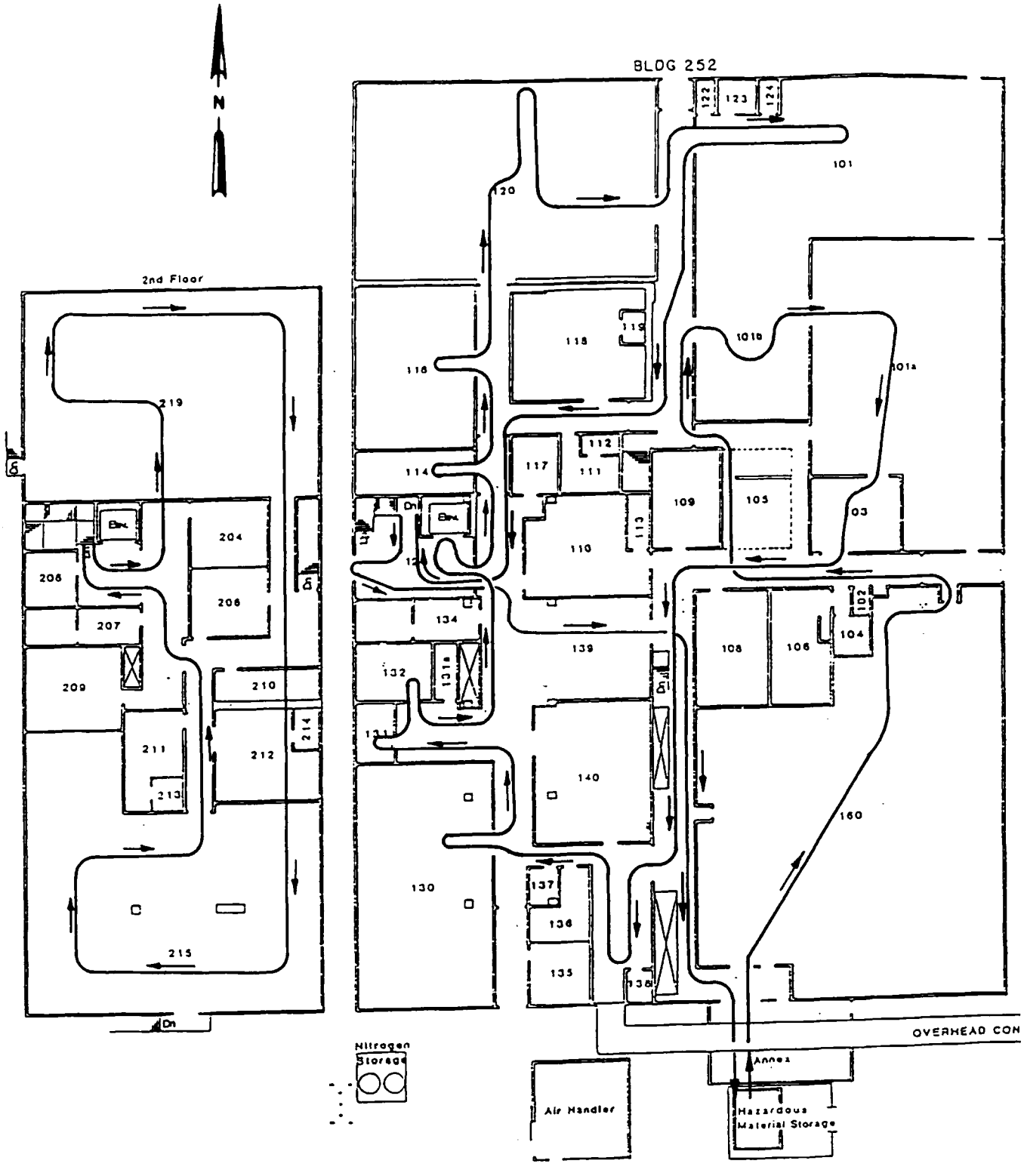
[a]Location Number is shown in Figure 2-1.
[b]Micrograms per swipe sample.
[c]SGB Number is the log book number.
[d]Sample exceeded calibration range.

Because this initial sampling and analytical effort found mercury throughout Building 252, a more extensive sampling and analytical program was proposed by McClellan AFB. The objectives and methodology for this sampling and analysis program are presented in Section 3 of this report.

A facility inspection was conducted by CH2M HILL on May 30, 1990. The objective of the initial site visit was to familiarize the CH2M HILL planning and sampling team with the site and to provide an initial survey of the building. Results of the initial site visit were used to prepare a Sampling and Analytical Plan.

The CH2M HILL team, accompanied by McClellan AFB personnel, proceeded through the building as shown in Figure 2-2. A Jerome Mercury Vapor Analyzer was used to analyze ambient air for the concentration of mercury vapor in the breathing zone/floor zone of the building. The resulting measurements are illustrated in Figure 2-3. Presented below are the results for the two zones, breathing/floor, by location, in milligrams of mercury per cubic meter (mg/m^3) of air. A "-" designates that no reading was taken in the indicated zone at the indicated location.

Room 160	0/0, 0/0, 0/0.001
Hallway between Rooms 103 and 104	0/0.009, 0.002/0.002
Room 105	0/0.002
Hallway outside Room 105	0.002/0.002
Room 101b	0.002/0.004
Room 101a	0.003/0.004, -/0.005
Inside and outside Room 131	0/0, 0/0
Room 116	0/0.003
Room 120	0.001/0.006, -/0.001, -/0.003, -/0.003, 0.005/0.002
Room 101	0/0.004 -/0.001, -/0.002, 0.001/-
Room 121	0/0.002
Room 219	0.003/0.007, 0.004/-, -/0.004, -/0.002, -/0.00
Outside Room 208	0.001/0.004
Room 215	0.002/-, 0.002/0.003, -/0.005
Hallway outside Room 160 near exit	0.009/- and 0.012/- (while walking)
Basement: Above floor	0.003
Near compressed air tank	0.001/0.001
Near overhead pipes	0.003
Inside updraft duct (not shown in Figure 2-3)	0.003

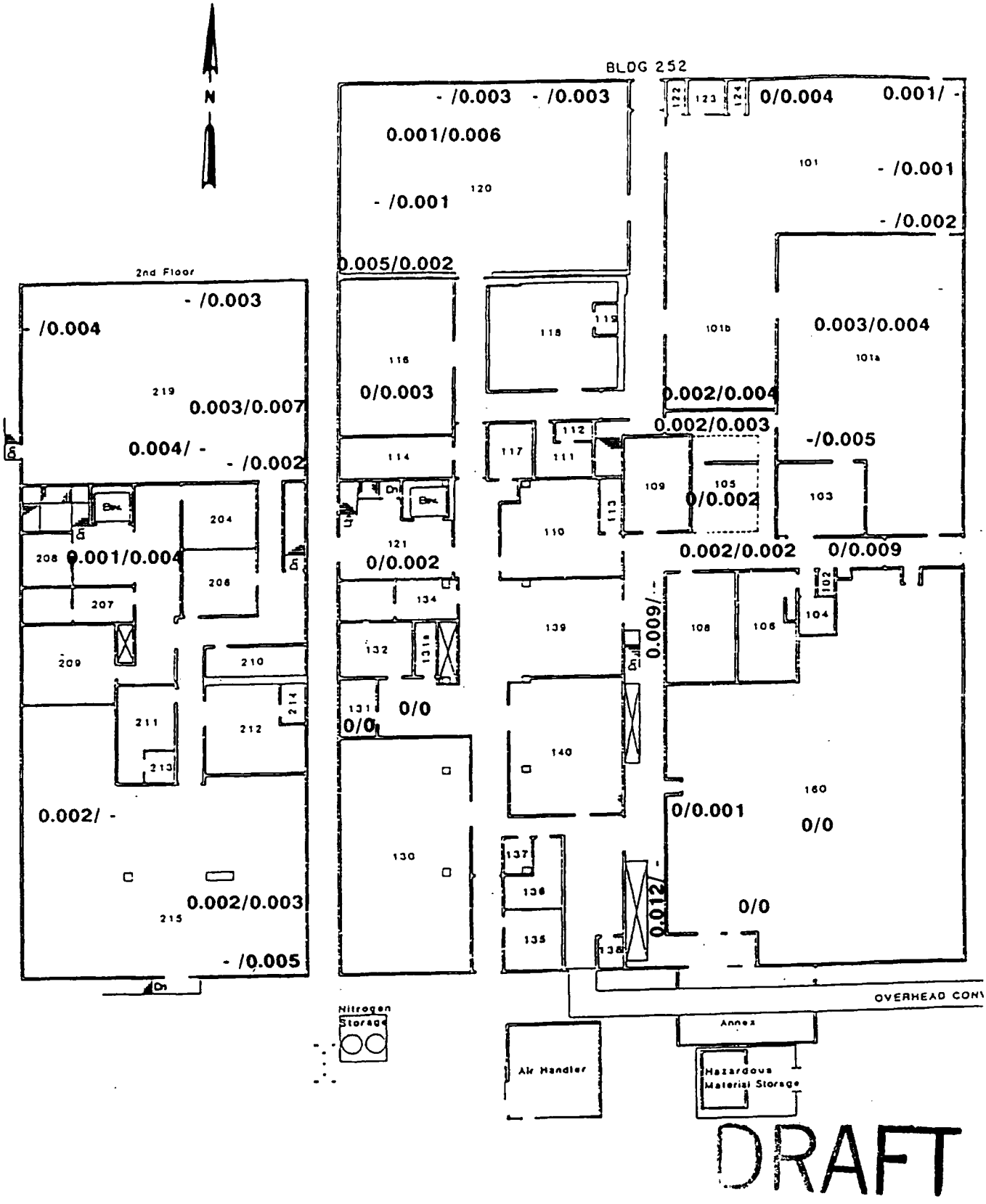


DRAFT

FIGURE 2-2

PATH THROUGH BUILDING 252 DURING INITIAL SITE VISIT

CH2M HILL



DRAFT

FIGURE 2-3

MERCURY VAPOR CONCENTRATIONS IN MICROGRAMS PER CUBIC METER FOR THE BREATHING ZONE/FLOOR ZONE OF BUILDING 252 DURING INITIAL SITE VISIT

CH2M HILL

Outside the building, the following readings were found at the locations and sampling zones indicated below. These locations not shown in Figure 2-3 may indicate potential migration routes from Building 252.

Dumpsters in northeast corner of building	0, 0, 0
Ground near north door next to Room 122	0.002, 0.002
South door next to Room 130	0
Inside shop vacuum hopper	0.021, 0.019

In summary, levels of mercury vapor found throughout Building 252 varied from zero to 0.012 mg/m^3. Generally, higher levels were found at the floor zone versus the breathing zone. The air handling ducts did not show appreciably different mercury vapor concentrations compared to ambient air in the rooms. However, the highest concentrations inside the building were found in the breathing zone around the four-person investigation group while the group was walking together. These concentrations were probably the result of mercury-contaminated dust being disturbed from the floor. The highest reading (0.021 mg/m^3) was found inside the hopper for the shop vacuum outside the west side of the building. This hopper may have received dust from the instrument maintenance and repair operations within the building. The low-level readings outside the north door near the ground indicated that additional samples should be taken outside the building to determine the existence of fugitive mercury-contaminated dust.

Section 3
SAMPLING AND ANALYSIS METHOD

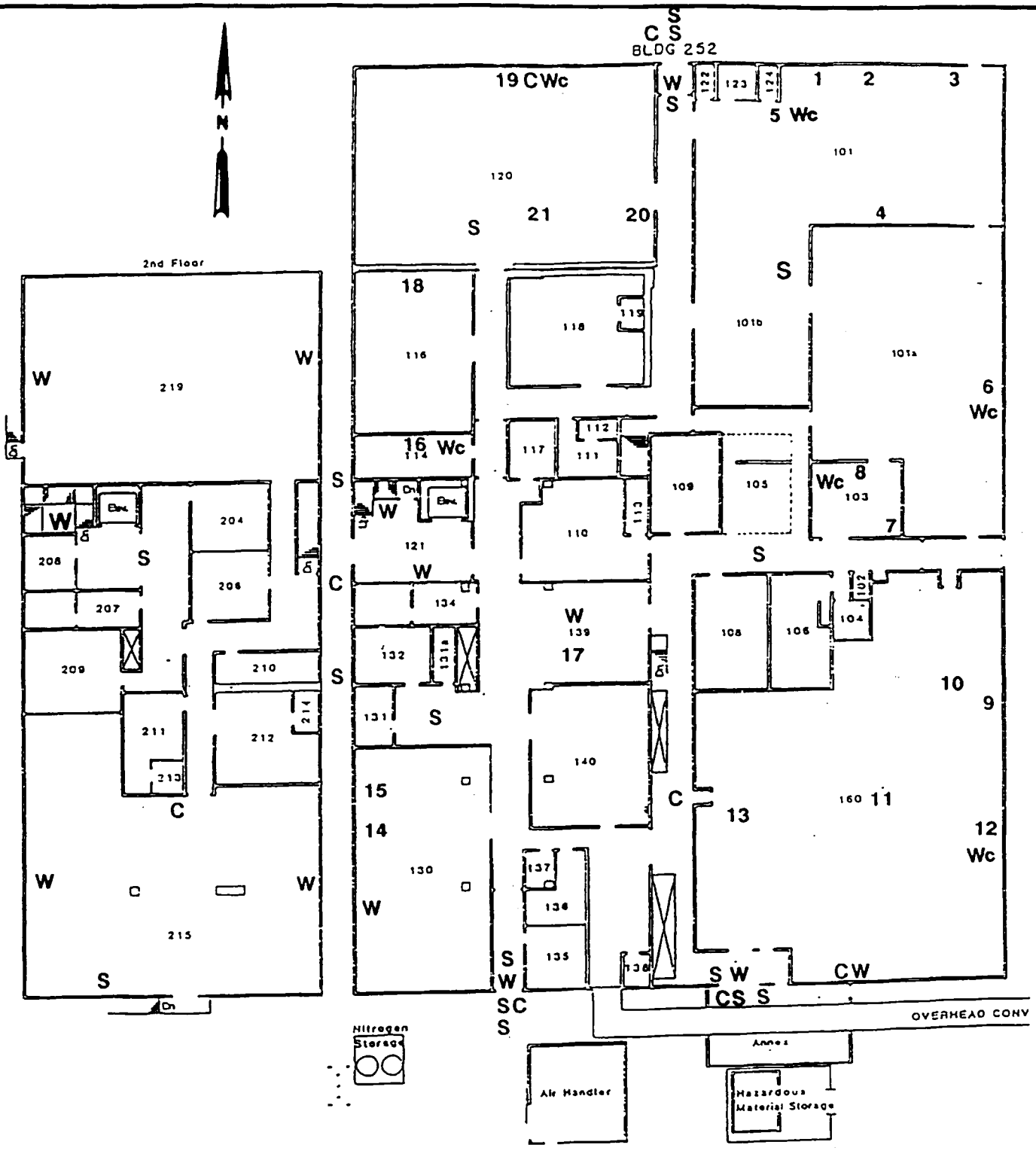
The overall objectives of this sampling and analysis program were to further characterize the concentration and extent of mercury contamination in and around Building 252, to test potential decontamination and remediation alternatives, and to inventory the volumes of affected building elements. To meet these objectives, a two-stage sampling effort was conducted. Stage 1 consisted of wipe, sweep, and chip sampling for determination of the extent of mercury contamination on various surfaces and equipment in and around Building 252. Stage 2 included on-site "bench-scale" test of some cleanup options.

The initial sampling and analytical effort conducted by the Bioenvironmental (SGB) group indicated that mercury was present throughout the building. Therefore, the goal of the wipe, sweep, and chip sampling was to confirm and expand on the SGB sampling. Widely dispersed locations were sampled to characterize the concentration and extent of mercury contamination and to locate potential "hot spots." In addition, wipe, sweep, and chip samples (Stage 1), and building material samples (Stage 2) were analyzed for total mercury to determine if the California total threshold limit concentration (TTLC) for mercury was exceeded. Comparison of sample concentra-tions to the TTLC (20 mg/kg) will help determine disposal requirements for any build-ing materials removed from the building. This is not a building cleanup objective for the main super structure, the inside of the exterior walls, the structural ceilings, and the concrete floors of both floors and basement.

Wipe samples provide information on the amount of mercury contamination on a sampling surface. The wipe cloth contains a mild solvent to remove mercury from the selected surface. Sweep samples are used to measure the concentration of mercury in loose material not adhered to a particular surface. Therefore, sweep samples will show the association of mercury with dust throughout the building. Finally, chip samples will be used to determine the presence of mercury within the building elements or construction materials. If mercury is present within these materials, a more rigorous remediation technique may be required compared to limited surface contamination only.

The sampling locations for Stage 1 wipe, sweep, and chip samples in Building 252 are shown in Figure 3-1 and Tables 3-1, 3-2, and 3-3. The sample locations were selected to determine mercury concentrations in areas not previously sampled and also to confirm concentrations at prior SGB sampling points.

In addition, several samples were taken at locations outside of Building 252 along possible migration pathways (see Figure 3-1). These locations are the north doorway, the two south doorways, the shop vacuum hopper area on the west side of the building, the



LEGEND

W – WIPE
Wc – CONFIRMATORY WIPE
S – SWEEP
C – CHIP

NOTES:

1. LOCATION OF BASEMENT AND ROOF SAMPLES NOT SHOWN
2. NUMBERS DESIGNATE LOCATION OF McCLELLAN AFB BIOENVIRONMENTAL (SGB) SWIPE SAMPLING

DRAFT

FIGURE 3-1

LOCATION OF WIPE, SWEEP, AND CHIP SAMPLING IN BUILDING 252

SOURCE: McCLELLAN AIR FORCE BASE

CH2M HILL

Table 3-1 Wipe Sample Locations		
Room	**Sample Area**	**Sample No.**
160	Southwall	05-109
Northwall Between 138 and 160	Wall	05-108
Inside North Door	Wall	05-118
121	Floor	05-101
121	Wall	05-102
200 (Women's Restroom)	Countertop	05-116
139	Ceiling Tile	05-106
Inside South Door Hallway Between 135 and 130	Wall	05-107
130	West Wall	05-105
219	West Wall	05-114
219	East HVAC	05-115
215	East Wall	05-112
215	West HVAC	05-113
Basement	Wall	05-117
101	Baseboard	05-119
120	North Wall	05-104
114	North Wall	05-103
103	North Wall	05-120
101A	East Wall	05-122
160	East Wall Exhaust Vent	05-110y
Vacuum Hopper, west of building	Inside Hopper (near side hatch)	05-121
Second Floor Roof	Inside exhaust stack, west side	05-125
Second Floor Room	Inside exhaust stack, east side	05-126
Batch Blank	--	05-111
Batch Blank	--	05-123

Table 3-2 Sweep Sample Locations		
Room	**Sample Area**	**Sample No.**
Inside South Door Hallway Between Rooms 135 and 130	Floor	05-7
Outside South Door Hallway Between Rooms 135 and 130	Concrete Ground	05-12
Outside South Door Hallway Between Rooms 135 and 130	Soil	05-13
Inside South Door Hallway Between Rooms 138 and 160	Floor	05-8
Outside South Door Hallway Between Rooms 138 and 160	Concrete Ground	05-16
Outside South Door Hallway Between Rooms 138 and 160	Soil	05-20
Inside North Door	Floor	05-11 05-9
Outside North Door	Concrete Ground	05-15
Outside North Door	Soil	05-14
North of House Vac Hopper	Concrete Ground	05-5
South of House Vac Hopper	Concrete Ground	05-6
Hallway Outside of Rooms 131 and 132	Floor	05-1
120	Floor	05-4
Hallway Between Rooms 108 and 109	Above Ceiling Tiles	05-2
101 b	Above Ceiling Tiles	05-3
Second-Story Hallway	Floor	05-10 05-10-MS 05-10-MSD
215	HVAC	05-19
Basement	HVAC	05-17
Basement	On Top of Equipment	05-18

Table 3-3
Chip Sample Locations

Room	Sample Area	Sample No.
Under House Vacuum Hopper	Concrete Ground	05-201
Outside South Door Hallway Between Rooms 135 and 130	Concrete Ground	05-202
Outside South Door Hallway Between Rooms 138 and 160	Concrete Ground	05-212
Outside North Door	Concrete Ground	05-211
Room 215	Floor	05-210
Basement	Floor	05-209
Hallway Between Rooms 140 and 160	Floor	05-208
Room 120	North Wall	05-203 05-203 05-204-MS 05-205-MSD 05-206
Room 160	South Wall	05-207

shop vacuum roof exhaust, and the high vacuum roof exhaust. Please note that not all locations are shown in Figure 3-1, for example basement and ceiling locations are not illustrated. These locations were chosen because of potential for migration due to workers exiting the building, water escaping the building with possible contaminants, and ventilation exhaust locations for the shop and high vacuum lines.

During the sampling effort the sampling teams inventoried the building materials to be removed during subsequent construction and inspected work areas for other potential concerns, such as polychlorinated biphenyl (PCB) or asbestos materials. No sampling was conducted for these materials at this time. Identification of potential concerns, other than mercury, was based on observations only and should not form the basis for cleanup procedures.

SAMPLING PROCEDURES

Wipe, sweep, and chip samples were taken to evaluate surface and subsurface contamination during the Stage 1 sampling effort. U.S. Environmental Protection Agency Environmental Response Team Standard Operating Procedure was used for these samples (Ref. 2).

Prior to collecting a wipe sample for surfacial mercury, the sample point was selected within a sample location. An acrylic plastic form 10 cm by 10 cm was used to standardize the wipe area (see Figure 3-2). With the sampler wearing a new pair of surgical gloves, a sterile teflon gauze pad was opened and soaked with 0.1N nitric acid (HNO_3) solvent. Excess HNO_3 was removed from the pad. The pad was then stroked firmly over the sample surface vertically, then a clean surface of the pad was stroked horizontally. Next another clean surface of the pad was stroked vertically, and finally, another clean surface was stroked horizontally to ensure complete coverage. After wiping, the gauze pad was placed inside an I-CHEM sample jar. The sample jar was labelled, sealed inside a plastic bag, and placed inside an ice chest with ice.

Sweep sampling was used to collect dust and/or residue on porous or nonporous surfaces. To collect sweep samples, an appropriate sample point was selected within a sample location. The area swept varied, depending on the availability and density of the dust or residue. While wearing a new pair of disposable surgical gloves, the sampler used a dedicated bristle brush to sweep material into a dedicated dustpan (see Figure 3-3). The sample was then transferred from dustpan to an I-Chem sample jar. The sample jar was labelled, sealed inside a plastic bag, and placed inside an ice chest with ice.

Chip sampling was used to determine the potential for mercury penetration in a porous sample media. The surface of the media was wiped with a sterile cotton gauze pad soaked with 0.1N HNO_3. The wipe technique used was the same as that used for wipe samples. However, this pad/solvent wipe was performed three times with a new

Figure 3-2 Wipe Sampling

Figure 3-3 Sweep Sampling

pad and fresh solvent each time. Next, the media surface was wiped two times using a fresh gauze pad soaked in deionized water. After the surface was allowed to dry, it was chipped to a depth of approximately one-eighth inch with a hammer and either a cold chisel or a wood chisel. The chisels were cleaned between sample locations with 0.1N HNO_3 and wrapped in aluminum foil cleaned with 0.1N HNO_3. The resulting chip samples were swept up with a 0.1N HNO_3-cleaned bristle brush and dust pan and placed in an I-Chem jar. The sample jar was labelled, sealed inside a plastic bag, and placed inside an ice chest.

The following personnel decontamination procedures were used upon exiting Building 252 following sampling activities:

- Outer glove removal
- Hard hat and air purifying respirator removal
- Tyvek removal
- Inner glove removal

All disposable personnel protective gear was placed in a 55-gallon drum to be properly stored and disposed by McClellan Air Force Base. Used sterile cotton gauge wipes from decontamination and drying of the chisels, brushes, shovels, and aluminum foil were placed in the 55-gallon drum with the used personnel protective gear and left in the decontamination area on the west side of Building 252.

Reusable safety equipment, such as respirators were decontaminated by the following procedure:

- Wiped with respirator cleanser solution
- Wiped with potable water
- Wiped with 0.1N HNO_3
- Wiped with potable water
- Dried

DECONTAMINATION TESTING

The Stage 2 sampling is part of the decontamination testing performed to assess potential cleanup alternatives for certain building construction elements. The Stage 2 effort consisted of hand-cleaning various surfaces by vacuuming or wiping with mild solutions that are considered capable of removing the mercury adhered to or adsorbed on surfaces. These surfaces included walls, ceiling tiles, and floors. The surfaces of these building elements were analyzed for total mercury before and after cleaning to determine the cleaning efficiency of the decontamination solutions and the hand-cleaning operations. This onsite feasibility test was performed concurrently with the Stage 1 sampling effort. Testing locations were determined in the field. Four cleanup techniques were tested: (1) vacuuming, (2) deionized (DI) water wipe, (3) 0.1N HNO_3

wipe, and (4) wipe with 500 mg sodium sulfide (NaS) in 1 liter of 0.1N sodium hydroxide (NaOH).

To test cleanup techniques, an area of wall, ceiling tile, or floor suspected of having surface contamination was selected. Each area of interest was divided into four sample points consisting of squares measuring approximately 20 cm x 20 cm. Each square is then subdivided into four inner squares of approximately 10 cm x 10 cm each (see Figure 3-4).

The lower left 10-cm square in each 20-cm area was left uncleaned to act as a control sample. It was cut with a sharp wood chisel and the surface material collected and retained for total mercury analysis. The diagonal upper right 10-cm square within each 20-cm area was treated with one of four cleanup techniques. Like the control area, this cleaned area was then cut with a chisel to collect a surface sample for total mercury analysis.

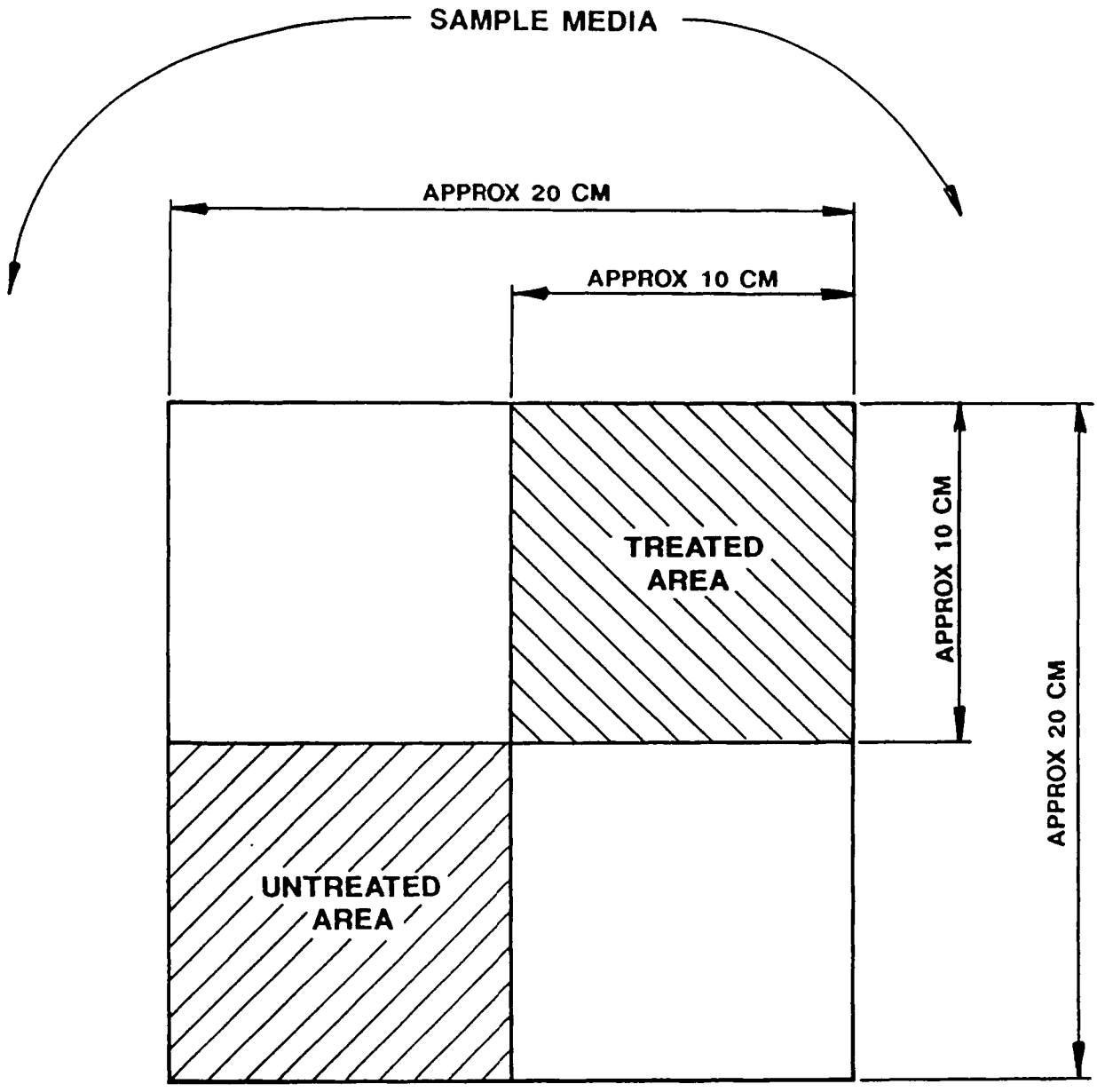
Wipes generated from decontamination operations were placed in the disposal drum used for personnel protective gear.

SAMPLE HANDLING

All sample handing was performed according to U.S. EPA protocol. Only 8 ounce labelled I-Chem glass sample containers were used for the wipe, sweep, chip, and decontamination testing samples. After sampling, the sample containers were sealed from light, kept cool, and protected from breakage in an ice chest. Ice was used to keep samples cold until they were placed in the walk-in refrigerator at the laboratory. Ice chests were transported to the laboratory daily by one of the sample team. Upon receipt of each sample set by the laboratory, each ice chest was inspected and any problems reported to the field supervisor. Samples were logged into the laboratory system and immediately placed into a refrigerator at a temperature of 4°C. Custody seals were not placed on ice chests because they were not left unattended at any time.

The sampling personnel maintained a field log book. This daily log identified at a minimum, onsite personnel, locations sampled, sampling procedures, and any abnormal occurrences.

A chain-of-custody record accompanied each sample shipment, and each time the samples change hands, the sender and receiver signed and dated the chain-of-custody record. When samples were shipped to the laboratory, a copy of the chain-of-custody record was retained. The laboratory was instructed to sign its copy of the chain-of-custody record and return a copy along with the analytical results. The following information will be included on the chain-of-custody record.



DRAFT

FIGURE 3-4
DIAGRAM OF THE TREATED
AND UNTREATED AREAS FOR
THE DECONTAMINATION TESTING

- Sample number
- Signature of sampler
- Date and time of collection
- Type of sample
- Number and type of container
- Signature of receiver

ANALYTICAL METHODS

Wipe samples were analyzed according to a modified U.S. EPA Method 245.1 (Ref. 3). The modification to this method was that a wipe gauze was added to 100 milliliters of DI water prior to digestion. Sweep and chip samples were analyzed according to U.S. EPA Method 245.5 (Ref. 3).

QUALITY ASSURANCE/QUALITY CONTROL

General quality assurance/quality control (QA/QC) objectives for this investigation were developed and implemented for obtaining and evaluating data of known quality that can used to determine the extent of mercury contamination within and surrounding Building 252. To achieve these QA/QC objectives, it was necessary that measurement data have an appropriate degree of accuracy and reproducibility, along with assurance that samples collected were appropriately representative of actual field conditions.

Specific QA/QC objectives were to:

- Establish sampling and sample preparation techniques in such a manner that analytical results are representative of the media and conditions being measured.

- Analyze a sufficient number of field and laboratory duplicate samples to establish the sampling and analytical precision. Field duplicate sweep and chip samples were collected at a rate of 5 percent, if possible. Laboratory duplicate samples were performed according to the rate established for the normal laboratory QC program with a minimum of 5 percent.

- Collect and analyze daily field blank samples to evaluate the potential for contamination from wipes, solvents, or sample containers. For wipe samples, a blank (unused wipe gauze) was collected for each sampling event. This consisted of a sterile gauze pad, wetted with the solvent, and placed in a prepared sample container. Field blanks of the wipe gauzes were collected on 5 percent of total wipe samples.

- Analyze sufficient number of laboratory method blank, laboratory replicates, matrix spike, and matrix spike duplicate samples (minimum of 5 percent of the total number of samples) internally within the laboratory to evaluate results for precision and accuracy.

A sample number system was used to identify each sample for chemical analysis, including field blanks and field duplicates. The sampling team maintained a sample log book that gave the field sample number, complete description of the sampling location, and other pertinent data such as the time and date of the sample for both normal and field (blank or duplicate) QC samples. The field sample numbers began with the number 05 (Delivery Order 5005), followed by a three-digit sequential number. Sweep samples were assigned sequential numbers beginning with 001, the wipe samples sequence began with 101, chip samples began with 201, and decontamination testing samples began with 301. For example, Sample No. 05-103 was the third wipe sample collected.

BUILDING INVENTORY

To inventory the volumes of affected building elements, the sampling team walked through the entire building and, using a tape measure, estimated the amount and type of floor covering, wall board, and ceiling tile. In addition, the amount of duct work visible or behind movable ceiling tiles was observed. Finally, the quantity and type of miscellaneous equipment in each room was estimated.

Section 4
RESULTS

CONTAMINANT DISTRIBUTION

Results from analysis of the wipe, sweep, and chip samples are listed in Tables 4-1, 4-2, and 4-3, respectively. Each of these tables designates the room and location of the sample, the sample numbers, and the concentration of mercury corresponding to the sample number.

To help place all the above mercury concentrations in perspective, Figure 4-1 shows the location and sample type for all the results. Graphic callouts indicate the sample locations. The mercury concentrations of the wipe, sweep, and chip samples are preceded by a W, S, and C, respectively, to identify the type of sample. To make reading of the mercury results easier and comparisons of the concentrations more comprehensive, the mercury concentrations were rounded off. Definitive values are presented in Tables 4-1, 4-2, and 4-3, and Appendix B.

The highest concentrations of mercury were found outside Building 252, not inside. North of the house vacuum hopper and outside of the southeast doorway, the concentrations of mercury measured in dust sweeps were 41,000 and 17,000 mg/kg, respectively. These are approximately three orders-of-magnitude greater than the California Total Threshold Limit Concentration (TTLC) of 20 mg/kg for mercury. Mercury also appears to have entered soils bordering the building. Soil sweeps outside the north, southwest, and southeast doors were 85, 57, and 32 mg/kg mercury, respectively. Floor sweeps from inside the north, southwest, and southeast doors were 930, 150, and 1,100 kg/mg mercury, respectively.

The concentrations of the wipe samples varied from non-detectable (ND) on several walls to 35 mg/wipe inside the HVAC system.

In summary, the sampling indicated mercury was found throughout Building 252. It was found on every floor, inside the HVAC system, and in exhaust ducts. Furthermore, mercury concentrations in the dust and soil outside of Building 252 exceeded the state TTLC limit for the contaminant.

DECONTAMINATION TESTING

Overall, the results of decontamination testing indicate that the mild cleaning solution did not adequately remove mercury from the selected media surfaces (see Figure 4-2). The 0.1 N HNO_3 removal of mercury from the wall, ceiling tile, and floor was 26, 52, and 26 percent effective, respectively. The removal of mercury using a cleaning solution of 500 mg NaS in 1 liter of 0.1N NaOH was 61, 21, and 4 percent effective,

Table 4-1 Mercury Concentration of Wipe Samples			
Mercury (ug/wipe)	**Room**	**Sample Area**	**Sample No.**
ND	160	Southwall	05-109
ND	Northwall Btwn 138 & 160	Wall	05-108
0.22	Inside North Door	Wall	05-118
17	121	Floor	05-101
0.16	121	Wall	05-102
0.06	200 (Women's Restroom)	Countertop	05-116
ND	139	Ceiling Tile	05-106
0.92	Inside Southwest Door Hallway	Wall	05-107
ND	130	West Wall	05-105
1.2	219	West Wall	05-114
4.4	219	East HVAC	05-115
ND	215	East Wall	05-112
35	215	Well HVAC	05-113
0.06	Basement	Wall	05-117
1.8	101	Baseboard	05-119
0.07	120	North Wall	05-104
0.06	114	North Wall	05-103
0.78	103	North Wall	05-120
10	101A	East Wall	05-122
3.7	160	East Wall Exhaust Vent	05-110y
31	Vacuum Hopper	Inside Hopper	05-121
0.27	Second Floor Roof	Inside exhaust stack, west side	05-125
19	Second Floor Room	Inside exhaust stack, east side	05-126
ND	Batch blank	--	05-111
ND	Batch blank	--	05-123
ND	Batch blank	--	05-124
ug/wipe = micrograms per 100-square-centimeter wipe.			

Table 4-2
Mercury Concentration of Sweep Samples

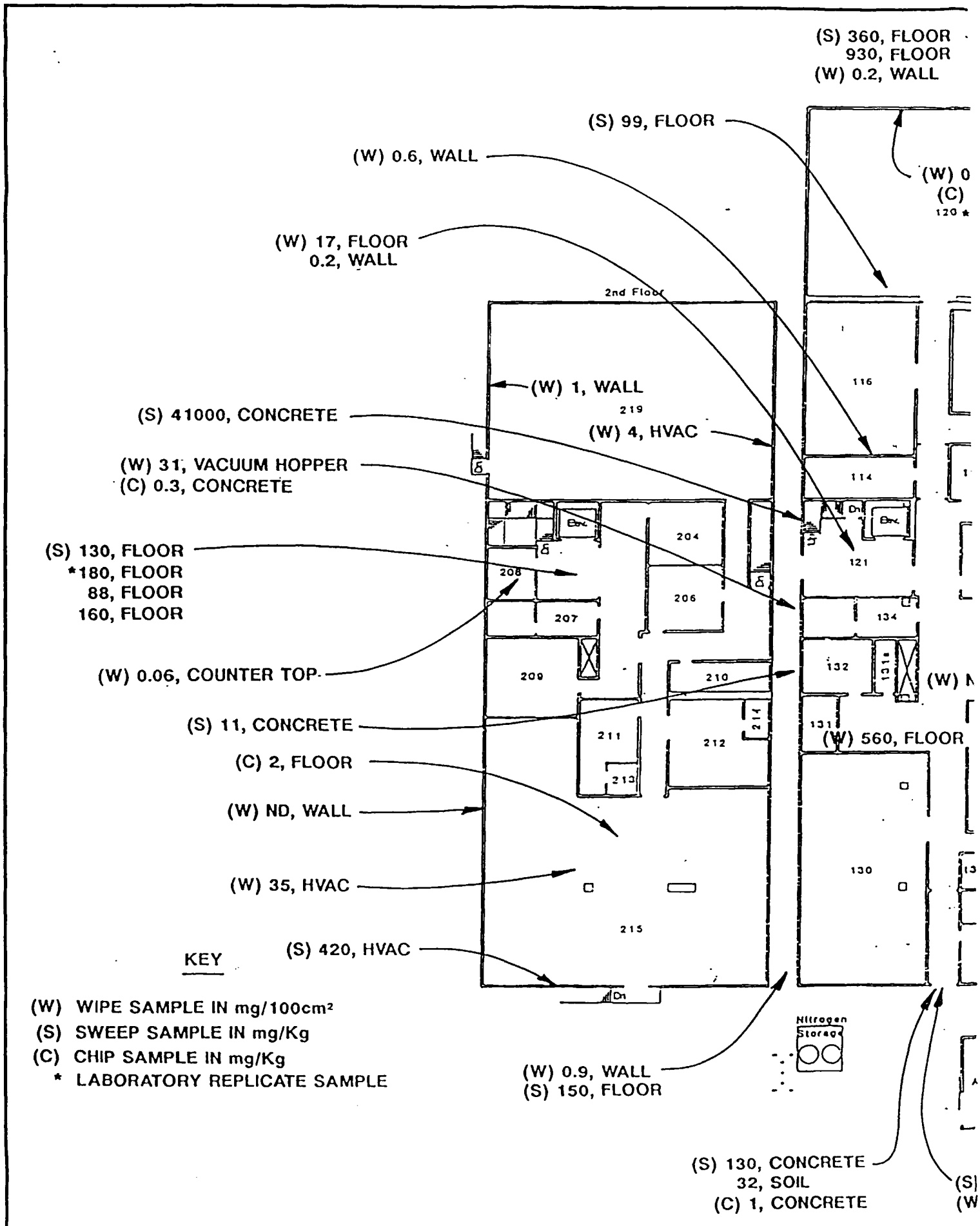
Mercury (mg/kg)	Room	Sample Area	Sample No.
150	Inside Southwest Door Hallway	Floor	05-7
130	Outside Southwest Door Hallway	Concrete Ground	05-12
32	Outside Southwest Door Hallway	Soil	05-13
1,100	Inside Southeast Door Hallway	Floor	05-8
17,000	Outside Southeast Door Hallway	Concrete Ground	05-16
57	Outside Southeast Door Hallway	Soil	05-20
360 930[b]	Inside North Door	Floor	05-11 05-9
85	Outside North Door	Concrete Ground	05-15
78	Outside North Door	Soil	05-14
41,000	North of House Vac Hopper	Concrete Ground	05-5
11	South of House Vac Hopper	Concrete Ground	05-6
560	Hallway Outside Rooms 131 & 132	Floor	05-1
99	120	Floor	05-4
27	Hallway Btwn Rooms 108 & 109	Above Ceiling Tiles	05-2
62	101 b	Above Ceiling Tiles	05-3
130 180[a] 80[b] 160[b]	Second-Story Hallway	Floor	05-10 05-10 05-10-MS 05-10-MSD
420	215	HVAC	05-19
4.4	Basement	HVAC	05-17
28	Basement	Equipment on Top	05-18

mg/kg = milligrams per kilogram sample
[a]laboratory replicate
[b]field duplicate sample

Table 4-3
Mercury Concentration of Chip Samples

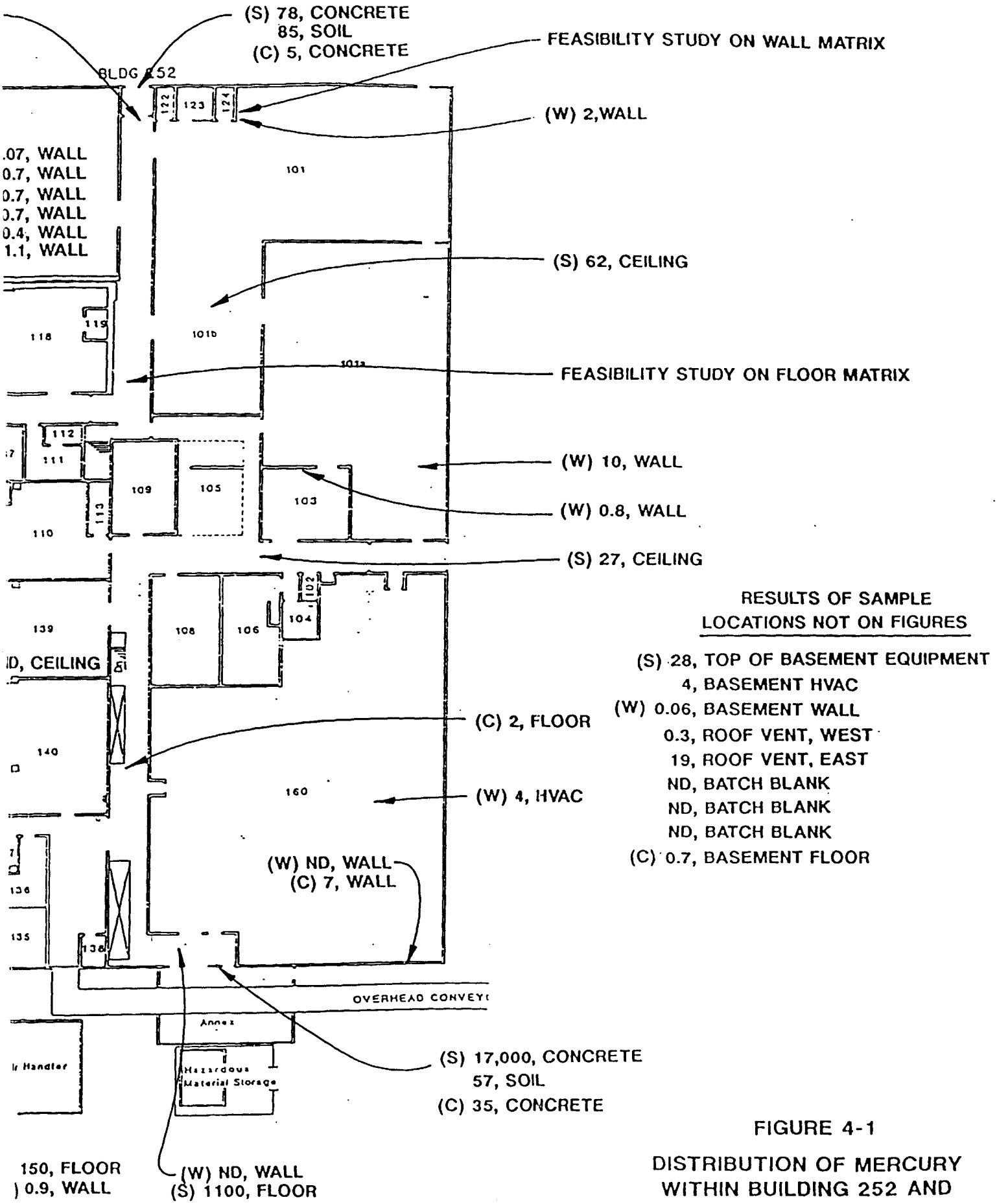
Mercury (mg/kg)	Room	Sample Area	Sample No.
0.3	Under House Vac Hopper	Concrete Ground	05-201
1.3	Outside South Door Hallway Btwn Rooms 135 & 130	Concrete Ground	05-202
35	Outside South Door Hallway Btwn Rooms 138 & 160	Concrete Ground	05-212
4.7	Outside North Door	Concrete Ground	05-211
2.4	Room 215	Floor	05-210
0.67	Basement	Floor	05-209
2.4	Hallway Btwn Rooms 140 & 160	Floor	05-208
0.72 0.72[a] 0.72[b] 0.43[b] 1.1[b]	Room 120	North Wall	05-203 05-203 05-204-MS 05-205-MSD 05-206
7.3	Room 160	South Wall	05-207

mg/kg = milligrams per kilogram sample
[a]laboratory replicate
[b]field duplicate sample



KEY

(W) WIPE SAMPLE IN mg/100cm²
(S) SWEEP SAMPLE IN mg/Kg
(C) CHIP SAMPLE IN mg/Kg
* LABORATORY REPLICATE SAMPLE

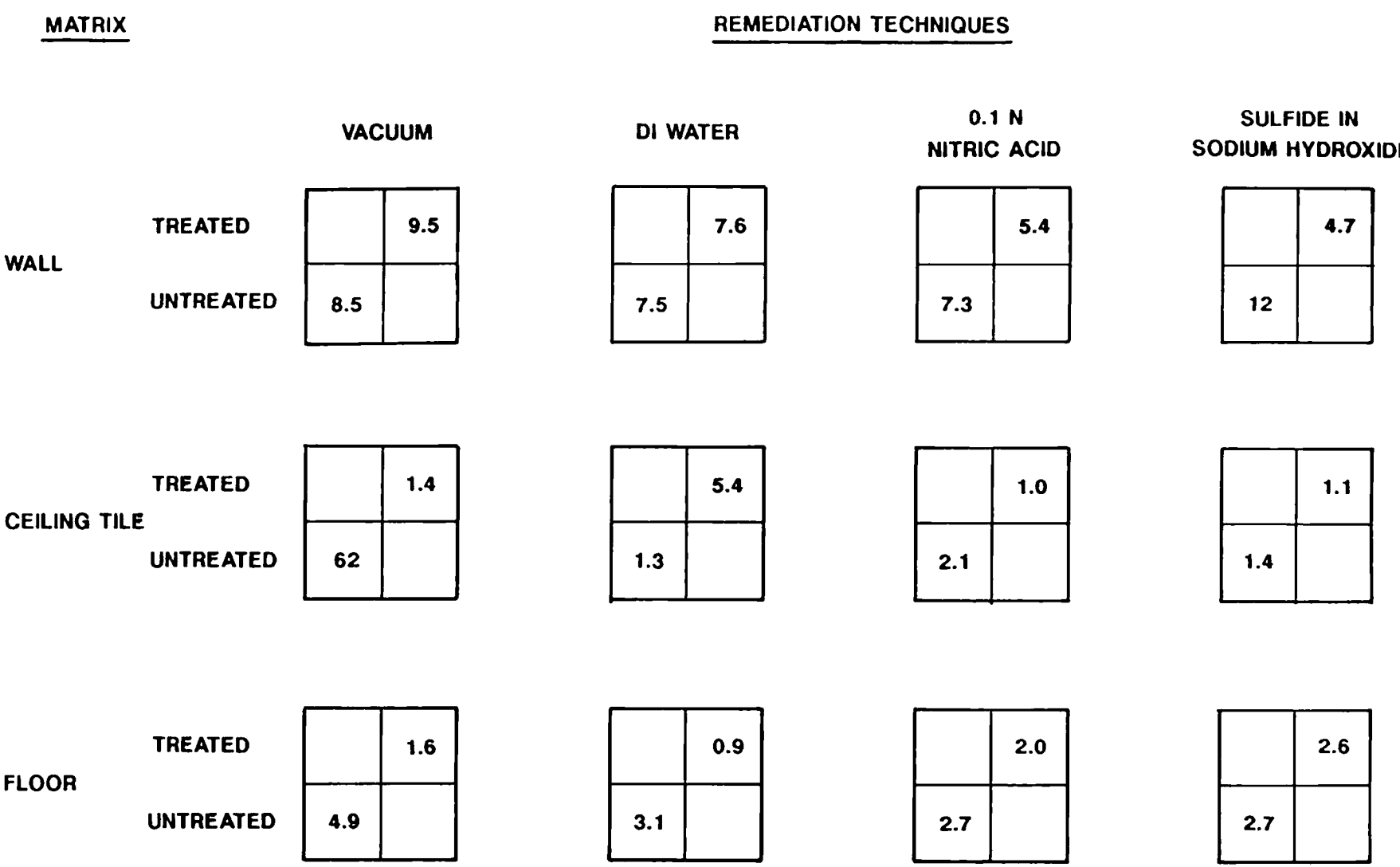


RESULTS OF SAMPLE LOCATIONS NOT ON FIGURES

(S) 28, TOP OF BASEMENT EQUIPMENT
4, BASEMENT HVAC
(W) 0.06, BASEMENT WALL
0.3, ROOF VENT, WEST
19, ROOF VENT, EAST
ND, BATCH BLANK
ND, BATCH BLANK
ND, BATCH BLANK
(C) 0.7, BASEMENT FLOOR

FIGURE 4-1

DISTRIBUTION OF MERCURY WITHIN BUILDING 252 AND ENVIRON BY SAMPLE METHOD



DRAFT

FIGURE 4-2

RESULTS OF DECONTAMINATION TESTING

CH2MHILL

respectively. These solutions were compared to a control solution, DI water. DI water effectively reduced mercury concentrations on the above surfaces by 0, 0, and 71 percent.

Another remediation technique, vacuuming, was not conclusive. Removal efficiencies (compared to the untreated samples) for the wall, ceiling tile, and floor surfaces were 0, 98, and 67 percent, respectively. The high removal efficiency for the vacuuming of the ceiling tile may be due to the mercury contamination in the untreated portion of ceiling tile being more than 5 fold greater than the next highest concentration of mercury in any untreated portion.

BUILDING INVENTORY

Building 252 is an industrial facility with numerous rooms and hallways in various types of construction. Some rooms have the walls and ceiling tile removed; other rooms have the furniture and floor tiles removed. In addition, Building 252 contains rooms with many items of equipment that appear to be from other rooms that were being gutted. Finally, some rooms within the building appear to be unchanged from their probable appearance during instrument repair operations. The photographs in Appendix B give a visual depiction of various rooms within Building 252.

A building inventory was taken of the ceiling tile, floor covering, and wallboard. To properly inventory these construction materials, the rooms were measured with a calibrated tape. The results of these measurements and the approximate square footage of ceiling tile, floor covering, and wall board for the various rooms and hallways in Building 252 are listed in Table 4-4.

The total ceiling tile in Building 252 is approximately 34,230 square feet. This consists of three types of ceiling tile: sheet rock which is sealed and taped to the walls; wall board (sheet rock) cut into 2-foot by 2-foot (approximately) pieces and lying on a suspended ceiling; and styrofoam pieces, approximately 1.5 feet by 3 feet, lying on a suspended ceiling.

The total amount of floor covering is approximately 34,230 square feet. This consists of four types of floor covering: floor tiles, vinyl coating, carpet, and rubber sub-flooring material.

The total amount of wall board in Building 252 is estimated at 38,745 square feet.

In addition to the construction materials, the inventory included evaluation of the miscellaneous equipment and the HVAC equipment present in the building. The inventory of these items is listed in Table 4-5. The miscellaneous equipment includes an approximation of the quantity of the equipment in each room. The inventory of the HVAC was taken only where the system could be visually observed and does not include the basement; therefore, the 2,835 linear feet of HVAC duct work is a minimum amount. A larger actual amount of HVAC duct work is believed to be present within the building.

TABLE 4-4 BUILDING INVENTORY OF CEILING TILE, FLOOR COVERING, AND WALL BOARD

ROOM NUMBER	LENGTH (feet)	WIDTH (feet)	HEIGHT (feet)	APPROXIMATE SQUARE FEET CEILING TILE	APPROXIMATE SQUARE FEET FLOOR COVERING	APPROXIMATE SQUARE FEET WALL BOARD	COMMENTS
121	28	13	15	364	364	420	
MAIN HALLWAY	125	8	13	1000	1000	3144	
139	27	26	13	702	702	702	
RmOUTSIDE131	23	14	13	322	322	481	
131	9	16	13	144	144	650	
131A	15	6	13	90	90	273	
132	18	14	13	252	252	832	
140	22	33	13	726	726	1430	
135	14	13	10	182	182	670	RESTROOM CERAMIC FLOOR & WALL TILES
130	58	30	13	1740	1740	2288	
137	11	8	13	88	88	143	CONCRETE WALLS
FRONT 136	11	7	15	77	77	330	CONCRETE WALLS
BACK 136	17	9	15	153	153	525	CONCRETE WALLS
HW ADJ.137	17	5	15	85	85	255	
RM AJD. 138	40	15	15	600	600	1200	
HW ADJ.160	109	8	13	872	872	2822	
160	75	75	13	5625	5625	3900	
102	7	4	8	28	28	176	TIN CEILING
HW ADJ. 108	75	8	13	600	600	1950	
103	20	18	10	360	360	560	WALL BOARD CEILING; CARPET FLOOR
101A	76	45	10	3420	3420	2068	WALL BOARD CEILING; CARPET FLOOR
101	75	39	10	2925	2925	2280	WALL BOARD CEILING; CARPET FLOOR
101B	45	28	10	1260	1260	1460	WALL BOARD CEILING; CARPET NOT INSTALLED, ON PALLETS
101B OFFICE	14	9	8	126	126	460	
120	71	50	10	3550	3550	1920	
116	50	29	9	1450	1450	1206	WALL BOARD CEILING
118	34	28	10	952	952	1240	
FRONT 111	6	4	10	24	24	120	
BACK 111	14	7	10	98	98	360	
112	6	3	13	18	18	150	
114	29	10	10	290	290	290	WALL BOARD CEILING
117	13	12	10	156	156	720	CARPET
110	29	24	10	696	696	1060	
134	28	9	10	252	252	740	RESTROOM CERAMIC FLOOR & WALL TILES
109	21	15	10	315	315	720	
TOP OF STAIRS	18	14	10	252	252	500	
HW	24	9	10	216	216	240	
219	70	50	15				ALL CEILING TILE, WALL BOARD & FLOOR COVERING REMOVED
208	14	13	10	182	182	140	RESTROOM-CERAMIC FLOOR & WALL TILES
207	32	9	10	288	288	320	RESTROOM-CERAMIC FLOOR & WALL TILES
210 206 204	50	40	15				ALL CEILING TILE, WALL BOARD & FLOOR COVERING REMOVED
215	90	70	15				
BASEMENT	75	50	10	3750	3750		WALL BOARD CEILING
TOTAL Sq FEET OF THE THREE MEDIA				34230	34230	38745	APPROXIMATE SQUARE FEET CARPET = 16554 APPROXIMATE SQUARE FEET WALL BOARD CEILING = 20580

CALCULATIONS FOR THE WALL BOARD SHOWN WITH EVERY ROOM HAVING ITS OWN WALLBOARD

TABLE 4-5 BUILDING INVENTORY OF MISCELLANEOUS EQUIPMENT AND HVAC SYSTEM

ROOM NUMBER	MISCELLANEOUS EQUIPMENT	HVAC[1] (feet)
121	4 desks	
Main Hallway	2 soda mach	175
139	31 desks; counter/w sink	27
Rm Outside 131	4 desks; 2 shelves	
131	2 desks; 1 fl cab	
131A		
132		
140	150* elec equip	
135		
130	32 wk stat; 4 desk	118
137	1 oven	
Front 136	6 cleaners; 3 hoods	
Back 136		
HW Adj. 137		
Rm Adj. 138	conveyor; induc htr;	
	14 vac pumps; 4 tables	
HW Adj. 160	2 closets w/elec equip	
160	7 work stn,2 elec equip,12 desks	600
	41 file cab,paper,misc test equip	
	1 storage locker,4 carts,40 chairs	
	misc personal and office items	
102		
HW Adj. 108		75
103		
101A	5 tables, 4 chairs	80
101		
101B		
101B Office		
120	90*desks,125*chairs,47 file cab,1 refrig	
116	21 elec equip	
118	1 chair,1 counter	
Front 111		
Back 111		
112		
114		50
117	1 desk	
110		140
134		
109	5 desks,1chair	
Top of Stairs	6 desks	
HW		
219	2 file cab	810
208		
207		
210,206,204	2 dumpsters	740
215	10 chairs;2 desks;4 piles lights	620
Basement	HIVAC system,house vac system,	
	air handling system,bldg heater	
	misc physical plant equip	
		2835 minimum total

* Approximately

[1] The length of HVAC system is a visual estimate where the system was accessible for observation.

Section 5
CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations developed as a result of sampling and analysis efforts completed to date. Conclusions are numbered and the recommendations that follow are also numbered to correspond to the applicable conclusion.

Because additional testing must be completed before the extent of contamination is fully determined and specific cleanup procedures designed, these conclusions and recommendations are considered preliminary. As additional information is collected and regulatory standards determined, recommendations may be significantly modified.

CONCLUSIONS

The following conclusions regarding the extent of contamination in and around Building 252 and potential cleanup alternatives have been developed based on sampling and analysis activities completed through July 13, 1990:

1. Mercury within Building 252 was detected at almost every sampling location. Only four samples (all wipe samples) did not detect mercury. Three of these wipes were from walls and the remaining non-detected wipe was from a ceiling tile. All other samples, including all sweep and chip samples, contained mercury in varying concentrations. Areas sampled that had confirmed contamination included the floors, walls (all but three locations), ceilings (all but one location), HVAC system, and equipment in the basement.

2. Mercury within Building 252 exists in three phases. The investigation of the building was initiated after free mercury (liquid) was observed during demolition activities. Subsequent visual inspections of the building have confirmed the presence of free mercury in various locations.

   During the initial site inspection, a Jerome mercury vapor analyzer was used to detect mercury in vapor phase. Mercury vapor concentrations detected inside the building ranged up to 0.012 mg/m^3 and vapors were detected at most sampling locations throughout the building. This inspection was conducted without attempts to disturb materials within the building. During future remediation efforts, mercury vapor concentrations may be higher due to disturbance of contaminated materials and/or increased temperatures.

Sweep samples of dust within the building contained mercury at every location sampled, including the HVAC distribution system. Because of these sweep sampling results, and because results of wipe sampling showed mercury on almost all horizontal surfaces, including in the HVAC, it is probable that mercury has adhered or adsorbed to dust and this dust may be the primary mechanism by which contamination was distributed throughout the building.

3. Concentrations of mercury inside the building, as detected in sweep and chip samples, can be compared to the California Total Threshold Limit Concentration (TTLC) of 20 mg/kg. Wipe sample results, while an indicator of the presence of contamination, cannot be directly compared to the TTLC.

   All sweep samples collected within the building, with the exception of one sweep sample from the basement HVAC, had mercury concentrations in excess of the TTLC. Therefore, dust in the building should be considered a hazardous waste by this standard.

   Chip samples of the floor (2) and interior walls (6) were all below the TTLC concentration. However, one of the two floor chip samples and five of the six wall chip samples had concentrations greater than 10 percent of the TTLC and should, therefore, be evaluated for solubility of the mercury compared to California Soluble Threshold Limit Concentration (STLC) and the EPA Toxicity Characteristic Leaching Procedure (TCLP) criteria.

4. Mercury was also detected outside of Building 252. Two sweep samples taken near exit doors contained greater than 1 percent mercury and all but one of the other exterior sweep samples were above the TTLC concentration. Chip samples of concrete outside of the exit doors generally contained concentrations of mercury below the TTLC, but all concrete chip samples did contain detectable concentrations of mercury.

   Mercury may have exited Building 252 via several potential pathways. Contamination at the doorways may be a result of accumulation from workers shoes as they exited the building, may have been caused by water flowing out of the doors, or may have been caused by dust blown out of the building when doors were opened. Additionally, dust from vacuum system discharges, either at the cyclones on the west side of the building or roof vents, may have contributed to contamination outside the building.

5. Building 252 contains a large quantity of equipment and stored items such as desks. It is probable that all of these items have been contaminated with mercury and some of the equipment probably still contains free mercury. Sampling and analyses conducted to date have focused on the building materials and have not evaluated the non-building materials and equipment within the building. Because of the nature of the equipment and stored items, decontamination of these items may present the most significant problem in future cleanup efforts.

6. Before cleanup of Building 252 can begin, cleanup standards must be developed. This includes not only the standard for eventual decontamination of the building itself, but also the standards that will determine how materials removed from the structure will be managed and/or disposed.

   Standards for management of materials to be removed from Building 252, including equipment, stored materials, and building dismantling debris, need to be developed. It is assumed that any materials with mercury concentrations in excess of either the TTLC or STLC will either have to be decontaminated to below these levels, or will have to be disposed of as a hazardous waste, if disposed in California. If disposal of these materials will be out of California, the EPA TCLP (0.2 mg/l) standard will apply.

   Although these standards may be applied to determine whether materials are to be disposed of as a hazardous waste, a secondary criteria must be developed to determine if non-hazardous wastes can be disposed of in Class III landfills, or must be handled as a designated waste and sent to Class II facilities.

   Additionally, a cleanup standard(s) must be set for decontamination of materials that are targeted for either industrial reuse, such as equipment, or non-industrial reuse, such as furniture.

   Until these standards are set, evaluation of cleanup alternatives, in terms cost-effectiveness, cannot be fully addressed.

7. Limited guidelines exist for workplace exposure limits to mercury. OSHA has set a ceiling concentration (instantaneous maximum) at 0.1 mg/m^3. California OSHA has the same ceiling concentration but also regulates that the time weighted average (TWA) for an eight-hour workday is 0.05 mg/m^3. The National Institute for Occupational Health and Safety (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also have set the TWA exposure at 0.05 mg/m^3.

The NIOSH standard is based on a 10-hour workday while the ACGIH standard is based on an 8-hour workday. OSHA has adopted ACGIH standards and, therefore, the OSHA 8-hour TWA is also 0.05 mg/m^3.

8. To evaluate potential cleanup alternatives one decontamination test was conducted for each of three building media; interior wall, ceiling tile, and floor. Results of these tests were generally inconclusive. For the wall test, all untreated sections had comparable contaminant concentrations (7.3 to 12 mg/kg). The vacuuming and DI water wipe tests did not reduce the concentrations of mercury. Although the nitric acid and sulfide solution wipes did show some reduction in mercury levels, a substantial percentage of the mercury (74 percent and 39 percent) remained on the walls. This indicates that the mercury on the walls may be in an insoluble form.

   The ceiling tile test showed that all remediation methods were ineffective in removing the mercury, except vacuuming. Although vacuuming reduced the mercury concentration by 98 percent, the untreated area had an anomolously high mercury concentration compared to the other test areas. Because this area had a much higher concentration than the other test areas, it cannot be determined if the vacuuming actually reduced the mercury concentration of if the lower concentration of the vacuumed area was due to existing variations in mercury levels.

   The floor test results indicated that vacuuming and DI water wipe both removed approximately 70 percent of the mercury. Although it could be concluded that these methods did remove some of the mercury in the form of dust, it would be expected that the more aggressive solvents (nitric acid and sulfide solution) would be at least as effective in removing dust as the DI water wipe. Because this was not the case, the results are inconclusive.

9. Inspection and inventory of the building showed that a potential exists for encountering asbestos materials during future remediation efforts. Some asbestos removal actions have already been accomplished, but asbestos may remain in currently inaccessible locations.

   Other potential contaminants used in the building include PCB in a transformer in the basement, and TCE in cleaning equipment. There was, however, no visible indication that these potential contaminants have been released to the building.

RECOMMENDATIONS

The following recommendations are numbered to correspond to the conclusions discussed above.

1. Sampling has demonstrated that mercury contamination is present throughout Building 252. Further sampling to characterize the extent of contamination within the building is not necessary at this time. Because of the concentrations of mercury found throughout the building, all materials in the building, especially dust, should be considered and handled as a hazardous waste.

2. Because mercury is present in free phase and associated with dust, it is recommended that an initial response action be initiated as soon as possible. This action should include the following steps. Real-time analysis of mercury vapors should be conducted during all of these steps with specific actions regarding levels of personal safety protection determined by the concentrations of mercury vapors present:

   - Thoroughly inspect and remove all visible free-phase mercury from the building structure and existing equipment.

   - Discontinue the use of any air handling system, such as the HVAC. This is to minimize further distribution of mercury throughout the building. NOTE: this dead-calm condition may contribute to potential heat stress concerns during future decontamination activities.

   - Discontinue all operations in the building and restrict access, allowing only USAF environmental personnel and contractor access. This is to further assist in minimizing distribution of contaminants.

   - Select one large room and conduct a gross decontamination by thoroughly vacuuming the room, attic areas above the room, and all contents of the room using mercury specific vacuuming equipment. Once this gross decontamination is completed, seal the room from the rest of the building to prevent recontamination. NOTE: this gross decontamination is intended to reduce the levels of contamination in the room but will not create a "clean" room. Safety precautions and equipment should still be utilized in this area.

- Begin gross decontamination of all stored materials and equipment in the building by vacuuming with mercury specific vacuums. As these materials and equipment are cleaned of visible dust, inventory the items, document conditions of the items, and move the items to the grossly decontaminated room for holding.

- After all non-building items are grossly decontaminated and moved to the holding room(s), conduct a gross decontamination of the building by vacuuming all accessible areas with mercury specific vacuuming equipment. Carpeting should be rolled up and the floors under the carpets vacuumed. Ceiling tiles should be removed, vacuumed, and stacked in each room. The attic areas above each room should be vacuumed as well as all other areas that can be accessed with minimal or no structural demolition.

These initial response actions should reduce the total amount of mercury in the building. Therefore, because the source amount is reduced, the concentrations of mercury vapors should also be reduced as equilibrium concentrations shift.

3. All materials in the building should be handled, for the time being, as hazardous wastes. Some media, such as the walls, may have concentrations below the TTLC but may still be hazardous wastes by STLC or TCLP standards. Additional sampling and analyses should be conducted on such media to determine the potential solubility of the mercury that is present.

4. Areas outside of Building 252, near the exits, have received mercury contamination. Additional sampling needs to be conducted to determine the distribution of this contamination. This may have to be accomplished in sequential steps to determine the horizontal extent, vertical extent, and media impacted. Sampling should focus not only on the ground areas, but should also include the roof, drainage pathways, and dust collection areas on the exterior walls.

   An initial response action should be taken to grossly decontaminate areas of known contamination. This should be accomplished by vacuuming with mercury specific vacuum equipment. Commercially available mercury spill response kits could also be used to collect mercury in specific areas of high concentrations, such as joints in the concrete immediately outside exits.

   Greater building controls should be implemented so as to minimize additional tracking of the building contamination to the outside. Additionally,

the air handling systems should be shut off so that positive pressure does not exist to carry contaminated dust out through open doorways. Doorways that are not needed for building access should be sealed with plastic to further prevent contamination from exiting the building.

Pedestrian and vehicular traffic near the building should be further restricted to prevent exposure to, and distribution of the contaminants.

NOTE: The contaminated areas outside of the building should not be washed down unless all wash water is contained, tested and handled appropriately.

5. As stated in recommendation 2 above, removable equipment and stored materials in the building should be grossly decontaminated, inspected and inventoried, consolidated into a grossly decontaminated room, and held for further decontamination and/or disposition. As a result of the inspection and inventory, the USAF should develop a piece by piece assessment of the worth of these items. Using this information, a decontamination/disposition model can be developed that will serve as the basis for removal of items from the building. For example: items of significant worth will be assessed in terms of the cost of disposal and replacement versus the cost and potential to decontaminate the item to acceptable levels to allow for reuse. Items regarded as essentially worthless will be assessed in terms of the cost of disposal without further decontamination versus the cost and potential to decontaminate the item to lower contaminant concentrations, followed by less expensive disposal options.

6. The USAF should begin working with applicable regulatory agencies to determine the cleanup levels for materials to be removed from the building. This includes equipment and items within the building and the interior components of the building to be dismantled. Specifically, the standards that need to be established include:

   - Total or soluble mercury levels that will be permitted in order to dispose items in a Class III waste management facility.
   - Decontamination levels that will, if achieved, permit industrial equipment to be salvaged for reuse on the base.
   - Decontamination levels that will, if achieved, permit non-industrial items to be salvaged and reused on, or off the base.

These standards can only be set by the regulatory agencies and must be determined in order to evaluated the cost-effectiveness for decontamination versus Class I disposal. If reasonable and appropriate standards can be agreed to and achieved, hazardous waste disposal will be minimized by recovery and reuse of items and equipment, or disposal of non-reuseable materials in appropriate waste management facilities other than Class I landfills.

7. The USAF should begin working with applicable regulatory agencies to determine the minimum cleanup level (MCL) for the building in order to allow reoccupancy. This standard will be based on a safety factor below the TWA worker exposure level. This standard can only be set by the regulatory agencies and must be determined before remediation alternatives can be selected and a cost-effectiveness evaluation can be completed.

8. Additional remediation testing should be conducted in order to assess potential alternatives. Decontamination of the shell of the building cannot be properly tested until equipment and materials are removed from the building, and the interior structures of the building are dismantled and removed. Decontamination testing should focus, for the time being, on methods to decontaminate materials to be removed from the building.

   As part of the recommended initial response action, pre-vacuuming and post-vacuuming wipes samples should be taken on materials and equipment to be removed from the building for potential reuse. This will allow assessment of the effectiveness of the vacuuming and will define the condition of the items placed in holding awaiting final decontamination steps.

   For materials to be removed from the building for disposal (dismantled building materials) pre-vacuuming and post-vacuuming chip samples should be collected for analysis. This will allow assessment of vacuuming effectiveness and help determine potential handling and disposal scenarios.

   Additional decontamination testing should be conducted on the building elements and the items stored in the building. This to assess potential final decontamination alternatives and costs. The following procedures should be tested immediately after the initial response action is completed:

- Cleaning surfaces using brass wool and a reducing acid (sulfamic acid). Pre-cleaning and post-cleaning samples should be collected to assess effectiveness.

- One or more commercially available mercury decontamination systems should be tested, especially on items targeted for potential reuse. These systems involve the use of sulfamic acid, zinc paste, and activated charcoal. Pre-cleaning and post-cleaning samples should be collected to assess effectiveness.

- Exposed areas of cement should be etched with an acid (muriatic acid) and washed with cleaning solutions. Pre-cleaning and post-cleaning chip samples should be collected to assess effectiveness.

Additional decontamination testing methods may have to be tested on the building shell structure after interior items have been removed.

9. All contractors working within Building 252 should be made aware that asbestos is probably present and may be encountered during building dismantling activities. Potential locations should be noted and, if encountered, must be mitigated and handled in accordance with applicable regulations.

PCBs potentially contained in the transformer in the basement should be removed through replacement of the transformer oil. This action could occur after the initial response action has been completed. Safety precautions and equipment should still be used, as appropriate, during any oil removal actions.

Although no visual evidence was observed that indicated release of TCE from cleaning areas, additional information should be collected regarding the history of use, handling, and disposal of solvents during past operations.

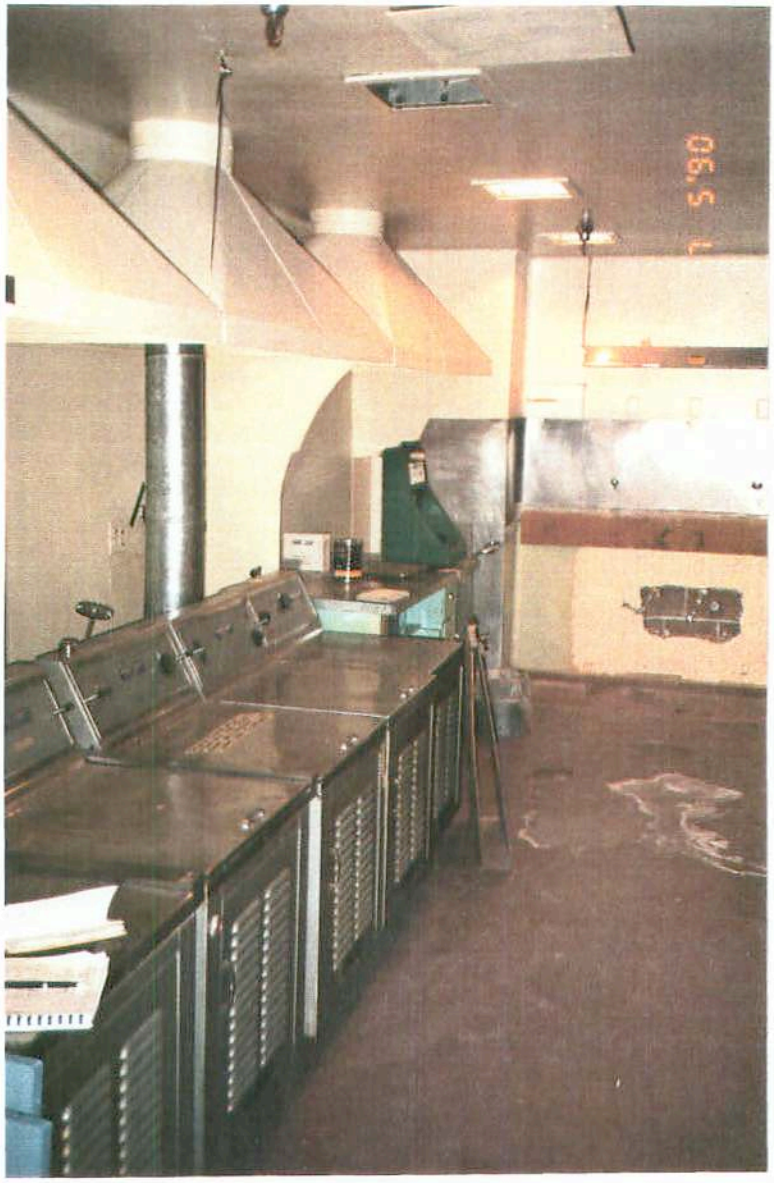
Section 6
REFERENCES

1. The Golden State Salutes McClellan Air Force Base, Marcoa Publishing Incorporated, San Diego, California, 1987.

2. U.S. EPA Environmental Response Team, Standard Operating Procedure 2011, G.S.A. Depot, Edison, NJ, December 1988.

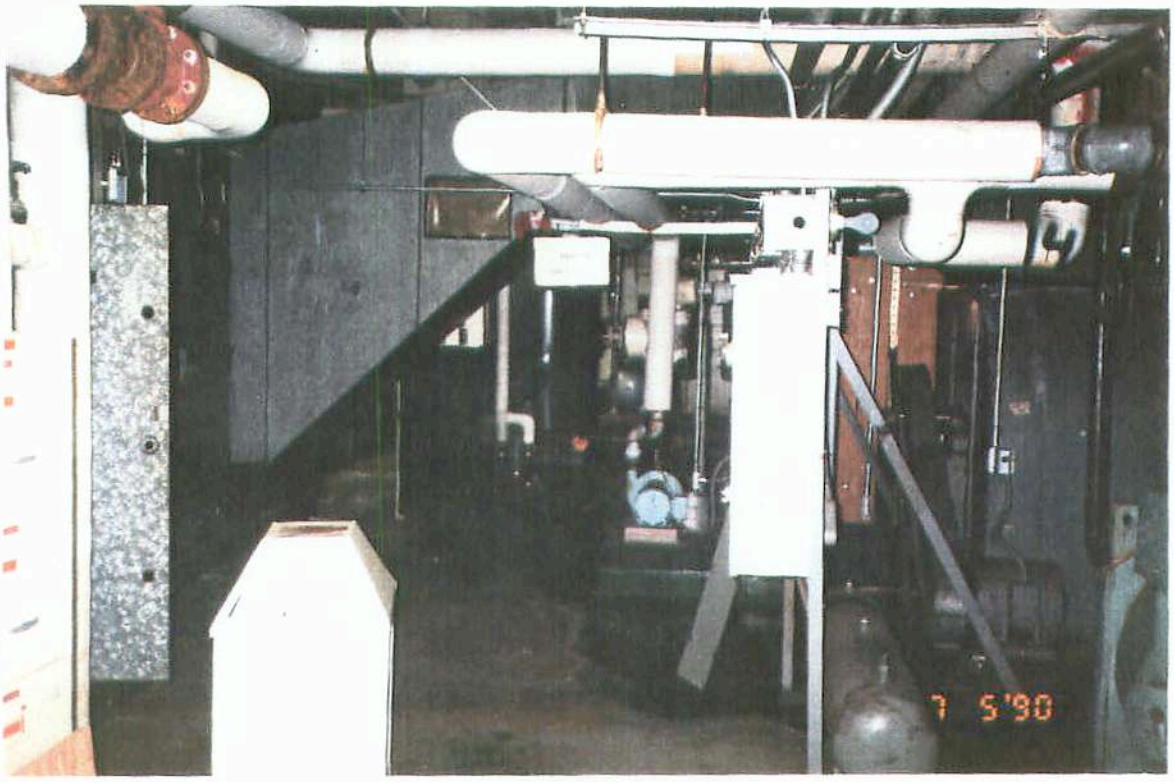
3. Methods for Evaluating Solid Waste, Third Edition, SW846. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, D.C. 1986.

Appendix A
BUILDING 252 PHOTOGRAPHS

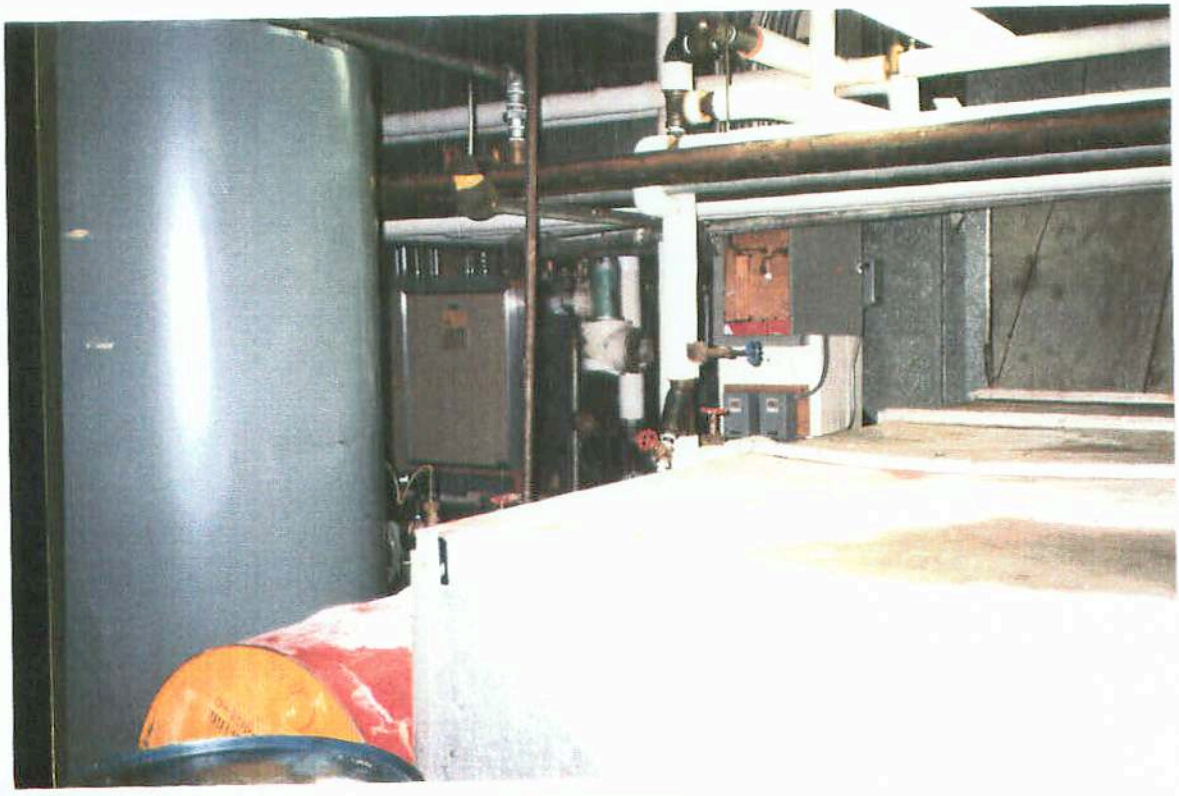


ROOM 136

ROOM 137



BASEMENT

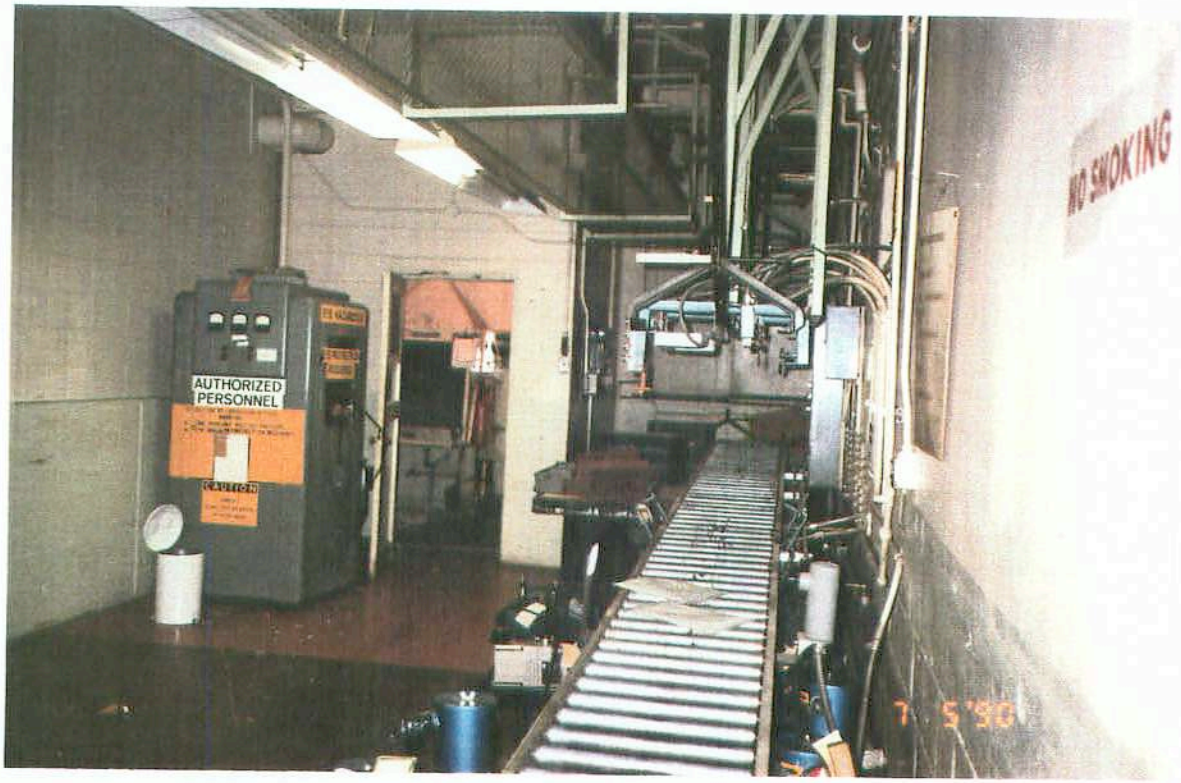


BASEMENT

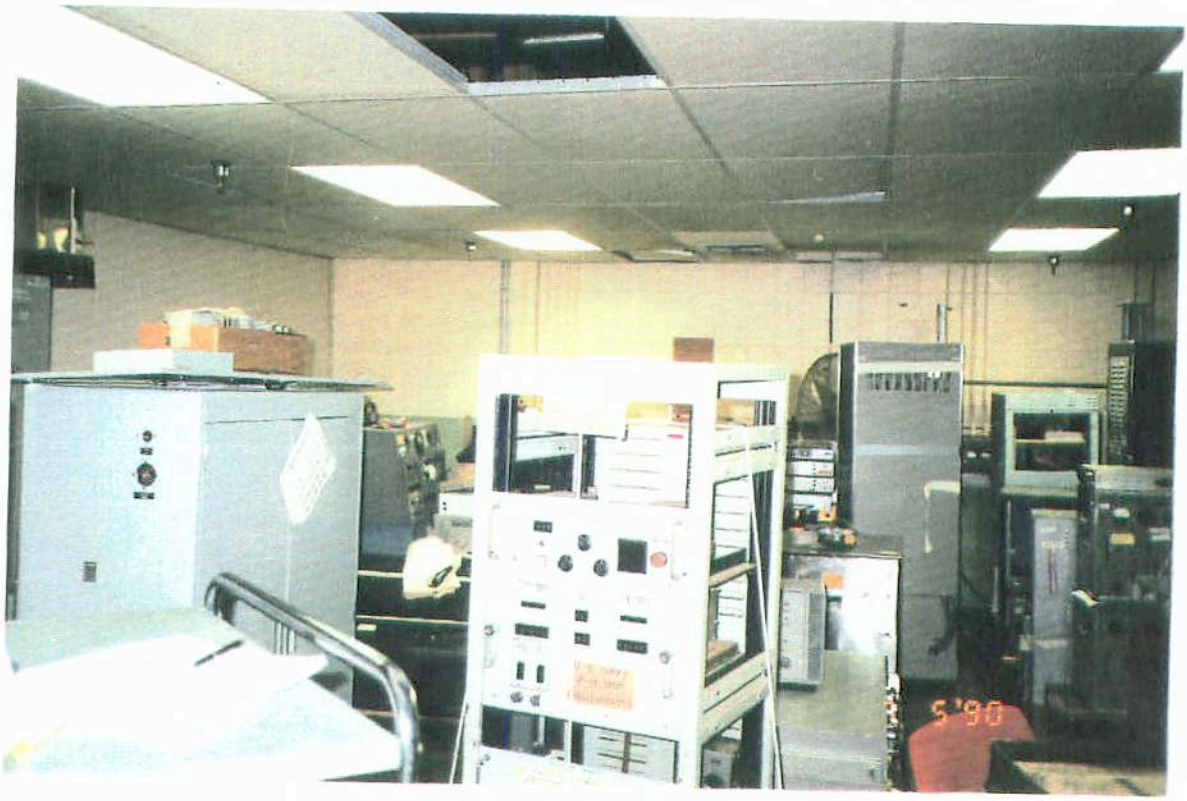
ROOM 160

ROOM 160

ROOM 130



OUTSIDE ROOM 140 & 138



ROOM 140

ROOM 116

ROOM 116

ROOM 114

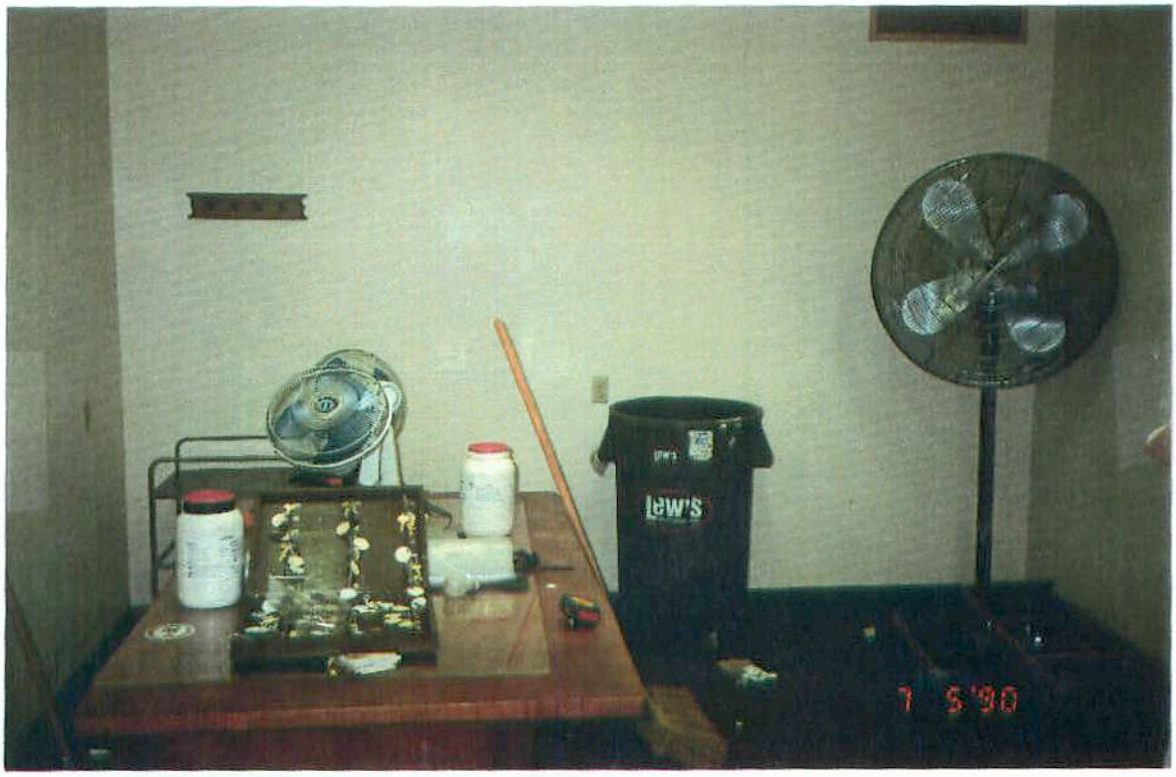
ROOM 140

ROOM 110

ROOM 101

ROOM 101B

ROOM 120

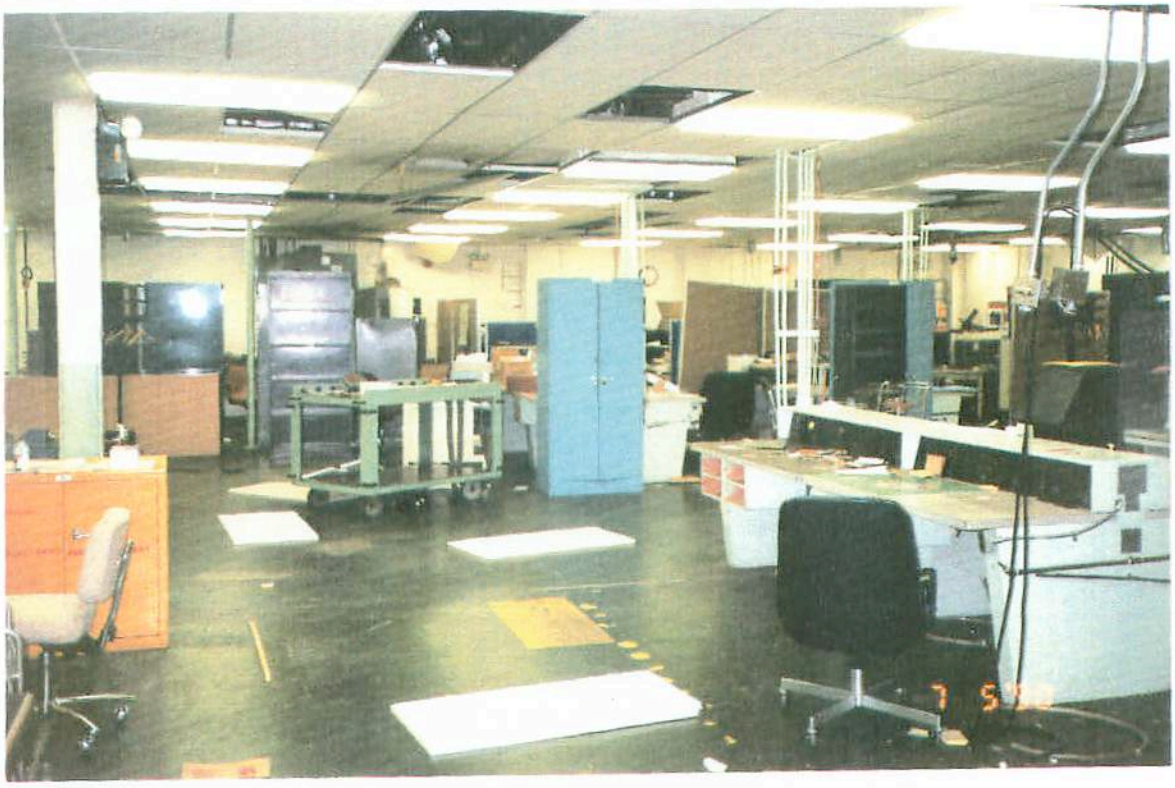


ROOM 117

ROOM 101A

ROOM 109

ROOM 160



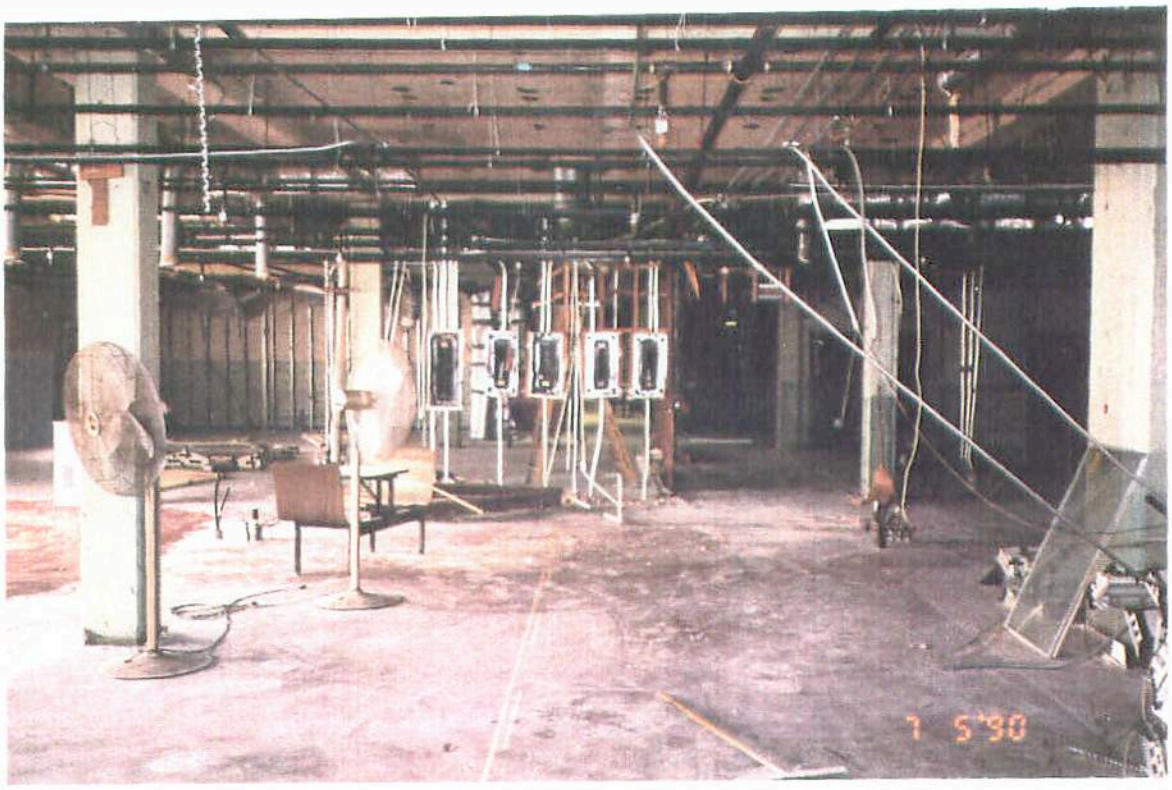
ROOM 160

SECOND FLOOR

SECOND FLOOR

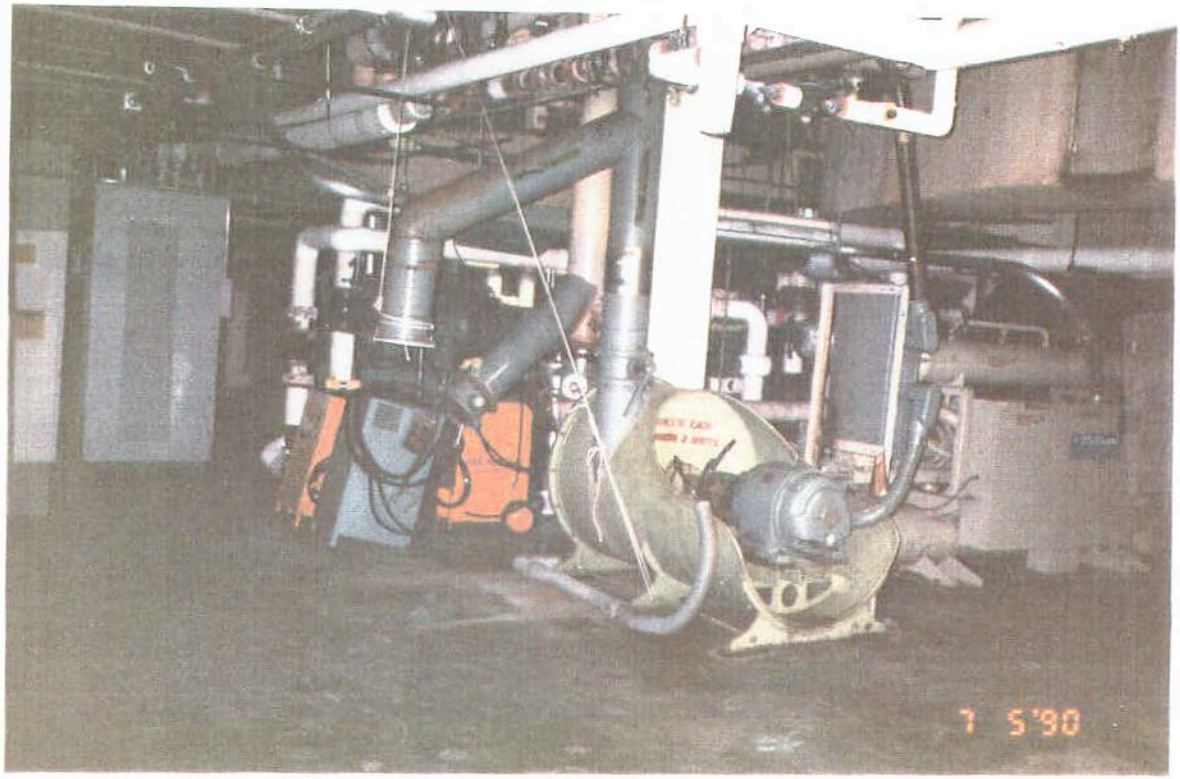
SECOND FLOOR

SECOND FLOOR

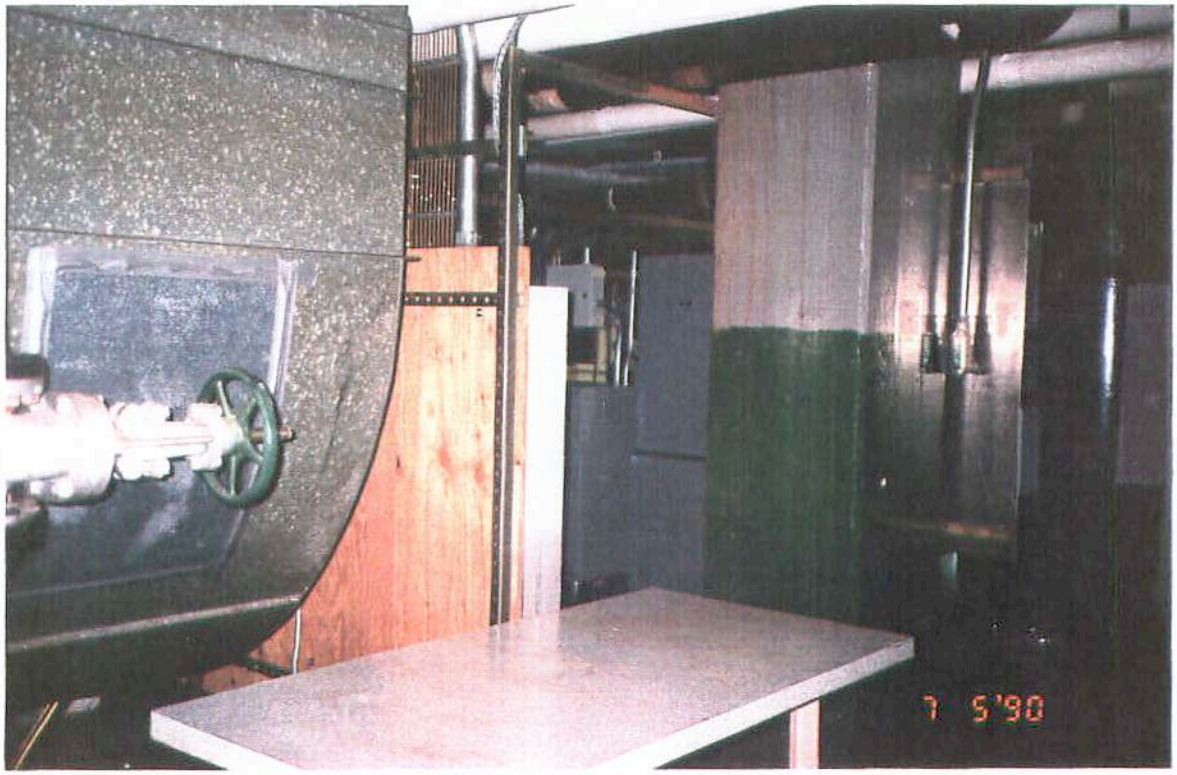


SECOND FLOOR

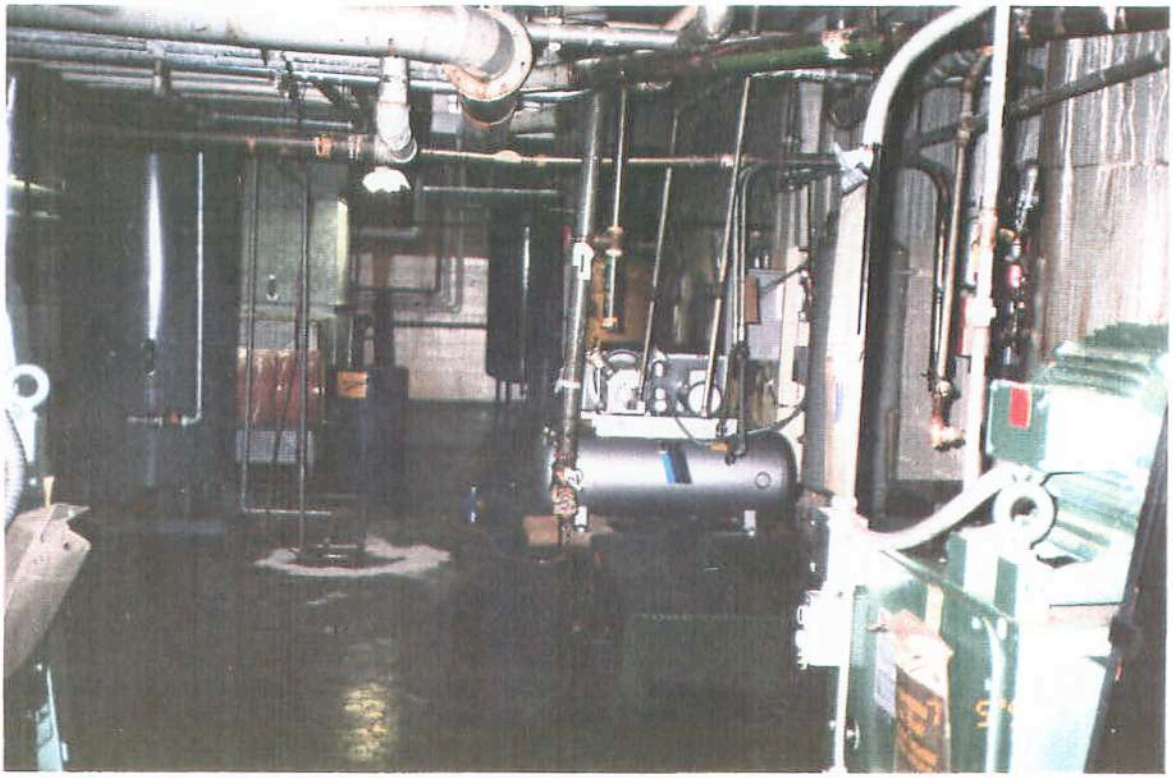
SECOND FLOOR



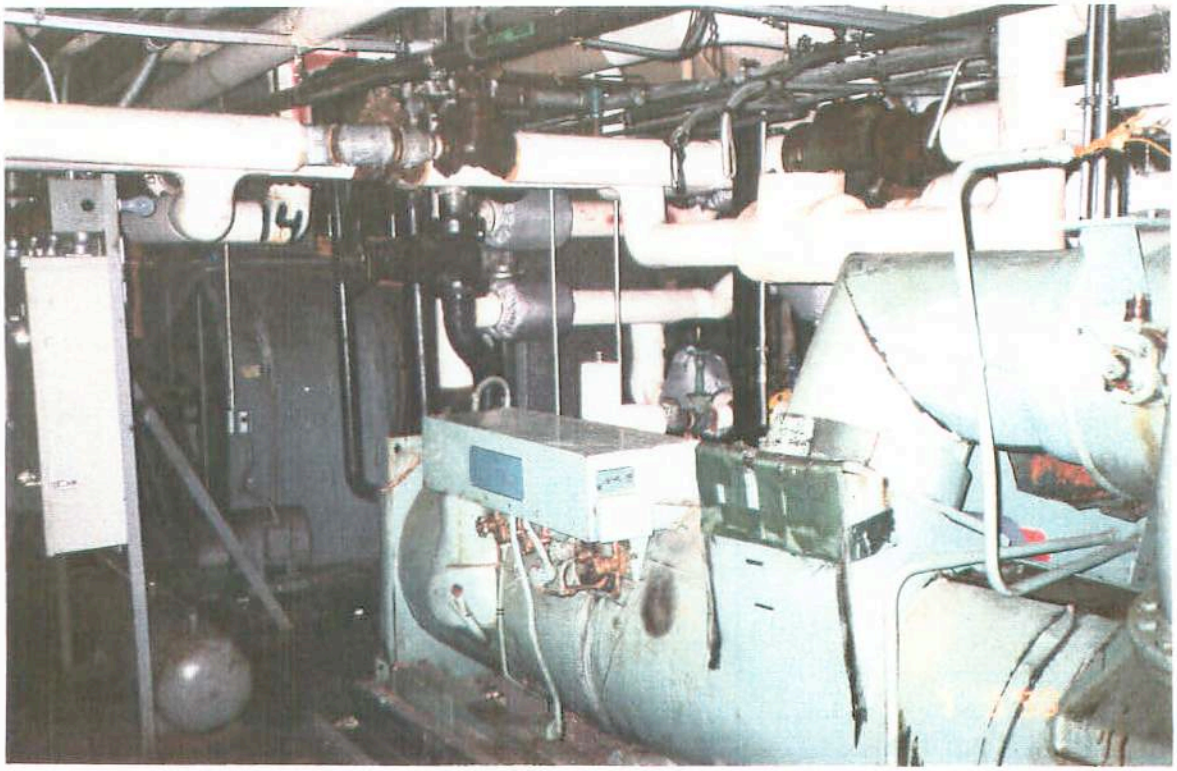
BASEMENT



BASEMENT



BASEMENT



BASEMENT

Appendix B
ANALYSIS RESULTS

APPENDIX B
SUMMARY OF ANALYSIS RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	CONC.	mg/kg	ug/wipe area
5 - 1	Floor, Hallway between Rooms 131 and 132	560	X	
5 - 2	Ceiling tile, Hallway between Rooms 108 and 109	27	X	
5 - 3	Ceiling tile, Room 101b	62	X	
5 - 4	Floor, Room 120	99	X	
5 - 5	Concrete, North of hopper	41000	X	
5 - 6	Concrete, South of hopper	11	X	
5 - 7	Floor, Inside south door between Rooms 130 and 135	150	X	
5 - 8	Floor, Inside south door between Rooms 138 and 160	1100	X	
5 - 9	Floor, Inside north door	360	X	
5 - 10	Floor, Second story hallway, just outside of ladies room	130	X	
5 - 10	Floor, Second story hallway, just outside of ladies room-Field duplicate	88	X	
5 - 10	Floor, Second story hallway, just outside of ladies room-Field duplicate	160	X	
5 - 10	Floor, Second story hallway, just outside of ladies room-Lab duplicate	180	X	
5 - 11	Floor, Inside north door	930	X	
5 - 12	Concrete, Outside south door between Rooms 130 and 135	130	X	
5 - 13	Soil, Outside south door between Rooms 130 and 135	32	X	
5 - 14	Concrete, Outside north door	78	X	
5 - 15	Soil, Outside north door	85	X	
5 - 16	Concrete, Outside south door between Rooms 138 and 160	17000	X	
5 - 17	HVAC, Basement	4.4	X	
5 - 18	Top of equipment, Basement	28	X	
5 - 19	HVAC, Room 215	420	X	
5 - 20	Soil, Outside south door between Rooms 138 and 160	57	X	

APPENDIX B
SUMMARY OF ANALYSIS RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	CONC.	mg/kg	ug/wipe area
5 - 101	Floor, Room 121	17		X
5 - 102	Wall, Room 121	0.16		X
5 - 103	North wall, Room 114	0.06		X
5 - 104	North wall, Room 120	0.07		X
5 - 105	West wall, Room 130	ND		X
5 - 106	Ceiling tile, Room 139	ND		X
5 - 107	Wall, Inside south door between Rooms 130 and 135	0.92		X
5 - 108	Wall, Inside south door between Rooms 138 and 160	ND		X
5 - 109	South wall, Room 160	ND		X
5 - 110	East wall exhaust vent, Room 160	3.7		X
5 - 111	Batch Blank	ND		X
5 - 112	East wall, Room 215	ND		X
5 - 113	South wall HVAC, Room 215	35		X
5 - 114	West wall, Rom 219	1.2		X
5 - 115	East wall HVAC, Room 219	4.4		X
5 - 116	Counter top, Second floor ladies room	0.06		X
5 - 117	Wall, Basement	0.06		X
5 - 118	Wall, Inside north door	0.22		X
5 - 119	Wall, North side of Room 101 near entrance to Room 124	1.8		X
5 -120	Wall, North side of Room 103	0.78		X
5 - 121	Inside hopper	31		X
5 - 122	Wall, East side of Room 101a	10		X
5 - 123	Batch Blank	ND		X

APPENDIX B
SUMMARY OF ANALYSIS RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	CONC.	mg/kg	ug/wipe area
5 - 124	Batch Blank	ND		X
5 - 125	West roof vent	0.27		X
5 - 126	East roof vent	19		X
5 - 201	Concrete, Near hopper	0.3	X	
5 - 202	Concrete, Outside south door between Rooms 130 and 135	1.3	X	
5 - 203	Wall, North side of Room 120	0.72	X	
5 - 203	Wall, North side of Room 120-Lab duplicate	0.72	X	
5 - 204	Wall, North side of Room 120-Field duplicate	0.72	X	
5 - 205	Wall, North side of Room 120-Field duplicate	0.43	X	
5 - 206	Wall, North side of Room 120-Field duplicate	1.1	X	
5 - 207	Wall, South side of Room 160	7.3	X	
5 - 208	Floor, Room 215	2.4	X	
5 - 209	Floor, Basement	0.67	X	
5 - 210	Floor, Room 215	2.4	X	
5 - 211	Concrete, Outside north door	4.7	X	
5 - 212	Concrete, Outside south door between Rooms 138 and 160	35	X	
5 - 301	Wall-After vacuuming	9.5	X	
5 - 302	Ceiling-After vacuuming	1.4	X	
5 - 303	Floor-After vacuuming	1.6	X	
5 - 304	Wall-Untreated	8.5	X	
5 - 305	Ceiling-Untreated	62	X	
5 - 306	Floor-Untreated	4.9	X	
5 - 307	Wall-After deionized water wipe	7.6	X	

APPENDIX B
SUMMARY OF ANALYSIS RESULTS

SAMPLE NUMBER	SAMPLE LOCATION	CONC.	mg/kg	ug/wipe area
5 - 308	Wall-Untreated	7.5	X	
5 - 309	Floor-After deionized water wipe	0.92	X	
5 - 310	Floor-Untreated	3.1	X	
5 - 311	Ceiling-After deionized water wipe	5.4	X	
5 - 312	Ceiling-Untreated	1.3	X	
5 - 313	Wall-After nitric acid wipe	5.4	X	
5 - 314	Wall-Untreated	7.3	X	
5 - 315	Floor-After nitric acid wipe	2	X	
5 - 316	Floor-Untreated	2.7	X	
5 - 317	Ceiling-After nitric acid wipe	0.98	X	
5 - 318	Ceiling-Untreated	2.1	X	
5 - 319	Wall-After sulfide wipe	4.7	X	
5 - 320	Wall-Untreated	12	X	
5 - 321	Floor-After sulfide wipe	2.6	X	
5 - 322	Floor-Untreated	2.7	X	
5 - 323	Ceiling-After sulfide wipe	1.1	X	
5 - 324	Ceiling-Untreated	1.4	X	

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/04/90

Case : 6228
Matrix: Solid

Client ID	CHEMWEST ID	Amount Detected (mg/Kg)
05-1	6228-12	560
05-4	6228-13	99
05-5	6228-14	41000
05-6	6228-15	11

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
Method Blank	6228-MB			BRL
MBS	6228-MBS	1	111%	
MBSD	6228-MBSD	1	109%	

Relative % Difference = 2%

The reporting limit for Mercury is 0.1 mg/Kg.

BRL: Below Reporting Limit.

Approved by: LAA

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/05/90

Case : 6228
Matrix: Wipes

Client ID	CHEMWEST ID	Amount Detected (ug/Wipe)
05-101	6228-1	17
05-102	6228-2	0.16
05-103	6228-3	0.06
05-104	6228-4	0.07
05-105	6228-5	BRL
05-106	6228-6	BRL
05-107	6228-7	0.92
05-108	6228-8	BRL
05-109	6228-9	BRL
05-110	6228-10	3.7
05-111	6228-11	BRL

Client ID	CHEMWEST ID	Spike Conc. (ug/Wipe)	% Rec.	Amount Detected (ug/Wipe)
Method Blank	6228-MB			BRL
MBS	6228-MBS	0.20	107%	
MBSD	6228-MBSD	0.20	110%	

Relative % Difference = 3%

The reporting limit for Mercury is 0.04 ug/Wipe.

BRL: Below Reporting Limit.

Approved by: _____

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/7/90
thru: 07/11/90

Case : 6235-QC
Matrix: Solid

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
Method Blank	6235-MB			BRL
MBS	6235-MBS	1	103%	
MBSD	6235-MBSD	1	86%	

Relative % Difference= 18%

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
05-10MS	6235-25MS	50	93%*	180
05-10MSD	6235-26MSD	50	59%*	160

Relative % Difference= 45%

*: Matrix interference and/or sample non-homogeneity.

Approved by: V. H.

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/07/90
thru: 07/11/90

Case : 6235
Matrix: Solid

Client ID	CHEMWEST ID	Amount Detected (mg/Kg)
05-9	6235-13	360
05-2	6235-14	27
05-14	6235-15	78
05-201	6235-16	0.3
05-202	6235-17	1.3
05-11	6235-18	930
05-17	6235-19	4.4
05-19	6235-20	420
05-15	6235-21	85
05-12	6235-22	130
05-8	6235-23	1100
05-10	6235-24	130
05-10MS	6235-25 unspiked	88
05-10MSD	6235-26 unspiked	160
05-20	6235-27	57
05-13	6235-28	32
05-3	6235-29	62
05-7	6235-30	150
05-18	6235-31	28
05-16	6235-32	17000
05-10DUP	6235-24DUP	180

The reporting limit for Mercury is 0.1 mg/Kg.

BRL: Below Reporting Limit.

Approved by: 9/11.

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/05/90

Case : 6235
Matrix: wipes

Client ID	CHEMWEST ID	Amount Detected (ug/Wipe)
05-121	6235-1	31
05-113	6235-2	35
05-117	6235-3	0.06
05-123	6235-4	BRL
05-114	6235-5	1.2
05-115	6235-6	4.4
05-118	6235-7	0.22
05-120	6235-8	0.78
05-119	6235-9	1.8
05-122	6235-10	10
05-116	6235-11	0.06
05-112	6235-12	BRL

Client ID	CHEMWEST ID	Spike Conc. (ug/Wipe)	% Rec.	Amount Detected (ug/Wipe)
Method Blank	6235-MB			BRL
MBS	6235-MBS	0.20	95%	
MBSD	6235-MBSD	0.20	98%	

Relative % Difference = 3%

The reporting limit for Mercury is 0.04 ug/Wipe.

BRL: Below Reporting Limit.

Approved by: 9/14.

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/10/90

Case : 6243
Matrix: Chip

Client ID	CHEMWEST ID		Amount Detected (mg/Kg)
05-203	6243-1		0.72
05-204MS	6243-2MS	unspiked	0.72
05-205MSD	6243-3MSD	unspiked	0.43
05-206	6243-4		1.1
05-207	6243-5		7.3
05-208	6243-6		2.4
05-209	6243-7		0.67
05-210	6243-8		2.4
05-211	6243-9		4.7
05-212	6243-10		35
05-203DUP	6243-1DUP		0.72

The reporting limit for Mercury is 0.1 mg/Kg.

BRL: Below Reporting Limits

Approved by: V.H.

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/10/90

Case : 6243
Matrix: Peel

Client ID	CHEMWEST ID	Amount Detected (mg/Kg)
05-301	6243-11	9.5
05-302	6243-12	1.4
05-303	6243-13	1.6
05-304	6243-14	8.5
05-305	6243-15	62
05-306	6243-16	4.9

The reporting limit for Mercury is 0.1 mg/Kg.

BRL: Below Reporting Limits

Approved by: V. H.

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/10/90

Case : 6243
Matrix: Chip

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
Method Blank	6243-MB			BRL
MBS	6243-MBS	1	84%	
MBSD	6243-MBSD	1	84%	

Relative % Difference = 0%

BRL: Below Reporting Limit.

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
05-204MS	6243-2MS	1	80%	1.5
05-205MSD	6243-3MSD	1	97%	1.4

Relative % Difference = 19%

Approved by: V. N.

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/10/90

Case : 6247
Matrix: Peel

Client ID	CHEMWEST ID	Amount Detected (mg/Kg)
05-307	6247-1	7.6
05-308	6247-2	7.5
05-309	6247-3	0.92
05-310	6247-4	3.1
05-311	6247-5	5.4
05-312	6247-6	1.3
05-313	6247-7	5.4
05-314	6247-8	7.3
05-315	6247-9	2.0
05-316	6247-10	2.7
05-317	6247-11	0.98
05-318	6247-12	2.1
05-319	6247-13	4.7
05-320	6247-14	12
05-321	6247-15	2.6
05-322	6247-16	2.7
05-323	6247-17	1.1
05-324	6247-18	1.4

Client ID	CHEMWEST ID	Spike Conc. (mg/Kg)	% Rec.	Amount Detected (mg/Kg)
Method Blank	6247-MB			BRL
MBS	6247-MBS	1	84%	
MBSD	6247-MBSD	1	84%	

Relative % Difference = 0%

The reporting limit for Mercury is 0.1 mg/Kg.

BRL: Below Reporting Limit.

Approved by: V.N.

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES
MERCURY

Date(s) Analyzed: 07/11/90

Case : 6247
Matrix: Wipe

Client ID	CHEMWEST ID	Amount Detected (ug/Wipe)
05-124	6247-19	BRL
05-125	6247-20	0.27
05-126	6247-21	19

Client ID	CHEMWEST ID	Spike Conc. (ug/Wipe)	% Rec.	Amount Detected (ug/Wipe)
Method Blank	6247-MB			BRL
MBS	6247-MBS	0.2	106%	
MBSD	6247-MBSD	0.2	103%	

Relative % Difference = 3%

The reporting limit for Mercury is 0.04 ug/Wipe.

BRL: Below Reporting Limit.

Approved by: V.N.

REV3:1.89

CHEMWEST ANALYTICAL LABORATORIES, INC.
600W North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 06235
Date JUL 90 18
Compl. Date
Section

CLIENT: CH2M Hill
3840 Rosin Court Suite 110
Sacramento, CA
95834

Project Name: McClellan AFB
Project No.
P.O. NO.
Contact Robert Evangelista
Phone (916) 920-0300

ANALYSIS: Thirty-two samples (12 wipes & 20 soil) rec'd under chain of custody in 8 oz. clear glass jars (32) to be analyzed for Total Mercury.

Sample Id	Date	Analysis	Matrix	Container
6235-1 05-121	7-3-90	Total Hg	wipes	1-8oz. jar
-2 05-113				
-3 05-117				
-4 05-123				
-5 05-114				
-6 05-115				
-7 05-118				
-8 05-120				
-9 05-119				
-10 05-122				
-11 05-116				
-12 05-112			↓	
-13 05-9			solid	
-14 05-2				
-15 05-14				
-16 05-201				
-17 05-202				
-18 05-11				
-19 05-17				
-20 05-19				
-21 05-15				
-22 05-12				
-23 05-8				
-24 05-10				
-25 05-10-MS				
-26 05-10-MSD				
-27 05-20				

RI 05 11 05 [illegible]

SG SUSAN GILBERT

OTC

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

CHEMWEST ANALYTICAL LABORATORIES INC.
600W North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 06228
Date 25 JUL 9018 : 58
Compl. Date
Section

CLIENT: CH2M Hill
3840 Rosin Court Suite 110
Sacramento, CA 95834

Project Name: Task Order 5006
Project No.
P.O. NO.
Contact R. Evangelista
Phone (916) 920-0300

ANALYSIS: Fifteen samples (11 wipes & 4 soils) rec'd under Chain of Custody in Chemwest 8oz. clear glass jars (15) to be analyzed for Total Mercury.

	Sample Id	LOC:	Date	Analysis	Matrix	Container
6228-1	05-101	Room 121 Floor	7-2-90	Total Hg	Wipes	1-8oz. Jar
-2	05-102	Room 121 Wall				
-3	05-103	Room 114 North Wall				
-4	05-104	Room 120 North Wall				
-5	05-105	Room 130 West Wall				
-6	05-106	—				
-7	05-107	—				
-8	05-108	—				
-9	05-109	—				
-10	05-110	—				
-11	05-111	—				
-12	05-1	—			Soil	
-13	05-4	Room 120				
-14	05-5	Outside Westside door				
-15	05-6	Westside of Building				

Copy of Report to W. Pearce at CH2M Hill

RI
KC KERRI CHAPIN

DTC

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

CHEM WEST ANALYTICAL LABORATORIES,INC.
600 West North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

Order No. 6235
Date Rec'd. 7-3-90 8:31
Compl. Date
Section

CLIENT: CH2M Hill
3840 Rosin Court, Suite 110
Sacramento, CA
95834

Project Name: McClellan AFB
Project No.
P.O. NO.
Contact Robert Evangelista
Phone (916) 920-0300

ANALYSIS:

Sample Id	Date	Analysis	Matrix	Container
6235-28 05-13	7-3-90	Total Hg	solid	1-8 oz jar
-29 05-3	↓	↓	↓	↓
-30 05-7				
-31 05-18				
-32 05-16				

Please send copy of report to W Pearce at CH2M Hill

RI
SG SUSAN GILBERT

OTC

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

CHEMWEST ANALYTICAL LABORATORIES, INC.
600W North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 06243
Date Rec'd. 7-5-90 @ 19:20
Compl. Date
Section

CLIENT: CH2M Hill
3840 Rosin Court Suite 110
Sacramento, CA
95834

Project Name: Task Order 5006
Project No.
P.O. NO.
Contact Robert Evangelista
Phone (916) 920-0300

ANALYSIS: Sixteen samples (10 chip & 6 peel) rec'd under chain of custody in 8 oz. clear glass jars (16) to be analyzed for Total Mercury.

Sample Id	Date	Analysis	Matrix	Container
6243-1 05-203	7-5-90	Total Hg	chip	1-8 oz. jar
-2 05-204-MS				
-3 05-205-MSD				
-4 05-206				
-5 05-207				
-6 05-208				
-7 05-209				
-8 05-210				
-9 05-211				
-10 05-212			peel	
-11 05-301				
-12 05-302				
-13 05-303				
-14 05-304				
-15 05-305				
-16 05-306				

RI
SG SUSAN GILBERT

OTC

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

CHEMWEST ANALYTICAL LABORATORIES, INC.
600W North Market Blvd.
Sacramento, California 95834
(916) 923-0840 FAX (916) 923-1938

CLIENT

Order No. 06247
Date 7/6/90
Compl. Date
Section

CLIENT: CH2M Hill
3840 Rosin Court Suite 110
Sacramento, CA
95834

Project Name: Task Order 5006
Project No.
P.O. NO.
Contact Robert Evangelista
Phone (916) 920-0380

ANALYSIS: Twenty-one samples (18 peel, 3 wipes) rec'd under chain of custody in 8 oz clear glass jars (21) to be analyzed for Total Mercury.

	Sample Id	Date	Analysis	Matrix	Container
06247-1	05-307	7-6-90	Total Hg	Peel	1-8oz jar
-2	05-308				
-3	05-309				
-4	05-310				
-5	05-311				
-6	05-312				
-7	05-313				
-8	05-314				
-9	05-315				
-10	05-316				
-11	05-317				
-12	05-318				
-13	05-319				
-14	05-320				
-15	05-321				
-16	05-322				
-17	05-323				
-18	05-324			wipe	
-19	05-124				
-21	05-125				
-21	05-126				

RI
S.G. SUSAN GILBERT

OTC

SAMPLE WILL BE HELD 30 DAYS UNLESS LONGER TIME IS ARRANGED

CH2M Hill **QUALITY ANALYTICS**

CW # 6228

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME: Task Order 5006
CLIENT NAME: CH2M HILL	
PROJECT MANAGER: R. Evangelista Evangelista	COPY TO: W. Pearce
REQUESTED COMP. DATE	SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ___
CLIENT ADDRESS AND PHONE NUMBER: 3840 Rosin Ct Suite 110, Sacramento, CA 95834 / 920 0300	

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED: Total Hg per wipe; Total Hg per unit weight per sample	REMARKS
2	7/4/90			WIPE		05-101	1		
						05-102	1		
						05-103	1		
						05-104	1		
						05-105	1		
						05-106	1		
						05-107	1		
						05-108	1		
						05-109	1		
						05-110	1		
						05-111	1		
				Sweep		05-1	1		
						05-4	1		
						05-5	1		
						05-6	1		

SAMPLED BY AND TITLE: R. Evangelista	DATE/TIME: 7/4/90	RELINQUISHED BY	DATE/TIME
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME
RECEIVED BY LAB: Susan Gilbert	DATE/TIME: 7-2-90 15:30	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ___	AIR BILL#

HAZWRAP/NEESA Y N
QC LEVEL 1 2 3
COC | ICE
ANA REQ | TEMP
CUST SEAL | Ph
SAMPLE COND.

REMARKS SUSAN GILBERT

ENTERED INTO LIMS ___ COC REVIEWED ___

REV 6/89 FORM 340

1-3

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

CW # 6235

PROJECT NUMBER	PROJECT NAME: McClellan AFB
CLIENT NAME: Ch2m Hill	
PROJECT MANAGER: Robert E.	COPY TO: W. Pearse
REQUESTED COMP. DATE	SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ___

CLIENT ADDRESS AND PHONE NUMBER: 3840 Resin Ct. Suite 110 Sac, CA 95834 920-0300

[redacted]

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	Total Hg per wipe	Total Hg per unit area of sample	REMARKS
	7/3		wipe			05-121	1	X		
	↓					05-113	↓	X		
						05-117		X		
						05-123		X		
						05-114		X		
						05-115		X		
						05-118		X		
						05-120		X		
						05-119		X		
						05-122		X		
						05-116		X		
						05-112		X		
			Sweep		X	05-~~09~~-9			X	
					X	05-~~02~~-2			X	
					X	05-14			X	

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE: [signature] / Tech	DATE/TIME: 7/3/90	RELINQUISHED BY: [signature]	DATE/TIME: 7/3/90 1831	HAZWRAP/NEESA Y N; QC LEVEL 1 2 3
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	COC / ICE; ANA REQ / TEMP
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	CUST SEAL / pH; SAMPLE COND.
RECEIVED BY LAB: Susan Gilbert [signature]	DATE/TIME: 7-3-90 1831	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ___	AIR BILL #	
REMARKS: CHEMWEST LAB				ENTERED INTO LIMS ___ COC ___

REV 4/89 FORM 340

2-3

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

CWA 6235

PROJECT NUMBER	PROJECT NAME
	Task Order 2

CLIENT NAME: CH2M HILL

PROJECT MANAGER	COPY TO:
Robert W.	W. PEARSE

REQUESTED COMP. DATE

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED: Total Lits Per unit Sampled	REMARKS
	7/3/90		CHIP		X	05-201	1	X	
	11				X	05-202	1	X	

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME	HAZWRAP/NEESA Y N
[illegible] Tech	7/3/90	[illegible]	7/3/90 1831	QC LEVEL 1 2 3
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	COC / ICE
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	ANA REQ / TEMP
				CUST SEAL / Ph
				SAMPLE COND.

RECEIVED BY LAB: SUSAN GILBERT	DATE/TIME	SAMPLE SHIPPED VIA	AIR BILL#
Susan Gilbert	7-3-90 18:31	UPS BUS FED-EX HAND OTHER ____	

REMARKS: CHEMWEST LAB

ENTERED INTO LIMS ____ COC REVIEWED ____

REV 4/89 FORM 340

3-3

CW# 6235

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME
	Task Order 2

CLIENT NAME: CH2M HILL

PROJECT MANAGER: Robert E.

COPY TO: W. Pearse

REQUESTED COMP. DATE:

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER:

ANALYSES REQUESTED: Total Hg per unit sample

[redacted]

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	Total Hg per unit sample	REMARKS
	7/3/90	Sweep			X	05-11	1	X	
						05-17			
						05-19			
						05-15			
						05-12			
						05-8			
						05-10			
						05-10MS			
						05-10MSD			
						05-20			
						05-13			
						05-3			
						05-7			
						05-18			
						05-16			

... IN GOOD CONDITION

SAMPLED BY AND TITLE: [illegible]	DATE/TIME: 7/?/90	RELINQUISHED BY: William E.	DATE/TIME: 7/?/90 1821
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY LAB: SUSAN GILBERT / Susan Gilbert	DATE/TIME: 7-3-90 18:31	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL #

HAZWRAP/NEESA Y N

QC LEVEL 1 2 3

COC	ICE
ANA REQ	TEMP
CUST SEAL	Ph
SAMPLE COND.	

REMARKS: CHEMWEST LAB

ENTERED INTO LIMS ____ COC REVIEWED ____

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

CW#6343 1-2

PROJECT NUMBER	PROJECT NAME	# OF CONTAINERS	CLIENT ADDRESS AND PHONE NUMBER	LAB ID	FOR LAB USE ONLY
	TASK ORDER 5006		2840 Fr[illegible] / 920-0300		LAB#
CLIENT NAME: CH2M HILL			Sacramento CA 95834		LAB#
PROJECT MANAGER: R Lumiglista	COPY TO: W. Pearce		ANALYSES REQUESTED		PROJECT NO.
REQUESTED COMP. DATE	SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ___				ACK / VERIFIED
					QUOTE# / BS
					NO. OF SAMP / PG / OF

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	Total Hg/Uni - Sample	REMARKS
	7/5/90		X			05-305-wr	1	X	

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME	
W Turnbull	5 Jul 90	W Turnbull	7/5/90	HAZWRAP/NEESA Y N
RECEIVED BY: Alan Ir Wong	DATE/TIME 7/5/90 1920	RELINQUISHED BY:	DATE/TIME	QC LEVEL 1 2 3
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME	COC / ICE
RECEIVED BY LAB:	DATE/TIME	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ___	AIR BILL#	ANA REQ / TEMP
				CUST SEAL / Ph
				SAMPLE COND.

REMARKS

ENTERED INTO LIMS ___ COC REVIEWED ___

RDL 4/89 FORM 2

2-2
CW#6343

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

PROJECT NUMBER:

PROJECT NAME: TASK ORDER 5006

CLIENT NAME: CH2M HILL

CLIENT ADDRESS AND PHONE NUMBER: 3840 Rosin Ct Suite 110 Sacramento, CA 95834 / 920 0200

PROJECT MANAGER: R. Evangelista

COPY TO: W. Pearce

REQUESTED COMP. DATE:

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

FOR LAB USE ONLY

LAB#

LAB#

PROJECT NO.

ACK | VERIFIED

QUOTE# | BS

NO. OF SAMP | PG | OF

ANALYSES REQUESTED: ~~Total Hg per sample~~; Total Hg per unit sample

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	~~Total Hg per sample~~	Total Hg per unit sample	LAB ID	REMARKS
	5 July		Chip			05-203	1		x		
						05-204-MS	1		X		
						05-205-MSD	1		X		
						05-206	1		X		
						05-207	1		X		
						05-208	1		X		
						05-209	1		X		
						05-210	1		X		
						05-211	1		X		
						05-212	1		X		
			RH			05-301	1		X		
						05-302	1		X		
						05-303	1		X		
						05-304	1		X		
						05-305	1		X		

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE: WEJ / Tech	DATE/TIME: 5 July 90	RELINQUISHED BY: WEJ	DATE/TIME: 7/5/90
RECEIVED BY: Allan Williams	DATE/TIME: 7/5/90 1920	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY LAB:	DATE/TIME:	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL#

QC LEVEL 1 2 3

COC | ICE

ANA REQ | TEMP

CUST SEAL | Ph

SAMPLE COND.

REMARKS

DOC

INTO LIMS ____ REVIEWED ____

CH2M HILL **CHAIN OF CUSTODY RECORD**

CW# 6247

PROJECT NUMBER	PROJECT NAME
	TASK ORDER 5006
CLIENT NAME: CH2M Hill	3840 Rosin Ct Ste 110 / 920 Sacramento, CA 95834/2000
REPORT TO: R. Evangelista	COPY TO: W. Pearce
REQUESTED COMPLETION DATE	LABORATORY

ANALYSES REQUESTED

FOR LAB USE ONLY

LAB # _____

PROJ # _____

ACK _____ VERIFIED _____

DATE INVOICED _____

NO. OF SAMPLES _____ pg _____ of _____

DISPOSITION: D R _____ DATE

STA NO	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS	Total Hg/Unfiltered sample
	7/6/10		Pool		05-307	1	X
					05-308	1	X
					05-309	1	X
					05-310	1	X
					05-311	1	X
					05-312	1	X
					05-313	1	X
					05-314	1	X
					05-315	1	X
					05-316	1	X
					05-317	1	X
					05-318	1	X
					05-319		
					05-320		
					05-321		

REMARKS

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE (SIGNATURE)	DATE/TIME	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME
1	1640	2	7/6/10	3	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)	DATE/TIME
4		5		6		7 SUSAN GILBERT	7/6/10 15:10

REMARKS _____

SAMPLING PROGRAM: SDWA ☐ NPDES ☐ RCRA ☐ OTHER _____ (SPECIFY)

SAMPLE SHIPPED VIA: ☐ UPS ☐ BUS ☐ FED-EX ☐ HAND OTHER _____

AIR BUS BILL NUMBER

PINK — COPY TO COORDINATOR FIELD FILES YELLOW — CLIENT

REV. 6/87 FORM 340

CH2M HILL CHAIN OF CUSTODY RECORD

CW #6247

PROJECT NUMBER:

PROJECT NAME: TASK ORDER 5006

CLIENT NAME: CH2M Hill, 3840 Rosin Ct [illegible] Sacramento, CA 95834 [illegible]

REPORT TO: R. Evangelista

COPY TO: W. Pearce

REQUESTED COMPLETION DATE:

LABORATORY:

STA NO	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS	Total [illegible]	Total [illegible]	REMARKS
	7/6/90		Pol		05-322	1			
			↓		05-323	1	X		
			↓		05-324	1	X		
			Wipe		05-124	1		X	
			↓		05-125	1		X	
			↓		05-126	1		X	

ANALYSES REQUESTED

FOR LAB USE ONLY

LAB # ______

PROJ # ______

ACK ______ VERIFIED ______

DATE INVOICED ______

NO. OF SAMPLES ______ pg ______ of ______

DISPOSITION: D R ______ DATE

SAMPLES REC'D IN GOOD CONDITION

SAMPLED BY AND TITLE (SIGNATURE)	DATE/TIME	RELINQUISHED BY (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME
1 W. [illegible] / Tech	7/6/90	2 W. [illegible]	7/6/90	3	

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	DATE/TIME	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY LAB: (SIGNATURE)	DATE/TIME
4		5		6		7 SUSAN GILBERT Susan Gilbert	7/6/90 15:43

REMARKS ______

SAMPLING PROGRAM: ☐ SDWA ☐ NPDES ☐ RCRA OTHER ______ (SPECIFY)

SAMPLE SHIPPED VIA: ☐ UPS ☐ BUS ☐ FED-EX ☐ HAND OTHER ______

AIR BUS BILL NUMBER

DISTRIBUTION: WHITE — ORIGINAL ACCOMPANIES SHIPMENT PINK — COPY TO COORDINATOR FIELD FILES YELLOW — CLIENT

REV. 6/87 FORM 340