Kona Community Hospital
18-0054-1 Compactor Improvements

79-1019 Haukapila Street
Kealakekua, Hawaii 96750

SPECIFICATIONS
FINAL/BID SUBMITTAL
OCTOBER 2020

Prepared for:
Kona Community Hospital
Department of Accounting and General Services
Division of Public Works
State of Hawaii

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Prepared by:
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FOR
MISCELLANEOUS SMALL PROJECTS
KONA COMMUNITY HOSPITAL MAIN BUILDING
79-1019 HAUKAPILA STREET
KEALAKEKUA, ISLAND OF HAWAII 96750

MNA PROJECT 2732_2

JANUARY 24, 2020

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TARGETED HAZARDOUS MATERIAL AND SOIL SCREENING SURVEY REPORT FOR MISCELLANEOUS SMALL PROJECTS KONA COMMUNITY HOSPITAL MAIN BUILDING 79-1019 HAUKAPILA STREET KEALAKEKUA, ISLAND OF HAWAII 96750

MNA Project 2732_2

January 24, 2020

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Data QC	Phillip Cabanila
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EXECUTIVE SUMMARY

In November 2019, Myounghee Noh & Associates, L.L.C. (MNA), was retained by INK Architects, LLC, to conduct a targeted hazardous material and soil screening survey at the Kona Community Hospital Main Building located at 79-1019 Haukapila Street, Kealakekua, Hawaii. Targeted were those areas anticipated to be disturbed during the renovation.

The objective of the survey was to identify the presence, extent, and conditions of hazardous materials in the building in the areas anticipated to be disturbed, so that the information can be incorporated in the design.

Hazardous Building Material Survey

On 21 November 2019, MNA conducted this hazardous material survey and identified 11 suspect building materials. Based on sampling and analysis of 18 asbestos/bulk and 10 lead/paint chip samples, MNA provides the following summary:

- No asbestos-containing materials (ACM) were observed in the project area.
- No lead-containing paints (LCP) were observed in the project area.
- No suspected arsenic-containing material were observed in the project area.

Soil Screening

The purpose of the soil screening was to evaluate the presence and levels of heavy metals and organochlorine pesticides to assess whether they may pose potential risks to construction workers and occupants during the renovation work, and to determine appropriate soil management and disposal practices.

During 21 - 22 November 2019, MNA collected 10 multi-incremental soil samples including one triplicate set from 0 to 6 inches and 6 to 18 inches below ground surface. The samples were collected in coordination with the Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response Office, from paved and unpaved areas where planned work will be conducted (Appendix C). Each sample combined fifty 30-gram subsamples and represented a decision unit (DU). The analytical results were compared to the HDOH Tier 1 Environmental Action Levels (EAL) for residential (unrestricted) and commercial/industrial (restricted) land use, above a drinking water resource and located greater than 150 meters from surface water features (State of Hawaii, Department of Health, 2017).

No measurable levels of pesticides, cadmium, mercury, selenium, or silver were reported in the samples. Measurable levels of arsenic, barium, chromium, and lead were reported in some of the results, but below their EALs for residential land use. Arsenic was reported in DU2 (new stairway) at 22 milligrams per kilogram (mg/kg), below the EAL, 24 mg/kg.

30 increment samples collected / unit: mg/kg			Depth (ft. bgs)	Arsenic	Barium	Chromium	Lead
				HDOH Unrestricted EAL			
Sample No.	Decision Units (based on planned future use)	Sample Identifier		24	1,000	1,100	200
1	New electric vehicle charging station for two vehicles on east side of the building.	2732-DU1-A	0.0-0.5	3.4	36	31	3.1
2		2732-DU1-A-1	0.0-0.5	---	67	65	2.8
3		2732-DU1-A-2	0.0-0.5	4.4	80	51	4.8
4		2732-DU1-B	0.5-1.5	5.4	80	52	5.5
5	New exterior stairs between Haukapila Street and lower parking lot.	2732-DU2-A	0.0-0.5	22	56	99	8.5
6		2732-DU2-B	0.5-1.5	18	57	100	9.0
7	New energy-efficient chiller and shelter for Special Services Building.	2732-DU3-A	0.0-0.5	9.9	34	76	6.8
8		2732-DU3-B	0.5-1.5	7.7	34	63	5.7
9	New concrete slab and electrical service to compactor.	2732-DU4-A	0.0-0.5 (below asphalt)	---	19	34	---
10		2732-DU4-B	0.5-1.5 (below asphalt)	---	11	38	---

DU – Decision Unit Ft. bgs – Feet below ground surface
HDOH EAL – Hawaii Department of Health Environmental Action Level
mg/kg – Milligrams per kilogram --- – None Detected

Hazard Controls Required

Based on the visual survey and sampling and analysis of suspect bulk materials and paints, no special hazard control measures are warranted for work within the current project scope. However, durst and runoff controls are required.

In an event the project scope changes, Contractors must verify, prior to bidding, the location and volumes of potentially hazardous materials and determine the appropriate dust and hazard control measures based on the area and material to be disturbed. Quantities of materials provided in this report are based on visual approximations only during the survey and should not be used for bidding purposes.

Based on the results of the multi-incremental soil screening, MNA recommends the following:

- Use of best management practices (BMP), such as dust control and erosion control, must be implemented to prevent surface runoff and migration of contaminants.
- Earthwork may cause a potential exposure to staff, the site workers, and the public via fugitive dust. The routes of exposure to fugitive dust are by inhalation, ingestion, and dermal contact. The Contractor must use engineering controls such as water misting and wind barriers to control fugitive dust.
- Excess soils that will be transported offsite for disposal must be characterized to ensure compliance with recipient guidelines and requirements.

1.0 INTRODUCTION

Myounghee Noh & Associates, L.L.C. (MNA), under an agreement with INK Architects, LLC, conducted a targeted hazardous material and soil screening survey for the planned miscellaneous small project at the Main Building of Kona Community Hospital, located at 79-1019 Haukapila Street, Kealakekua, Hawaii.

MNA's survey was conducted in support of the planned renovation project. Targeted were those areas anticipated to be disturbed by the renovation and construction work, as follows (Table 1):

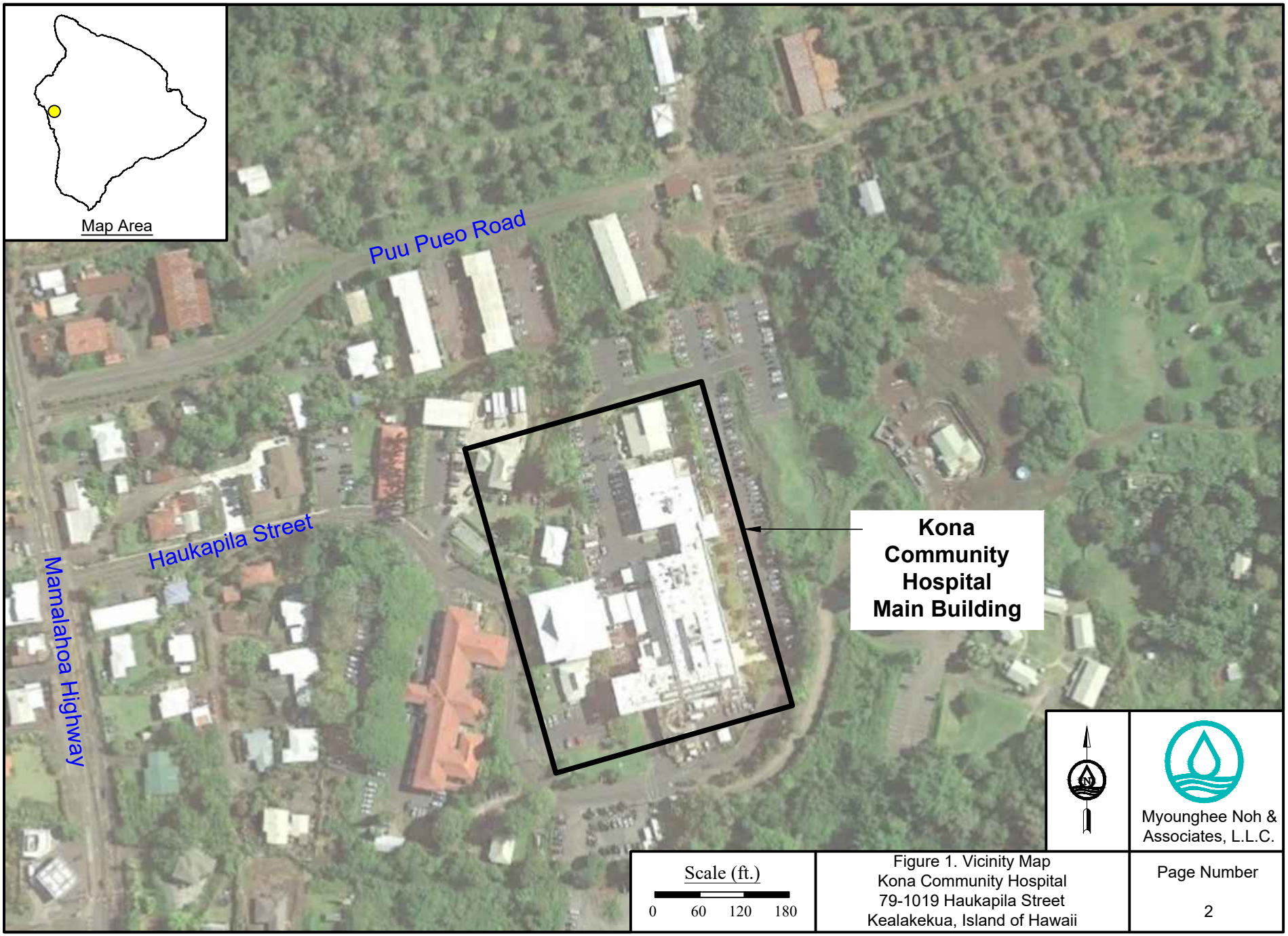
- Hazardous building materials due to the suspected presence of asbestos, lead, or arsenic.
- Soil suspected of containing elevated levels of heavy metals and organochlorine pesticides.

Kona Community Hospital Main Building
November 2019

Table 1. Anticipated Design Scope of Work

Area	Work Anticipated
Bid Package #2 (Soil Screening Only)	
Exterior Trash Compactor	• Demolish existing curb ramp, guard rail, and bumper guard. • Provide new concrete slab and electrical service to compactor. • Provide new bumper guard along edge of loading dock.
Bid Package #3 (Hazmat and Soil Screening Survey)	
Interior	• Split from existing medical gas lines in the hallway outside of the office and route lines inside office with ports on the wall. • Provide emergency shutoff valves in the hallway, adjacent to office entry door. • Medical gas lines to be surface-mounted due to existing concrete wall in office.

Figure 1. Vicinity Map


Map Area
Puu Pueo Road
Haukapila Street
Mamalahoa Highway
Kona
Community
Hospital
Main Building
Scale (ft.)
0 60 120 180
Myounghee Noh &
Associates, L.L.C.
Figure 1. Vicinity Map
Kona Community Hospital
79-1019 Haukapila Street
Kealakekua, Island of Hawaii
Page Number
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2.0 SAMPLING AND SURVEY METHODS

On 21 November 2019, a State of Hawaii-certified asbestos professional, Phillip Cabanila, conducted the hazardous material survey. The inspector performed a visual assessment of the project site, identified materials suspected of containing asbestos, lead, or arsenic, and collected samples of these materials. In addition, the field inspectors staked out the decision units (DU) for the soil screening and collected multi-incremental soil samples. Inspector certifications are presented in Appendix A.

2.1 Identifying Homogeneous Materials

The inspector identified building materials with the same appearance, color, and substrate as homogeneous materials. Interior homogeneous materials are considered unique per building. Building materials with the same characteristics (appearance, color, and substrate), as an identified homogeneous material, should be considered to possess the same hazard characteristics, unless specifically identified as otherwise in the report. As an example, if off-white paint on concrete block wall is found to be lead-containing paint (LCP), then all identical off-white paint on concrete block wall in the survey area should be treated as LCP. Table 2 provides an overview of sampling and a summary of hazardous materials identified.

Table 2. Summary of Sampling and Results

Materials Sampled	Samples Submitted/ Inspected	Suspect Material Locations	Identified Hazardous Materials
Main Building			
Asbestos in bulk material or paint	18	Ceilings, floor, walls	None
Lead in paint	10	Ceiling, conduit, walls	None
Arsenic in bulk	0	---	None

2.2 Building Material Sampling

Bulk and paint samples were collected using a decontaminated chisel, razor, or hammer in a manner that minimized airborne dust. The inspector collected triplicate samples for asbestos and duplicate samples for lead. No suspected arsenic-containing building materials were identified. Samples were placed in sealable plastic bags, labeled with a unique identification number, and recorded on a chain-of-custody. For each sample, the date, sample appearance, analyte, and sample location were recorded on a field data form. Asbestos samples were transported under chain-of-custody to LA Testing in South Pasadena, California. Lead samples were delivered under chain-of-custody to Hawaii Analytical Laboratory in Honolulu, Hawaii.

2.3 Soil Screening

Based on the past use of the areas where soil is anticipated to be disturbed and planned future use, the chemicals of potential concern (COPC) were heavy metals and organochlorine pesticides.

Multi-incremental soil samples were collected from four DUs where the planned work will be completed. Each DU was designated in association with the proposed work and divided into 30 sampling grids. The DU locations are described as follows:

- DU 1 (2732-DU1-A) – Surface soil (0-0.5 ft. bgs.) on the east side of the Main Building where the proposed electric vehicle charging stations are planned to be installed. This DU was approximately 1,000 square feet. Soil increments were randomly collected from each grid.
  - (2732-DU1-A-1) – Duplicate sample from DU 1
  - (2732-DU1-A-2) – Triplicate sample from DU 1
- DU 1 (2732-DU1-B) – Near-surface soil (0.5-1.5 ft. bgs) on the east side of the Main Building where proposed vehicle charging stations are planned. This DU was approximately 1,000 square feet. Soil increments were randomly collected from each grid.
- DU 2 (2732-DU2-A) – Surface soil at the existing stairs located on the southwest portion of the site where the proposed new exterior stairs are planned to be installed. This DU was approximately 2,000 square feet. Surface soil increments were randomly collected from each grid.
- DU 2 (2732-DU2-B) – Near-surface soil (0.5-1.5 ft. bgs) at DU2.
- DU 3 (2732-DU3-A) – Surface soil around the existing concrete chiller pad located on the west central portion of the site where the chiller cover structure is planned to be installed. This DU was approximately 700 square feet. Surface soil increments were randomly collected from each grid.
- DU 3 (2732-DU3-B) – Near-surface soil (0.5-1.5 ft. bgs) at DU3.
- DU 4 (2732-DU4-A) – Soil beneath the existing asphaltic concrete (0-0.5 ft. bgs) at the loading dock located on the central portion of the site where the new concrete trash compactor pad is planned. This DU was approximately 500 square feet. Samples were randomly collected from each grid.
- DU 4 (2732-DU4-B) – Near-surface soil (0.5-1.5 ft. bgs) at DU4.

Soil increments were collected using a one-inch diameter stainless steel T-handled core sampler. For each increment (or subsample), existing grass was cleared to expose bare soil, as necessary. For areas beneath the asphalt concrete, the pavement was chipped away using a rotary hammer, to access the soil/aggregate material beneath. The T-handled sampler was advanced into the soil until the soil surface met a pre-marked 6-inch depth indicator on the sampler, generating approximately 30 grams of soil for each subsample. Thirty subsample locations were selected using a grid pattern across the DU for representative sampling. Between DUs, the sampling tools were decontaminated with Liquinox®, tap water, and deionized water.

Each subsample was placed directly into a sealable plastic bag, from the T-handled sampler. Upon completion of collecting subsamples, the soil bulk sample bag was placed into a second sealable plastic bag, labeled with a unique identification number, and recorded on a chain-of-custody form. Samples were placed in a cooler and chilled to below 4ºC with frozen gel ice for transport to the

analytical laboratory. The date, sample appearance, analyte, and sample location were recorded on a field data form. The samples were transported under chain-of-custody protocols to Advanced Analytical Laboratory, Oahu, Hawaii, for analysis of organochlorine pesticides and heavy metals.

Investigation derived waste (IDW) was minimized through the selection of sampling technique. IDW included disposable personal protective equipment (PPE) and decontamination waste, including paper towels, and decontamination wastewater. One trash bag of PPE was generated and disposed of in a municipal waste dumpster. Decontamination wastewater was dispersed back onto their respective DA upon completion of sampling and decontamination.

3.0 LABORATORY INFORMATION

LA Testing analyzed the asbestos samples by polarized light microscopy using the Environmental Protection Agency (EPA) Method 600/R-93/116. LA Testing, South Pasadena, is certified by:

- National Voluntary Laboratory Accreditation Program (NVLAP), certification 200232-0
- State of Hawaii Department of Health (HDOH), certification L-01-034
- American Industrial Hygienist Association (AIHA) Environmental Lead Laboratory Accreditation Program (ELLAP), certification 102814

Hawaii Analytical Laboratory analyzed the lead samples by flame atomic absorption spectroscopy using the EPA Method 7082m. Hawaii Analytical Laboratory, Honolulu, is certified by:

- NVLAP, certification 200655-0
- HDOH, certification L-14-002
- AIHA ELLAP, certification 101812

Advanced Analytical Laboratory analyzed the soil samples for heavy metals by inductively coupled plasma - mass spectrometry using the EPA method 6020B, and pesticides by gas chromatography using 8081B. Advanced Analytical Laboratory, is certified by:

- International Organization for Standardization/International Electrotechnical Commission (ISO/IES), certification 17025:2005
- Department of Defense Environmental Laboratory Accreditation Program (DOD-ELAP), certification L-2442

4.0 ASBESTOS RESULTS

Materials determined to contain greater than, or equal to, 1% asbestos are considered regulated asbestos-containing material (ACM) under the National Emission Standards for Hazardous Air Pollutants (NESHAP) as specified in 40 Code of Federal Regulations (CFR) Part 61 Subpart M. The U.S. Occupational Safety and Health Administration (OSHA) Asbestos General Industry and Construction Standards also define ACM as 1% asbestos or more by volume under 29 CFR 1910.1001 and 29 CFR 1926.1101, respectively. However, any measurable levels of asbestos fibers are considered to be a health concern, in an uncontrolled work environment.

Six homogeneous materials suspected of containing asbestos were identified and sampled, generating 18 samples for analysis. None of the samples contained measureable levels of asbestos. Therefore, it is concluded that no ACM is present in the area anticipated to be disturbed.

Table 3. Asbestos-Containing Material Determination

Rooms	Locations	HM ID	Material Color	Material	Substrate	Result	Estimated Quantity
Biomedical Lab	Wall	1	Off-white	Skim coat Plaster	Concrete block	ND	100 sq. ft.
Biomedical Lab, Hallway	Ceilings	2	White with pinholes	Acoustic tile	None	ND	500 sq. ft.
Hallway	Wall	3	White	Wallpaper Skim coat	Concrete block	ND	5 sq. ft.
Electrical Room	Ceiling, wall	4	Off-white	Painted drywall Joint compound	None	ND	200 sq. ft.
Electrical Room	Floor	5	Off-white with streaks	12" x 12" Vinyl tile Mastic	Concrete	ND	100 sq. ft.
Electrical Room	Walls	6	Lt. brown	Cove base Mastic Wallpaper	Drywall	ND	40 ln. ft.

All materials were in good condition or in an "as installed" condition.
Abbreviations and Acronyms
HM ID – Homogeneous Material Identifier
ln. ft. – Linear Feet
ND – Not Detected
sq. ft. – Square Feet

The suspected ACM descriptions and identifiers are provided in Appendix B. Sample location drawings are provided in Appendix C. Photographs of suspected materials are presented in Appendix D. Laboratory analytical reports, chain-of-custody, and field data forms are provided in Appendix E.

5.0 LEAD RESULTS

The U.S. Department of Housing and Urban Development (HUD) and the EPA define paint containing 5,000 milligrams per kilogram (mg/kg), or 0.5% by weight, or more of lead to be lead-based paint (LBP). Paint containing any measurable concentration of lead is considered to be LCP and a health concern. When lead is detected in a multi-layer sample, it is assumed that all layers represented by the sample contain lead at the same concentration.

Five suspected lead paints were identified and sampled, generating 10 paint chip samples. Laboratory analytical results indicated no measurable levels of lead. Therefore, it is concluded that no lead paint is present in the project area.

Table 4. Lead-Containing Paint Determination

Rooms	Locations	HM ID	Material Color	Substrate	Result (mg/kg)	Estimated Quantity
Biomedical Lab	Wall	7	Off-white	Concrete block	<40	100 sq. ft.
Hallway	Wall	8	White	Wallpaper	<40	5 sq. ft.
Electrical Room	Ceiling, wall	9	Off-white	Drywall	<40	200 sq. ft.
Electrical Room	Wall	10	Off-white	Concrete block	<40	100 sq. ft.
Electrical Room	Conduit	11	Off-white	Metal	<40	100 ln. ft.

All paints were in good condition or in an "as installed" condition.
Abbreviations and Acronyms
HM ID – Hazardous Material Identifier
ln.ft. – Linear Feet
mg/kg– milligrams per kilogram or parts per million
sq. ft. – Square Feet

Suspected lead paint descriptions and identifiers are provided in Appendix B. Sample location drawings are in Appendix C. Photographs of suspected lead paints are presented in Appendix D. Laboratory analytical reports, chain-of-custody, and field data forms are provided in Appendix E.

6.0 ARSENIC RESULTS

The disturbance of arsenic-containing materials is regulated by the OSHA Inorganic Arsenic General Industry Standard under 29 CFR 1910.1018. No suspected arsenic-containing materials were observed; therefore, no samples were collected during this survey.

7.0 SOIL SCREENING RESULTS

The analytical results for contaminants were compared to the State of Hawaii Department of Health (HDOH) Tier 1 Environmental Action Levels (EAL) for both commercial/industrial (restricted) and residential (unrestricted) land use, above a drinking water resource and located greater than 150 meters from surface water features (State of Hawaii, Department of Health, 2017). Triplicate multi-incremental soil samples were collected from DU-01 surface soil for quality control to determine the reproducibility of the sampling (refer to Section 8.0).

No measurable levels of pesticides, cadmium, mercury, selenium, or silver were reported in the sample analytical results. Measurable levels of arsenic, barium, chromium, and lead were reported in some of the results, but below their EALs for residential land use. Arsenic was reported in DU2 (new stairway) at 22 milligrams per kilogram (mg/kg), below the HDOH EAL, 24 mg/kg (Tables 5 and 6).

Table 5. Summary of Soil Analyte Concentrations DU1 and DU2

Sample ID (Depth) / Analytes	Boring Number and Analytical Results (mg/kg)						Tier 1 EAL (mg/kg)	
	DU1 (New Electrical Charging Station)				DU2 (New Stairway)			
	2732-DU1-A (0.0-0.5 ft bgs) Primary	2732-DU1-A-1 (0.0-0.5 ft bgs) Duplicate	2732-DU1-A-2 (0.0-0.5 ft bgs) Triplicate	2732-DU1-B (0.5-1.5 ft bgs)	2732-DU2-A (0.0-0.5 ft bgs)	2732-DU2-B (0.5-1.5 ft bgs)	Unrestricted	Restricted
Resource Conservation and Recovery Act 8 Metals (6020B)								
Arsenic	3.4	ND (2.0)	4.4	5.4	22	18	24	95
Barium	36	67	80	80	56	57	1,000	2,500
Cadmium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	14	72
Chromium	31	65	51	52	99	100	1,100	1,100
Lead	3.1	2.8	4.8	5.5	8.5	9.0	200	800
Mercury	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	4.7	61
Selenium	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	78	1,000
Silver	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	78	1,000
Pesticides (8081A)								
alpha-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.075[1]	0.075[1]
beta-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
gamma-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
delta-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
Heptachlor	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	1.3	5.6
Aldrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	3.9	8.4
Heptachlor epoxide	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.2	2.7
Endosulfan I	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	13[2]	13[2]
Endosulfan II	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)		
Endosulfan sulfate	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)		
Dieldrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	2.5	24
4,4'-DDD	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	2.2	8.4
4,4'-DDE	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	1.9	8.2
4,4'-DDT	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	1.8	5.6
Endrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	3.8[3]	30[3]
Endrin aldehyde	ND (0.015)	ND (0.015)	ND (0.015)	ND (0.015)	ND (0.015)	ND (0.015)		
Chlordane (technical)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	17	23
Methoxychlor	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	16	16
Toxaphene	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	0.48	1.8

Table 6. Summary of Soil Analyte Concentrations DU 3 and DU4

Sample ID (Depth) / Analytes	Boring Number and Analytical Results (mg/kg)				Tier 1 EAL (mg/kg)	
	DU3 (New Chiller and Shelter)		DU4 (New Concrete Slab)			
	2732-DU3-A (0.0-0.5 ft bgs)	2732-DU3-B (0.5-1.5 ft bgs)	2732-DU4-A (0.0-0.5 ft below the asphalt)	2732-DU4-B (0.5-1.5 ft below the asphalt)	Unrestricted	Restricted
Resource Conservation and Recovery Act 8 Metals (6020B/A3050B)						
Arsenic	9.9	7.7	ND (2.0)	ND (2.0)	24	95
Barium	34	34	19	11	1,000	2,500
Cadmium	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	14	72
Chromium	76	63	34	38	1,100	1,100
Lead	6.8	5.7	ND (1.0)	ND (1.0)	200	800
Mercury	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	4.7	61
Selenium	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	78	1,000
Silver	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	78	1,000
Pesticides (8081A)						
alpha-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.075[1]	0.075[1]
beta-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
gamma-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
delta-BHC	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)		
Heptachlor	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	1.3	5.6
Aldrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	3.9	8.4
Heptachlor epoxide	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	0.2	2.7
Endosulfan I	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	13[2]	13[2]
Endosulfan II	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)		
Endosulfan sulfate	ND (0.01)	ND (0.01)	ND (0.01)	ND (0.01)		
Dieldrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	2.5	24
4,4'-DDD	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	2.2	8.4
4,4'-DDE	ND (0.002)	ND (0.002)	ND (0.002)	ND (0.002)	1.9	8.2
4,4'-DDT	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	1.8	5.6
Endrin	ND (0.001)	ND (0.001)	ND (0.001)	ND (0.001)	3.8[3]	30[3]
Endrin aldehyde	ND (0.015)	ND (0.015)	ND (0.015)	ND (0.015)		
Chlordane (technical)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	17	23
Methoxychlor	ND (0.005)	ND (0.005)	ND (0.005)	ND (0.005)	16	16
Toxaphene	ND (0.20)	ND (0.20)	ND (0.20)	ND (0.20)	0.48	1.8

Criteria: Hawaii Department of Health Tier 1 Environmental Action Levels with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and more than 150 meters from surface water (State of Hawaii Department of Health, rev. Fall 2017).

Notes:

[1] EAL is for Hexachlorocyclohexane ("BHC" as Lindane) = Alpha- + Beta- + Gamma- + Delta-BHC

[2] EAL is for Endosulfan = Endosulfan I + Endosulfan II + Endosulfan sulfate

[3] EAL is for Endrin = Endrin + Endrin aldehyde + Endrin ketone

DU4 was located under asphalt.

Abbreviations/Acronyms:

ID identifier
ft bgs feet below ground surface
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

8.0 DATA QUALITY REVIEW AND ASSESSMENT

MNA conducted an analytical data quality review to determine the usability of the data generated by performing a data check for sample preservation methods, technical sample holding times, method blanks, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), matrix spike/matrix spike duplicate (MS/MSD), and surrogate recoveries. Table 7 presents the field performance review for the triplicate samples.

All samples were labeled and recorded in a COC document. No analytes were detected in the laboratory blank sample, which indicated that the analytical processes were free of the contaminants. The LCS/LCSD, MS/MSD, and surrogate recoveries were within the laboratory acceptable ranges. The technical holding times for analytes were met. All COPC reporting limits were below the Tier 1 EALs for unrestricted land use.

Field performance was reviewed by comparing the results of triplicate multi-increment samples to support the reproducibility of the sampling technique and analytical practice and representativeness of the samples. Average, standard deviation, and relative standard deviation (RSD) between the triplicate samples were evaluated when analytes were detected above the reporting limits. If the RSD between field triplicate samples is 35% or less, the total error is considered within a reasonable range for precision and reproducibility for field sampling activities. The RSD was calculated using the following equation.

$$RSD\ (\%) = \frac{100s}{\bar{x}}$$

Where: $\bar{x}$ = Average, s = Standard deviation

The upper confidence level (UCL) of the average was calculated using the Chebyshev method for comparison to the EALs. The UCL was calculated using the following equation.

$$95\%\ UCL = average + \left(\sqrt{\frac{1}{\alpha}} - 1 \times \frac{SD}{\sqrt{r}}\right)$$

Where: SD = Standard deviation; r = number of replicate samples;
α = acceptable level of potential decision error (0.05 for a 95% UCL);
t = $(1-\alpha)^{th}$ quantile of the Student's-t distribution with (r-1) degrees of freedom

A set of triplicate samples were collected from DU1. The data comparison between triplicate samples is presented in Table 7Table 7. If the RSD between field triplicate samples is 35% or less, the total error is considered within a reasonable range for precision and reproducibility for field sampling activities. No RSD data was collected for arsenic. The RSD for barium was greater than 35%, indicating poor precision. The high RSD may have resulted from heterogeneous soil conditions from the rocky site and uneven decay rates of chemicals in soil. The RSD for chromium and lead, were 35%, and 30%, respectively (Table 7).

Table 7. Field Performance Review, DU1

Sample ID / Analyte	Analytical Results (mg/kg)			Field Performance Review				Tier 1 EAL (mg/kg)
	DU1-A (0.0-0.5 ft) Primary	DU1-A-1 (0.0-0.5 ft) Duplicate	DU1-A-2 (0.0-0.5 ft) Triplicate	Average (mg/kg)	Standard Deviation	RSD (%)	95% UCL	Unrestricted
Resource Conservation and Recovery Act 8 Metals (6010 and 7010B)								
Arsenic	3.4	ND (2.0)	4.4	---	---	---	---	24
Barium	36	67	80	61	23	37%	117.89	1,000
Chromium	31	65	51	49	17	35%	92	1,100
Lead	3.1	2.8	4.8	4	1	30%	6.28	200

Criteria: Hawaii Department of Health Tier 1 Environmental Action Levels with unrestricted (residential) and restricted (commercial/industrial) land uses above a drinking water resource and more than 150 meters from surface water (State of Hawaii Department of Health, rev. Fall 2017).

Abbreviations/Acronyms:

ID identifier
ft bgs feet below ground surface
mg/kg milligrams per kilogram
ND (00) not detected (laboratory reporting limit)

9.0 SUMMARY OF SURVEY RESULTS

Hazardous Building Material Survey

MNA conducted a targeted hazardous material survey at the Kona Community Hospital Main Building79-1019 Haukapila Street, Kealakekua, Island of Hawaii. MNA's survey was conducted in support of the medical gas line installation project (design scope in Table 1).

Based on the analysis of 18 asbestos-suspected samples and 10 lead-suspected samples, MNA concluded that no asbestos- or arsenic-containing building materials, or lead paints are present in the project area.

Soil Screening

MNA collected 10 multi-incremental samples including one triplicate set from surface and near-surface soil (0-0.5 and 0.5-1.5 ft. bgs) in areas where soil disturbance is anticipated (Appendix C). No measurable levels of pesticides, cadmium, mercury, selenium, or silver were reported in the sample analytical results. Measurable levels of arsenic, barium, chromium, and lead were reported in some of the results, but below their EALs for residential land use. Arsenic was reported in DU2 (new stairway) at 22 milligrams per kilogram (mg/kg), below the HDOH EAL, 24 mg/kg.

10.0 RECOMMENDATIONS FOR RENOVATION AND CONSTRUCTION WORK

It is required that properly trained employees perform construction work and renovation that disturbs hazardous materials, in a manner protective of the site workers, the public, facility users, and the environment. The following recommendations address OSHA and other applicable federal requirements. These recommendations provide guidance for the management of hazardous building materials and control of occupational and environmental hazards associated with operations, maintenance, renovation, and demolition. These recommendations are based on information gathered during the hazardous materials survey. These recommendations are not intended to constitute a formal work plan but are intended to provide a starting point for the development of a work plan or procedure.

10.1 Asbestos-Containing Materials

No suspect ACM were identified in the project areas during this survey. Therefore, no special asbestos control measures are provided.

10.2 Lead-Containing Paints

Based on the sampling and analysis of five suspected lead paints in the Main Building, no LCP were identified in the project areas during this survey. Therefore, no special lead control measures are provided; however, Contractors must review the Safety Data Sheet of the new paint coatings to determine all appropriate engineering controls to prevent exposures to the potential contaminants in the new paint coatings.

10.3 Arsenic-Containing Materials

No suspected arsenic-containing materials were identified in the project areas during this survey. Therefore, no special arsenic control measures are provided.

10.4 Soil Contamination

Based on the results of the soil screening, MNA recommends the following:

- Use of best management practices (BMP), such as dust control and erosion control, must be implemented to prevent surface runoff and migration of contaminants.
- Earthwork may cause a potential exposure to staff, the site workers, and the public via fugitive dust. The routes of exposure to fugitive dust are by inhalation, ingestion, and dermal contact. The Contractor must use engineering controls such as water misting and wind barriers to control fugitive dust.
- Excess soils that will be transported offsite for disposal must be characterized to ensure compliance with recipient guidelines and requirements.

11.0 LIMITATIONS

Industry standard effort was made to identify suspected hazardous building materials during the survey at the project area. However, this does not imply a guarantee that all suspected building materials and hazardous materials were identified by this assessment because certain building materials and/or surfaces may be hidden by walls, flooring, partitions, other building components, or existing equipment. If any previously unforeseen suspected materials become known, such as any potentially hazardous chemicals in the new paint coatings, Contractor is responsible to assess potential worker and occupant exposures prior to the planned renovation project.

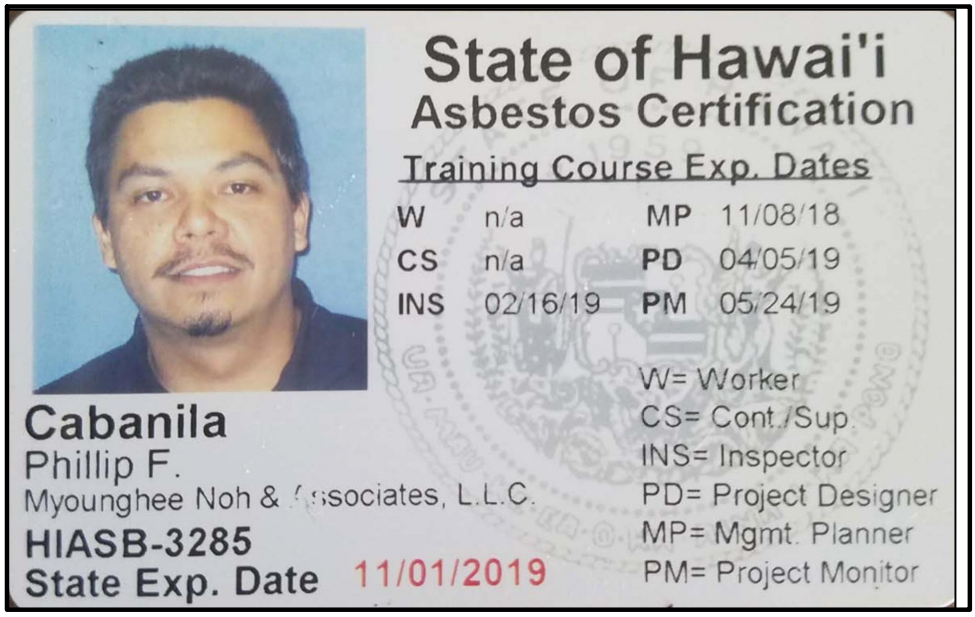
Material quantities provided in this report are based on visual approximations taken at the time of the survey only and should not be used for bidding purpose. It is the Contractor's responsibility to verify the material quantities and volume of waste prior to bidding.

Analytical results provided in this report do not meet the requirements for waste characterizations. Contractor must coordinate with permitted landfills for required characterizations.

APPENDIX A

INSPECTOR CERTIFICATIONS

Phillip Cabanila



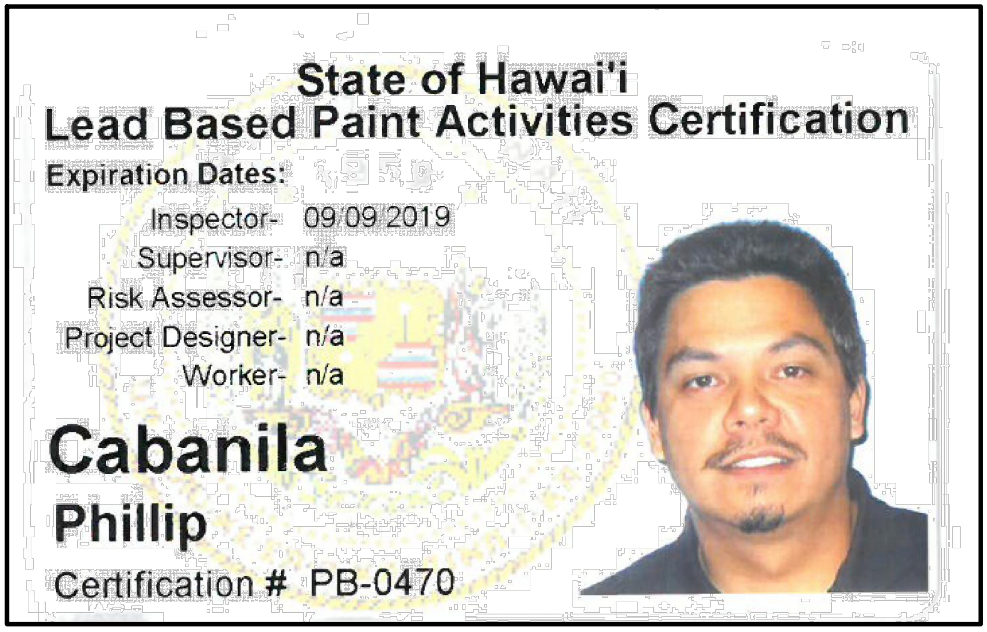
State of Hawai'i
Asbestos Certification

Training Course Exp. Dates

W	n/a	MP	11/08/18
CS	n/a	PD	04/05/19
INS	02/16/19	PM	05/24/19

W= Worker
CS= Cont./Sup.
INS= Inspector
PD= Project Designer
MP= Mgmt. Planner
PM= Project Monitor

Cabanila
Phillip F.
Myounghee Noh & Associates, L.L.C.
HIASB-3285
State Exp. Date 11/01/2019



State of Hawai'i
Lead Based Paint Activities Certification

Expiration Dates:

Inspector-	09/09/2019
Supervisor-	n/a
Risk Assessor-	n/a
Project Designer-	n/a
Worker-	n/a

Cabanila
Phillip
Certification # PB-0470

APPENDIX B

HOMOGENEOUS MATERIALS IDENTIFIED

AND SAMPLE TYPES COLLECTED

Homogeneous Materials Identified and Sample Types Collected

HM ID	Rooms	Locations	Material Color	Material	Substrate	Asb	Pb	Result
1	Biomedical Lab	Wall	Off-white	Skim coat Plaster	Concrete block	X		ND
2	Biomedical Lab, Hallway	Ceilings	White with pinholes	Acoustic tile	None	X		ND
3	Hallway	Wall	White	Wallpaper Skim coat	Concrete block	X		ND
4	Electrical Room	Ceiling, wall	Off-white	Painted drywall Joint compound	None	X		ND
5	Electrical Room	Floor	Off-white with streaks	12" x 12" Vinyl tile Mastic	Concrete	X		ND
6	Electrical Room	Walls	Lt. brown	Cove base Mastic Wallpaper	Drywall	X		ND
7	Biomedical Lab	Wall	Off-white	Paint	Concrete block		X	<40 mg/kg
8	Hallway	Wall	White	Paint	Wallpaper		X	<40 mg/kg
9	Electrical Room	Ceiling, wall	Off-white	Paint	Drywall		X	<40 mg/kg
10	Electrical Room	Wall	Off-white	Paint	Concrete block		X	<40 mg/kg
11	Electrical Room	Conduit	Off-white	Paint	Metal		X	<40 mg/kg

Abbreviations and Acronyms

Asb - Asbestos

HM ID - Homogeneous Material Identifier

mg/kg - milligrams per kilogram, equivalent to parts per million

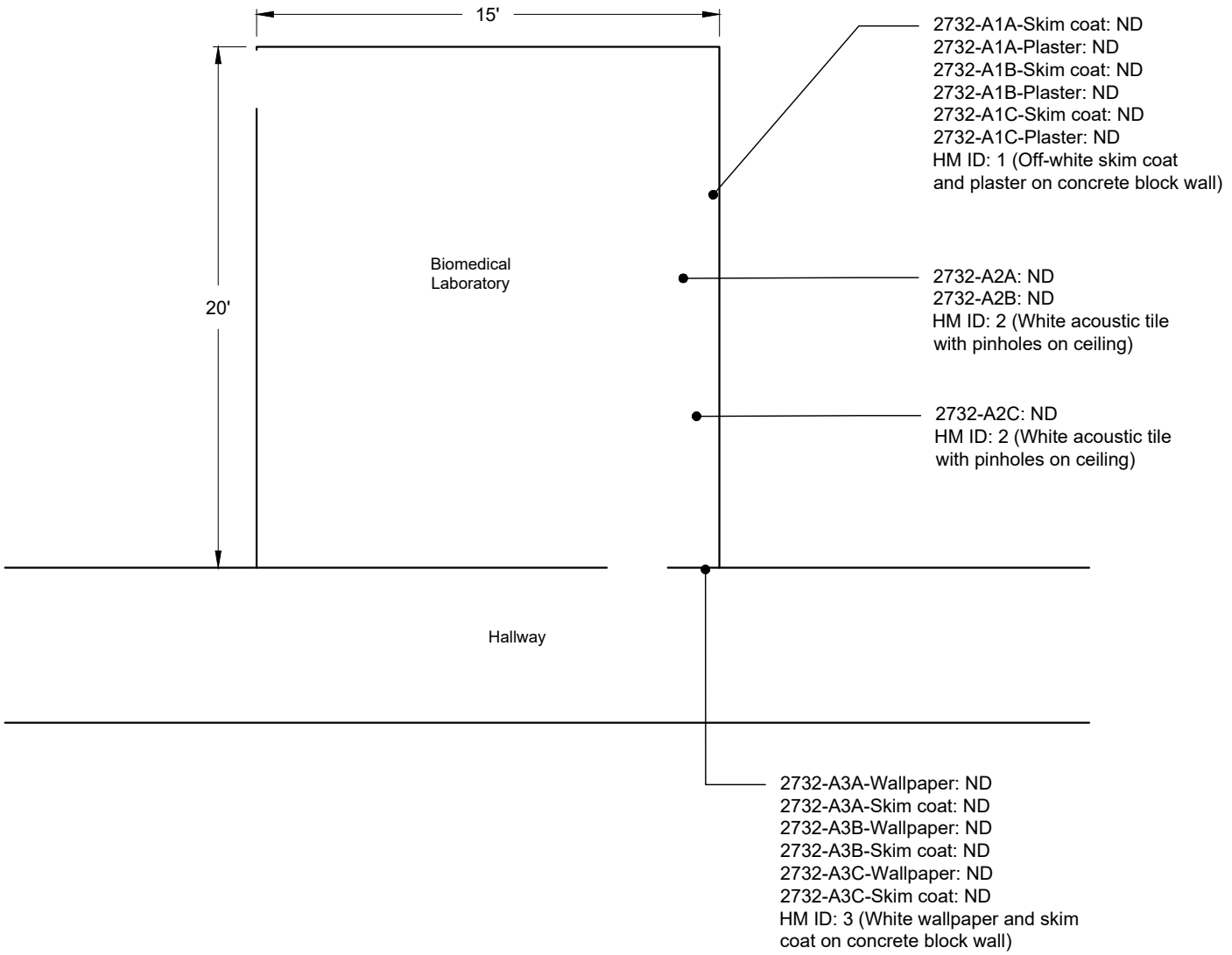
ND - Not Detected

Pb - Lead

APPENDIX C

SAMPLE AND HAZARDOUS MATERIAL LOCATION DRAWINGS

List of Drawings	
Asbestos and Lead Sample Locations Biomedical Laboratory and Hallway	C-1 – C-2
Asbestos and Lead Paint Sample Locations Electrical Room	C-3 – C-4
Soil Sampling Decision Unit Locations	C-5



Legend and Notes

HM ID - Homogeneous Material Identifier

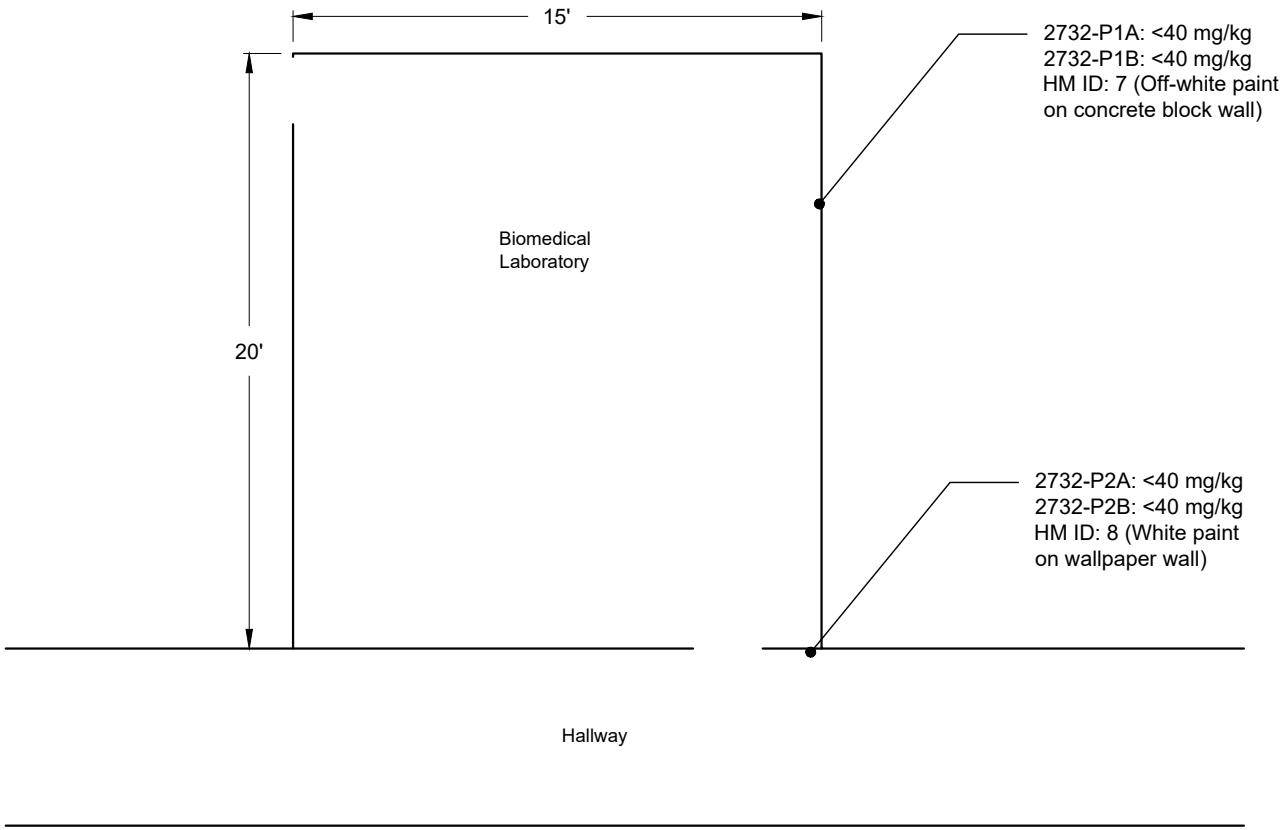
ND - None Detected

Myounghee Noh &
Associates, L.L.C.

Asbestos Sample Locations
Kona Community Hospital
Biomedical Laboratory and Hallway

Sheet Number

C - 1



Legend and Notes

HM ID - Hazardous Material Identifier

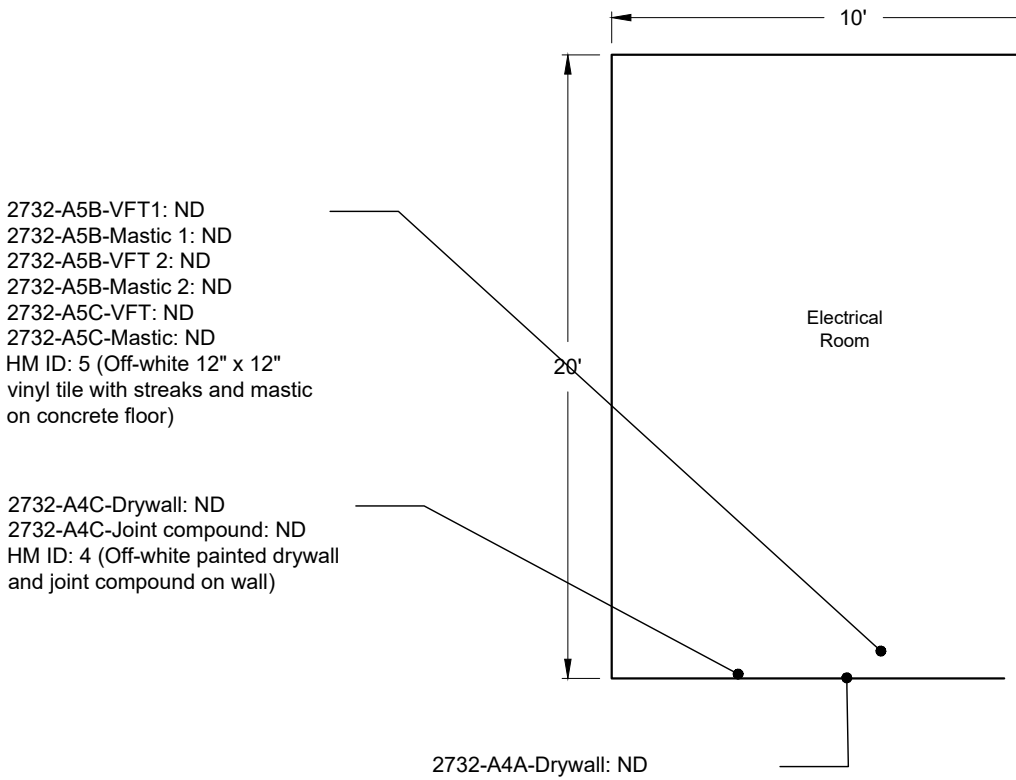
mg/kg - milligrams per kilogram - equivalent to parts per million

Myounghee Noh &
Associates, L.L.C.

Lead Sample Locations
Kona Community Hospital
Biomedical Laboratory and Hallway

Sheet Number

C - 2



2732-A5B-VFT1: ND
2732-A5B-Mastic 1: ND
2732-A5B-VFT 2: ND
2732-A5B-Mastic 2: ND
2732-A5C-VFT: ND
2732-A5C-Mastic: ND
HM ID: 5 (Off-white 12" x 12" vinyl tile with streaks and mastic on concrete floor)

2732-A4C-Drywall: ND
2732-A4C-Joint compound: ND
HM ID: 4 (Off-white painted drywall and joint compound on wall)

2732-A4A-Drywall: ND
2732-A4A-Joint compound: ND
2732-A4B-Drywall: ND
2732-A4B-Joint compound: ND
HM ID: 4 (Off-white painted drywall and joint compound on wall)

2732-A5A-VFT1: ND
2732-A5A-VFT 2: ND
2732-A5A-Mastic: ND
HM ID: 5 (Off-white 12" x 12" vinyl tile with streaks and mastic on concrete floor)

2732-A6A-Cove base: ND
2732-A6A-Mastic: ND
2732-A6A-Wallpaper: ND
2732-A6B-Cove base: ND
2732-A6B-Mastic: ND
HM ID: 6 (Lt. brown cove base and mastic on wallpaper and drywall wall)

2732-A6C-Cove base: ND
2732-A6C-Mastic: ND
HM ID: 6 (Lt. brown cove base and mastic on wallpaper and drywall wall)

Legend and Notes

HM ID - Homogeneous Material Identifier

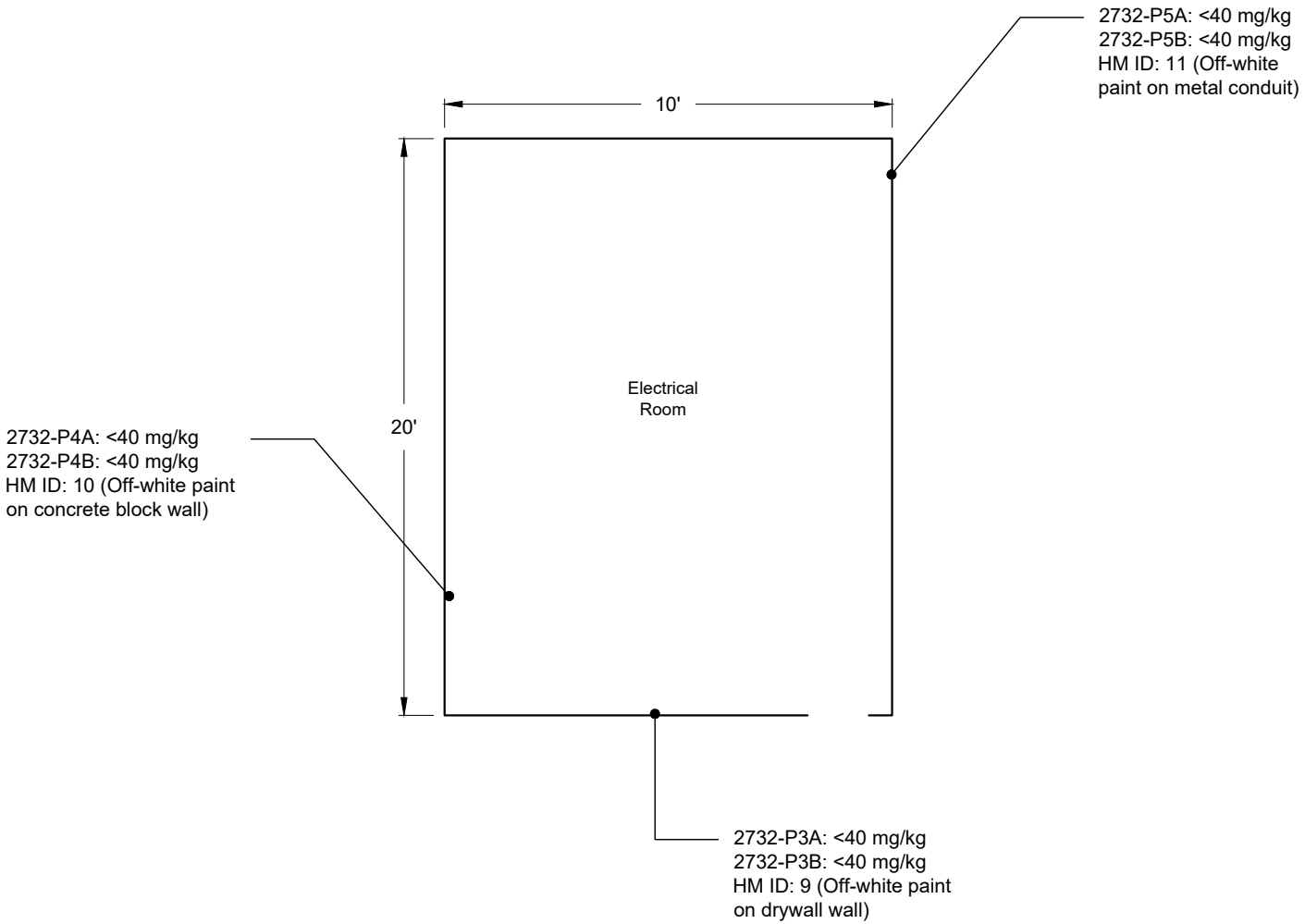
ND - None Detected

Myounghee Noh & Associates, L.L.C.

Asbestos Sample Locations
Kona Community Hospital
Electrical Room

Sheet Number

C - 3



Legend and Notes

HM ID - Hazardous Material Identifier

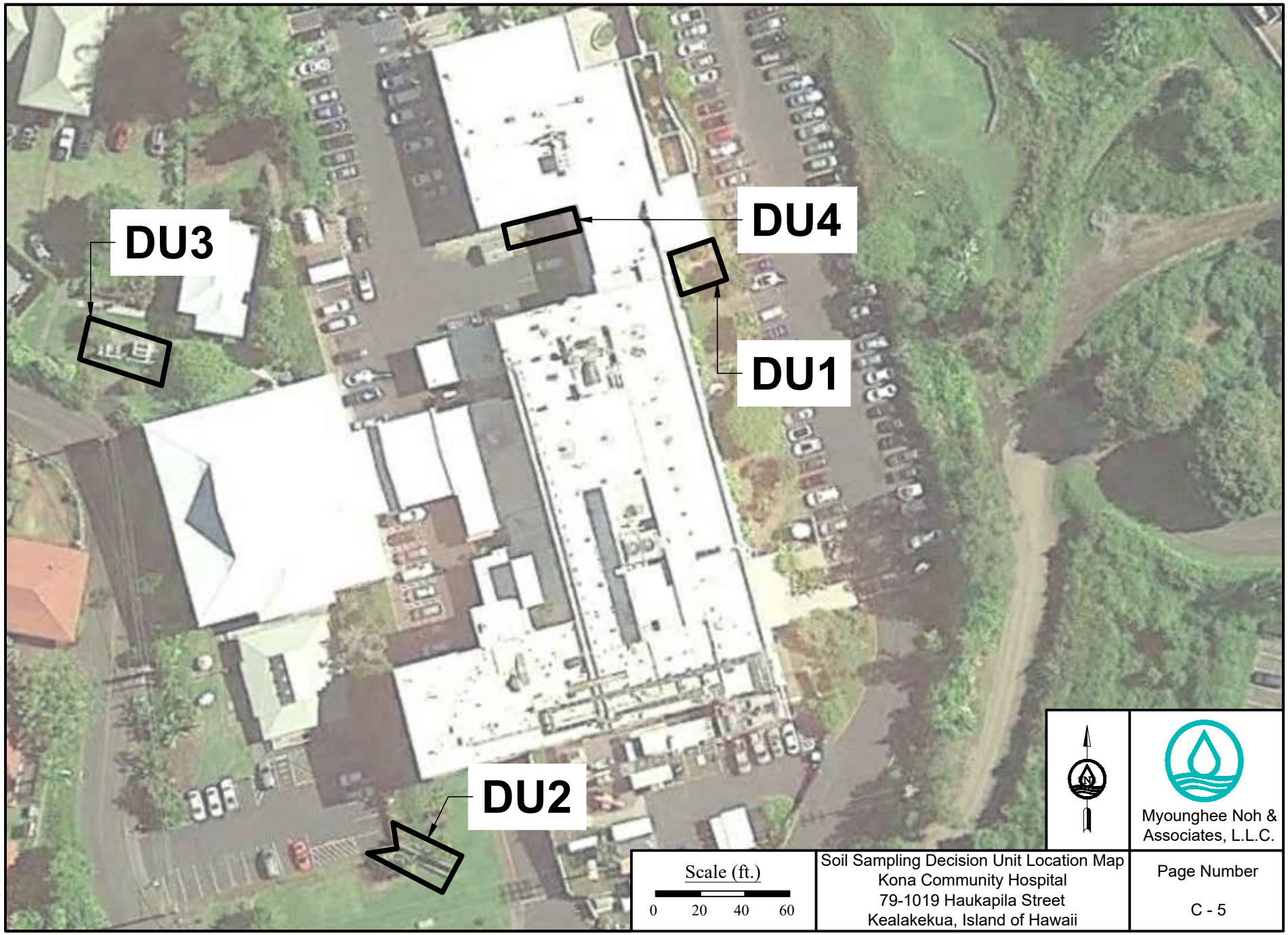
mg/kg - milligrams per kilogram - equivalent to parts per million

Myounghee Noh & Associates, L.L.C.

Lead Sample Locations
Kona Community Hospital
Electrical Room

Sheet Number

C - 4



Scale (ft.)
0 20 40 60

Soil Sampling Decision Unit Location Map
Kona Community Hospital
79-1019 Haukapila Street
Kealakekua, Island of Hawaii

Myounghee Noh & Associates, L.L.C.

APPENDIX D

PHOTOGRAPHS

HM ID: 1

Biomedical Laboratory
Off-white skim coat and plaster on concrete block wall.

Non-ACM
2732-A1A-Skim coat: ND
2732-A1A-Plaster: ND
2732-A1B-Skim coat: ND
2732-A1B-Plaster: ND
2732-A1C-Skim coat: ND
2732-A1C-Plaster: ND

HM ID: 2

Biomedical Laboratory
White acoustic tile with pinholes on ceiling.

Non-ACM
2732-A2A: ND
2732-A2B: ND
2732-A2C: ND

HM ID: 3

Hallway
White wallpaper and skim coat on concrete block wall.

Non-ACM
2732-A3A-Wallpaper: ND
2732-A3A-Skim coat: ND
2732-A3B-Wallpaper: ND
2732-A3B-Skim coat: ND
2732-A3C-Wallpaper: ND
2732-A3C-Skim coat: ND

HM ID: 4

Electrical Room
Off-white painted drywall and joint compound on wall.

Non-ACM
2732-A4A-Drywall: ND
2732-A4A-Joint compound: ND
2732-A4B-Drywall: ND
2732-A4B-Joint compound: ND
2732-A4C-Drywall: ND
2732-A4C-Joint compound: ND

HM ID: 5

Electrical Room
Off-white 12” x 12” vinyl tile with streaks and mastic on concrete floor.

Non-ACM
2732-A5A-VFT 1: ND
2732-A5A-VFT 2: ND
2732-A5A-Mastic: ND
2732-A5B-VFT 1: ND
2732-A5B-Mastic 1: ND
2732-A5B-VFT 2: ND
2732-A5B-Mastic 2: ND
2732-A5C-VFT: ND
2732-A5C-Mastic: ND

HM ID: 6

Electrical Room
Light born cove base, mastic, and wallpaper on drywall wall.

Non-ACM
2732-A6A-Cove base: ND
2732-A6A-Mastic: ND
2732-A6A-Wallpaper: ND
2732-A6B-Cove base: ND
2732-A6B-Mastic: ND
2732-A6C-Cove base: ND
2732-A6C-Mastic: ND
2732-A6C-Wallpaper: ND

HM ID: 7

Biomedical Laboratory
Off-white paint on concrete block wall.

Non-LCP
2732-P1A: <40 mg/kg
2732-P1B: <40 mg/kg

HM ID: 8

Hallway
White paint on drywall wall.

Non-LCP
2732-P2A: <40 mg/kg
2732-P2B: <40 mg/kg

HM ID: 9

Electrical Room
Off-white paint on drywall wall.

Non-LCP
2732-P3A: <40 mg/kg
2732-P3B: <40 mg/kg

HM ID: 10

Electrical Room
Off-white paint on concrete block wall.

Non-LCP
2732-P4A: <40 mg/kg
2732-P4B: <40 mg/kg

HM ID: 11

Electrical Room
Off-white paint on metal conduit.

Non-LCP
2732-P5A: <40 mg/kg
2732-P5B: <40 mg/kg

APPENDIX E

LABORATORY ANALYTICAL REPORTS

LA Testing

520 Mission Street South Pasadena, CA 91030
Tel/Fax: (323) 254-9960 / (323) 254-9982
http://www.LATesting.com / pasadenalab@latesting.com

LA Testing Order:	321926774
Customer ID:	32MYOU50
Customer PO:	
Project ID:	

Attention:	Phillip Cabanila	**Phone:**	(808) 937-1807
	Myounghee Noh & Associates, LLC	**Fax:**	
	99-1046 Iwaena Street	**Received Date:**	12/17/2019 10:50 AM
	Suite 210A	**Analysis Date:**	12/18/2019
	Aiea, HI 96701	**Collected Date:**	11/21/2019
Project:	2732_2 Kona Community Hospital Small Misc. Projects		

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
2732-A1A-Skim Coat *321926774-0001*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A1A-Plaster *321926774-0001A*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A1B-Skim Coat *321926774-0002*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A1B-Plaster *321926774-0002A*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A1C-Skim Coat *321926774-0003*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A1C-Plaster *321926774-0003A*	1 - OW, painted SC, CMU	Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A2A *321926774-0004*	2 - Wht w/ pinholes, AT	Gray/White Fibrous Heterogeneous	20% Cellulose 40% Min. Wool	20% Perlite 20% Non-fibrous (Other)	None Detected
2732-A2B *321926774-0005*	2 - Wht w/ pinholes, AT	Gray/White Fibrous Heterogeneous	20% Cellulose 40% Min. Wool	20% Perlite 20% Non-fibrous (Other)	None Detected
2732-A2C *321926774-0006*	2 - Wht w/ pinholes, AT	Gray/White Fibrous Heterogeneous	20% Cellulose 40% Min. Wool	20% Perlite 20% Non-fibrous (Other)	None Detected
2732-A3A-Wallpaper *321926774-0007*	3 - Wht painted, wallpaper W/SC	White/Beige Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
2732-A3A-Skim Coat *321926774-0007A*	3 - Wht painted, wallpaper W/SC	Gray Non-Fibrous Homogeneous	3% Glass	97% Non-fibrous (Other)	None Detected
2732-A3B-Wallpaper *321926774-0008*	3 - Wht painted, wallpaper W/SC	White/Beige Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
2732-A3B-Skim Coat *321926774-0008A*	3 - Wht painted, wallpaper W/SC	Gray Non-Fibrous Homogeneous	3% Glass	97% Non-fibrous (Other)	None Detected
2732-A3C-Wallpaper *321926774-0009*	3 - Wht painted, wallpaper W/SC	White/Beige Fibrous Homogeneous	90% Cellulose	10% Non-fibrous (Other)	None Detected
2732-A3C-Skim Coat *321926774-0009A*	3 - Wht painted, wallpaper W/SC	Gray Non-Fibrous Homogeneous	3% Glass	97% Non-fibrous (Other)	None Detected
2732-A4A-Drywall *321926774-0010*	4 - OW painted, DW	Brown/White Fibrous Heterogeneous	20% Cellulose 2% Glass	78% Non-fibrous (Other)	None Detected

Initial report from: 12/18/2019 12:07:05

LA Testing

520 Mission Street South Pasadena, CA 91030

Tel/Fax: (323) 254-9960 / (323) 254-9982

http://www.LATesting.com / pasadenalab@latesting.com

LA Testing Order:	321926774
Customer ID:	32MYOU50
Customer PO:	
Project ID:	

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
2732-A4A-Joint Compound *321926774-0010A*	4 - OW painted, DW	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A4B-Drywall *321926774-0011*	4 - OW painted, DW	Brown/White Fibrous Heterogeneous	20% Cellulose 2% Glass	78% Non-fibrous (Other)	None Detected
2732-A4B-Joint Compound *321926774-0011A*	4 - OW painted, DW	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A4C-Drywall *321926774-0012*	4 - OW painted, DW	Brown/White Fibrous Heterogeneous	20% Cellulose 2% Glass	78% Non-fibrous (Other)	None Detected
2732-A4C-Joint Compound *321926774-0012A*	4 - OW painted, DW	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5A-VFT 1 *321926774-0013*	5 - OW w/ streaks, 12"x12" VT w/ mastic	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5A-VFT 2 *321926774-0013A*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Brown/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5A-Mastic *321926774-0013B*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5B-VFT 1 *321926774-0014*	5 - OW w/ streaks, 12"x12" VT w/ mastic	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5B-Mastic 1 *321926774-0014A*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Brown/Gray Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5B-VFT 2 *321926774-0014B*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Brown/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5B-Mastic 2 *321926774-0014C*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Yellow/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5C-VFT *321926774-0015*	5 - OW w/ streaks, 12"x12" VT w/ mastic	White Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A5C-Mastic *321926774-0015A*	5 - OW w/ streaks, 12"x12" VT w/ mastic	Yellow Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6A-Cove Base *321926774-0016*	6 - Lt. brn, 4" CB, DW	Gray/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6A-Mastic *321926774-0016A*	6 - Lt. brn, 4" CB, DW	White/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6A-Wallpaper *321926774-0016B*	6 - Lt. brn, 4" CB, DW	Brown/Gray Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected
2732-A6B-Cove Base *321926774-0017*	6 - Lt. brn, 4" CB, DW	Gray/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected

Initial report from: 12/18/2019 12:07:05

LA Testing

520 Mission Street South Pasadena, CA 91030

Tel/Fax: (323) 254-9960 / (323) 254-9982

http://www.LATesting.com / pasadenalab@latesting.com

LA Testing Order:	321926774
Customer ID:	32MYOU50
Customer PO:	
Project ID:	

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos		Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**	**% Non-Fibrous**	**% Type**
2732-A6B-Mastic *321926774-0017A*	6 - Lt. brn, 4" CB, DW	White/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6C-Cove Base *321926774-0018*	6 - Lt. brn, 4" CB, DW	Gray/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6C-Mastic *321926774-0018A*	6 - Lt. brn, 4" CB, DW	White/Beige Non-Fibrous Homogeneous		100% Non-fibrous (Other)	None Detected
2732-A6C-Wallpaper *321926774-0018B*	6 - Lt. brn, 4" CB, DW	Brown/Gray Fibrous Homogeneous	98% Cellulose	2% Non-fibrous (Other)	None Detected

Analyst(s)

James Siepler (12)

John Talley (26)

Jerry Drapala Ph.D, Laboratory Manager
or Other Approved Signatory

EMSL maintains liability limited to cost of analysis. The above analyses were performed in general compliance with Appendix E to Subpart E of 40 CFR (previously EPA 600/M4-82-020 "Interim Method"), but augmented with procedures outlined in the 1993 ("final") version of the method. This report relates only to the samples reported above, and may not be reproduced, except in full, without written approval by EMSL. EMSL bears no responsibility for sample collection activities or analytical method limitations. Interpretation and use of test results are the responsibility of the client. All samples received in acceptable condition unless otherwise noted. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the federal government. EMSL recommends gravimetric reduction for all non-friable organically bound materials prior to analysis. Estimation of uncertainty is available on request.

Samples analyzed by LA Testing South Pasadena, CA NVLAP Lab Code 200232-0, CA ELAP 2283

Initial report from: 12/18/2019 12:07:05

OrderID: 321926774

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*):

#321926774

LATESTING
520 MISSION STREET
SOUTH PASADENA, CA 91030
PHONE: (800)-303-0047
FAX: (323)-254-9962

Company: Myounghee Noh & Associates, LLC	**EMSL-Bill to:** ☐ Same ☐ Different If Bill to is Different note instructions in Comments** *Third Party Billing requires written authorization from third party*
Street: 200 Kohola Street	
City: Hilo **State/Province:** HI	**Zip/Postal Code:** 96720 **Country:** United States of America
Report To (Name): Phillip Cabanila	**Telephone #:** 808-937-1807
Email Address: phillip@noh-associates.com	**Fax #:** **Purchase Order:**
Project Name/Number: 2732_2 Kona Community Hospital Small Misc. Projects	**Please Provide Results:** ☐ Fax ■ Email ☐ Mail
U.S. State Samples Taken: Hawaii	**Connecticut Samples:** ☐ Commercial ☐ Residential

Turnaround Time (TAT) Options* – Please Check

☐ 3 Hour ☐ 6 Hour ☐ 24 Hour ☐ 48 Hour ☐ 72 Hour ☐ 96 Hour ■ 1 Week ☐ 2 Week

**For TEM Air 3 hr through 6 hr, please call ahead to schedule.*There is a premium charge for 3 Hour TEM AHERA or EPA Level II TAT. You will be asked to sign an authorization form for this service. Analysis completed in accordance with EMSL's Terms and Conditions located in the Analytical Price Guide.*

PCM - Air ☐ Check if samples are from NY
- ☐ NIOSH 7400
- ☐ w/ OSHA 8hr. TWA

PLM - Bulk (reporting limit)
- ■ PLM EPA 600/R-93/116 (<1%)
- ☐ PLM EPA NOB (<1%)

Point Count
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)

Point Count w/Gravimetric
- ☐ 400 (<0.25%) ☐ 1000 (<0.1%)
- ☐ NYS 198.1 (friable in NY)
- ☐ NYS 198.6 NOB (non-friable-NY)
- ☐ NIOSH 9002 (<1%)

TEM – Air ☐ **4-4.5hr TAT (AHERA only)**
- ☐ AHERA 40 CFR, Part 763
- ☐ NIOSH 7402
- ☐ EPA Level II
- ☐ ISO 10312

TEM - Bulk
- ☐ TEM EPA NOB
- ☐ NYS NOB 198.4 (non-friable-NY)
- ☐ Chatfield SOP
- ☐ TEM Mass Analysis-EPA 600 sec. 2.5

TEM – Water: EPA 100.2
- Fibers >10µm ☐ Waste ☐ Drinking
- All Fiber Sizes ☐ Waste ☐ Drinking

TEM- Dust
- ☐ Microvac - ASTM D 5755
- ☐ Wipe - ASTM D6480
- ☐ Carpet Sonication (EPA 600/J-93/167)

Soil/Rock/Vermiculite
- ☐ PLM CARB 435 - A (0.25% sensitivity)
- ☐ PLM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - B (0.1% sensitivity)
- ☐ TEM CARB 435 - C (0.01% sensitivity)
- ☐ TEM Qual. via Filtration Technique
- ☐ TEM Qual. via Drop-Mount Technique

Other:
- ☐

■ **Check For Positive Stop – Clearly Identify Homogenous Group** **Filter Pore Size (Air Samples):** ☐ 0.8µm ☐ 0.45µm

Samplers Name: Phillip Cabanila **Samplers Signature:**

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
2732-A1A	Asbestos Bulk	Bulk	11/21/2019 1030
2732-A6C	Asbestos Bulk	Bulk	

Client Sample # (s): 2732-A1A Bulk - 2732-A6C **Total # of Samples:**

Relinquished (Client): **Date:** **Time:**

Received (Lab): DConnolly EFedEx **Date:** 12-17-19 **Time:** 10:50

Comments/Special Instructions:
Stop Positive

LA TESTING

Asbestos Chain of Custody

EMSL Order Number (*Lab Use Only*):

#321926774

EMSL Analytical, Inc.
520 Mission Street
South Pasadena, CA 91030
Phone: (800)-303-0047
Fax: (323)-254-9962

Additional Pages of the Chain of Custody are only necessary if needed for additional sample information

Sample #	Sample Description	Volume/Area (Air) HA # (Bulk)	Date/Time Sampled
2732-A1A	Asbestos Bulk	Bulk	11/21/2019
2732-A6C	Asbestos Bulk	Bulk	

***Comments/Special Instructions:**

Stop Positive

#321926774

Hazardous Homogeneous Materials and Sampling Survey Field Form: Asbestos

Project Number: 2732_2 Location: Kona Community Hospital Inspector Initials: PC/AC Survey Dates and Times: 11/21-22/2019

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
1	MAIN	B	BIOMED ~~LAB~~	WALL	OW	PAINTED SC	CMU	(G) F P	(Y) N / TSI (S) M	100 OF POTENTIAL DISTURBED AREA, 700 TOTAL	TAN

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 1 A	BIOMED ENG ↓	WALL ↓	0001	
2732-A 1 B			0002	
2732-A 1 C			0003	
			0004	

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
2	BASEMENT 4/ MAIN	B	BIOMED ENG, HALL	CEILING	WHT W/ PINHOLES	AT	NA	(G) F P	(Y) N / TSI S (M)	500	YELLOW-ORANGE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 2 A	BIOMED ENG ↓	CEILING ↓	0003	
2732-A 2 B				
2732-A 2 C				

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
3	MAIN	B4	HALL	WALL	~~·~~ WHT PAINTED	~~SC~~ WALLPAPER W/ SC	CMU	(G) F P	(Y) N / TSI (S) M	5	BLUE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 3 A	HALL ↓	WALL	0007-0009	
2732-A 3 B				
2732-A 3 C				

#3219267 74

Hazardous Homogeneous Materials and Sampling Survey Field Form: Asbestos

Project Number: 2732_2 Location: Kona Community Hospital Inspector Initials: PC/AC Survey Dates and Times: 11/21-22/2019

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
4	MAIN	-	ELEC.	WALLS, CEILINGS	OW PAINTED	DW	NA	(G) F P	(Y) N / TSI S (M)	200	BROWN

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 4 A	ELEC	WALL	0010-0015	
2732-A 4 B	↓	↓		
2732-A 4 C				

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
5	MAIN	-	ELEC	FLR	OW W/STEAKS & MASTIC	12"x12" VT w/ MASTIC	CC	(G) F P	Y (N) / TSI S (M)	100	LT. BLUE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 5 A	ELEC	FLR	0012	
2732-A 5 B	↓	↓		
2732-A 5 C				

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Friable ACM / Type	Area Sq. ft or L. ft	Hatch Color
6	MAIN	-	ELEC	WALLS	LT. BRN	4" CB	DW	(G) F P	Y (N) / TSI S (M)	40	ORANGE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-A 6 A	ELEC	WALL	0012	
2732-A 6 B	↓	↓		
2732-A 6 C				

Hawaii Analytical Laboratory
ANALYTICAL REPORT

Monday, December 23, 2019

Ms. Myounghee Noh
Myounghee Noh & Associates
99-1046 Iwaena St. Suite 210A
Aiea HI 96701

Phone Number: (808) 484-9214
Facsimile: (808) 484-4660
Email: m_noh@noh-associates.com

Lab Job No: 201910745
Date Submitted: 12/17/2019
Your Project: 2732_2, Kona Community Hospital Small Misc. Projects, 11/21/19

Lead, total (paint chips)

NIOSH Method: 7082m LEAD by FAAS

Sample No.	Your Sample Description	Results	Units	Date Analyzed
201963910	**2732-P1A**	< 40	mg/kg	12/20/2019
Comments				
201963911	**2732-P1B**	< 40	mg/kg	12/20/2019
Comments				
201963912	**2732-P2A**	< 40	mg/kg	12/20/2019
Comments				
201963913	**2732-P2B**	< 40	mg/kg	12/20/2019
Comments				
201963914	**2732-P3A**	< 40	mg/kg	12/20/2019
Comments				
201963915	**2732-P3B**	< 40	mg/kg	12/20/2019
Comments				
201963916	**2732-P4A**	< 40	mg/kg	12/20/2019
Comments				
201963917	**2732-P4B**	< 40	mg/kg	12/20/2019
Comments				

Ms. Myounghee Noh
Myounghee Noh & Associates
99-1046 Iwaena St. Suite 210A
Aiea HI 96701

Phone Number: (808) 484-9214
Facsimile: (808) 484-4660
Email: m_noh@noh-associates.com

Lab Job No: 201910745
Date Submitted: 12/17/2019
Your Project: 2732_2, Kona Community Hospital Small Misc. Projects, 11/21/19

Lead, total (paint chips)

NIOSH Method: 7082m LEAD by FAAS

Sample No.	Your Sample Description	Results	Units	Date Analyzed
201963918	**2732-P5A**	< 40	mg/kg	12/20/2019
Comments				
201963919	**2732-P5B**	< 40	mg/kg	12/20/2019
Comments				

All Quality Control data are acceptable unless otherwise noted.
MRL for lead air is 5ug.
MRL for lead wipe is 10ug.
MRL for lead paint or soil is 40 mg/kg for a 0.25g sample.

General Comments
The sample[s] analysis subject of this analytical report were conducted in general accordance with the procedures associated with the "analytical method" referenced above. Modifications to this methodology may have been made based upon the analyst's professional judgment and / or sample matrix effects encountered. The analysis of sample relates only to the sample analyzed, and may or may not be representative of the original source of the material submitted for our analysis. All analysts participate in interlaboratory quality control testing to continuously document profiency. This report is not to be duplicated except in full without the expressed written permission of Hawaii Analytical Laboratory. This report should not be construed as an endorsement for a product or a service by the AIHA LAP, LLC or any affiliated organizations. Sample and associated sampling / collection data is reported as provided by client. TWA values have been calculated based on information supplied by the client that the laboratory has not independently verified. Results have not been corrected for blank determinations unless noted in remarks. Unless otherwise indicated the sample condition at the time of receipt was acceptable.

Results and Symbols Definitions
> This testing result is greater than the numerical value listed.
< This testing result is less than the numerical value listed.
# = Analytical methods marked with an "#" are not within our AIHA LAP, LLC Scope of Accreditation.
MRL = Method Reporting Limit.

Jennifer Hsu Liao
Laboratory Manager

HAWAII ANALYTICAL LABORATORY, LLC
3615 Harding Avenue, Suite 308
Honolulu, HI 96816
Ph: 808-735-0422 - Fax: 808-735-0047
www.analyzehawaii.com

☐ New Client?

Report To*	Phillip Cabanila
Company	Myounghee Noh & Associates, L.L.C.
Address*	200 Kohola Street Hilo, Hawaii 96720
Phone / Cell No.*	808-937-1807
Report results to	Phillip Cabanila
via email or fax	phillip@noh-associates.com

Invoice To*	Kealohi Serrao
Company	Myounghee Noh & Associates, L.L.C.
Address*	91-1046 Iwaena Street Suite 210 A Aiea, Hawaii 96701
Phone / Cell No.*	
Purchase Order No.	
Email Invoice To	kealohi@noh-associates.com

Need Results By*:
- ☑ 5 Working Days (WD)
- ☐ 4 WD
- ☐ 3 WD
- ☐ 2 WD
- ☐ 24 hours
- ☐ 6 hours or less
- ☐ 4 hours or less
- ☐ 1-2 hours

Site/Project Name: Kona Community Hospital Small Misc. Projects

Client Project No.: 2732_2

Sampled By: Phillip Cabanila

Comments / Special Instructions: ☐ verbal results needed?

PLM POSITIVE STOP Instructions:
- ☐ Positive stop per SAMPLE
- ☐ Positive stop per LAYER

LAB USE ONLY
Lab Report No.: 201910745

	Sample Identification / Description* (Maxmium of 30 Characters)	Date Sampled* (mm/dd/yy)	Collection Medium	Sample Area / Air Volume	Analysis Requested*	Method Reference	Lab ID
1	2732-P1A	11/21/2019	Pb Chips	KCH	Pb Chips	7082m	201963910
2	P1B						201963911
3	P2A						201963912
4	P2B						201963913
5	P3A						201963914
6	P3B						201963915
7	P4A						201963916
8	P4B						201963917
9	P5A						201963918
10	P5B						201963919
11							
12							

Relinquished By (Print and Sign)	Date/Time	Received By (Print and Sign)	Date/Time
PHILLIP CABANILA		Corin Forrest	12-17-19 A10:04 RCVD

Sample description can be paint chips, concrete, specific sample collection location, etc...
If matrix is 'soil', please specify if it is a FOREIGN SOIL SAMPLE (outside Hawaii) in the comment section.
All samples submitted are subject to Hawaii Analytical Laboratory terms and conditions.
***Required fields, failure to complete these fields may result in a delay in your samples being processed.**

☐ via FedEx ☐ via USPS ☐ via .....

Page: 1 of 1

Hazardous Homogeneous Materials and Sampling Survey Field Form: Lead Paint

Project Number: **2732_2** Location: **Kona Community Hospital** Inspector Initials: **PC/AC** Survey Dates and Times: **11/21-22/19**

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
7	BASEMENT 4/ MAIN	1	BIOMED ENG	WALL	OW	P	CMU	(G) F P	100 OF POTENTIAL DISTURBED AREA	TAN

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P 1 A	BIOMED	WALL	0001-0004	700 SQ. FT.
2732-P 1 B	ENG	↓		

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
8	MAIN	B4	HALL	WALL	WHT	P	WALLPAPER	(G) F P	5	BLUE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P 2 A	HALL	WALL	0007-0009	
2732-P 2 B	↓	↓		

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
9	MAIN	-	ELEC	WALLS, CEILING	OW	P	DW	(G) F P	200	BROWN

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P 3 A	ELEC	WALL	0010-0015	
2732-P 3 B	↓			

10745

Hazardous Homogeneous Materials and Sampling Survey Field Form: Lead Paint

Project Number: **2732_2** Location: **Kona Community Hospital** Inspector Initials: **PC/AC** Survey Dates and Times: **11/21-22/19**

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
10	MAIN	-	ELEC	WALL	OW	P	CMU	(G) F P	100	RED-ORANGE

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P 4 A	ELEC	WALL	0011, 0013, 0015	
2732-P 4 B	↓	↓		

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
11	MAIN	-	ELEC	CONDUIT	OW	P	M	(G) F P	100	GREEN

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P 5 A	ELEC	CONDUIT	0012	
2732-P 5 B	↓	↓		

HM ID	Building	Flr.	Rooms	Locations	Material Color	Material	Substrate	Condition	Area Sq. ft or L. ft	Hatch Color
								G F P		

Sample ID	Room Sampled	Sample Location	PIC ID	Notes
2732-P A				
2732-P B				

10745

ACCU LABORATORY

12524 130th Lane NE
Kirkland WA 98034

Tel: (425) 214-5858
(425) 214-5868
Email: lisa@accu-lab.com
website: www.accu-lab.com

Analytical Report

Client	**Advanced Analytical Laboratory**	**Acculab WO#**	**19-AL1206-1**
	544 Ohohia Street #10		
	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Organochlorine Pesticides in Soil by EPA 8081B/3550C

Accu Lab Batch# AL120619-3

Client sample ID					**2732-DU1-A**	**2732-DU1-A-1**	**2732-DU1-A-2**	**2732-DU1-B**	**2732-DU2-A**
Lab ID	**MRL**	**Unit**	**MTH BLK**	**LCS**	19-AL1206-1-1	19-AL1206-1-2	19-AL1206-1-3	19-AL1206-1-4	19-AL1206-1-5
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil
Date Extracted			12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019
α-BHC	1.0	ug/kg	nd		nd	nd	nd	nd	nd
γ-BHC (Lindane)	1.0	ug/kg	nd	115%	nd	nd	nd	nd	nd
β-BHC	1.0	ug/kg	nd		nd	nd	nd	nd	nd
Heptachlor	1.0	ug/kg	nd	122%	nd	nd	nd	nd	nd
δ-BHC	1.0	ug/kg	nd		nd	nd	nd	nd	nd
Aldrin	1.0	ug/kg	nd	105%	nd	nd	nd	nd	nd
Heptachlor Epoxide	1.0	ug/kg	nd		nd	nd	nd	nd	nd
Endosulfan I	5.0	ug/kg	nd		nd	nd	nd	nd	nd
4,4'-DDE	2.0	ug/kg	nd		nd	nd	nd	nd	nd
Dieldrin	1.0	ug/kg	nd	92%	nd	nd	nd	nd	nd
Endrin	1.0	ug/kg	nd	137%	nd	nd	nd	nd	nd
4,4'-DDD	5.0	ug/kg	nd		nd	nd	nd	nd	nd
Endosulfan II	5.0	ug/kg	nd		nd	nd	nd	nd	nd
4,4'-DDT	5.0	ug/kg	nd	94%	nd	nd	nd	nd	nd
Endrin Aldehyde	15.0	ug/kg	nd		nd	nd	nd	nd	nd
Methoxychlor	5.0	ug/kg	nd		nd	nd	nd	nd	nd
Endrin Ketone	5.0	ug/kg	nd		nd	nd	nd	nd	nd
Endosulfan Sulfate	10	ug/kg	nd		nd	nd	nd	nd	nd
Technical Chlordane	0.10	**mg/kg**	nd		nd	nd	nd	nd	nd
Toxaphene	0.20	**mg/kg**	nd		nd	nd	nd	nd	nd
Surrogate Recoveries									
Decachlorobiphenyl			90%	89%	98%	101%	100%	102%	117%
Tetrachloro-m-xylene			95%	93%	90%	98%	104%	93%	95%

Acceptable Recovery Limits:

Surrogates	*50-150%*
LCS/MS/MSD	*50-150%*
Acceptable RPD limit:	*30%*

ACCU LABORATORY

12524 130th Lane NE
Kirkland WA 98034

Tel: (425) 214-5858
(425) 214-5868
Email: lisa@accu-lab.com
website: www.accu-lab.com

Analytical Report

Client	**Advanced Analytical Laboratory**	**Acculab WO#**	**19-AL1206-1**
	544 Ohohia Street #10		
	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Organochlorine Pesticides in Soil by EPA 8081B/3550C

Accu Lab Batch# AL120619-3

Client sample ID			**2732-DU2-B**	**2732-DU3-A**	**2732-DU3-B**	**2732-DU4-A**	**2732-DU4-B**
Lab ID	**MRL**	**Unit**	19-AL1206-1-6	19-AL1206-1-7	19-AL1206-1-8	19-AL1206-1-9	19-AL1206-1-10
Matrix			Soil	Soil	Soil	Soil	Soil
Date Extracted			12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019
α-BHC	1.0	ug/kg	nd	nd	nd	nd	nd
γ-BHC (Lindane)	1.0	ug/kg	nd	nd	nd	nd	nd
β-BHC	1.0	ug/kg	nd	nd	nd	nd	nd
Heptachlor	1.0	ug/kg	nd	nd	nd	nd	nd
δ-BHC	1.0	ug/kg	nd	nd	nd	nd	nd
Aldrin	1.0	ug/kg	nd	nd	nd	nd	nd
Heptachlor Epoxide	1.0	ug/kg	nd	nd	nd	nd	nd
Endosulfan I	5.0	ug/kg	nd	nd	nd	nd	nd
4,4'-DDE	2.0	ug/kg	nd	nd	nd	nd	nd
Dieldrin	1.0	ug/kg	nd	nd	nd	nd	nd
Endrin	1.0	ug/kg	nd	nd	nd	nd	nd
4,4'-DDD	5.0	ug/kg	nd	nd	nd	nd	nd
Endosulfan II	5.0	ug/kg	nd	nd	nd	nd	nd
4,4'-DDT	5.0	ug/kg	nd	nd	nd	nd	nd
Endrin Aldehyde	15.0	ug/kg	nd	nd	nd	nd	nd
Methoxychlor	5.0	ug/kg	nd	nd	nd	nd	nd
Endrin Ketone	5.0	ug/kg	nd	nd	nd	nd	nd
Endosulfan Sulfate	10	ug/kg	nd	nd	nd	nd	nd
Technical Chlordane	0.10	**mg/kg**	nd	nd	nd	nd	nd
Toxaphene	0.20	**mg/kg**	nd	nd	nd	nd	nd
Surrogate Recoveries							
Decachlorobiphenyl			108%	99%	97%	82%	84%
Tetrachloro-m-xylene			73%	84%	82%	73%	73%

Acceptable Recovery Limits:

Surrogates	*50-150%*
LCS/MS/MSD	*50-150%*
Acceptable RPD limit:	*30%*

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Analytical Report

Client	**Advanced Analytical Laboratory**	**Acculab WO#**	**19-AL1206-1**
	544 Ohohia Street #10		
	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Organochlorine Pesticides in Soil by EPA 8081B/3550C

Accu Lab Batch# AL120619-3

Client sample ID			**MS** **K-Barn**	**MSD** **K-Barn**	**RPD** **K-Barn**
Lab ID	**MRL**	**Unit**	19-AL1206-3-1	19-AL1206-3-1	19-AL1206-3-1
Matrix			Soil	Soil	Soil
Date Extracted			12/6/2019	12/6/2019	12/6/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019
α-BHC	1.0	ug/kg			
γ-BHC (Lindane)	1.0	ug/kg	113%	115%	2%
β-BHC	1.0	ug/kg			
Heptachlor	1.0	ug/kg	94%	96%	2%
δ-BHC	1.0	ug/kg			
Aldrin	1.0	ug/kg	105%	108%	3%
Heptachlor Epoxide	1.0	ug/kg			
Endosulfan I	5.0	ug/kg			
4,4'-DDE	2.0	ug/kg			
Dieldrin	1.0	ug/kg	71%	72%	1%
Endrin	1.0	ug/kg	99%	100%	1%
4,4'-DDD	5.0	ug/kg			
Endosulfan II	5.0	ug/kg			
4,4'-DDT	5.0	ug/kg	77%	71%	8%
Endrin Aldehyde	15.0	ug/kg			
Methoxychlor	5.0	ug/kg			
Endrin Ketone	5.0	ug/kg			
Endosulfan Sulfate	10	ug/kg			
Technical Chlordane	0.10	**mg/kg**			
Toxaphene	0.20	**mg/kg**			
Surrogate Recoveries					
Decachlorobiphenyl			91%	91%	
Tetrachloro-m-xylene			90%	82%	

Acceptable Recovery Limits:

Surrogates	*50-150%*
LCS/MS/MSD	*50-150%*
Acceptable RPD limit:	*30%*

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Analytical Report

Client	**Advanced Analytical Laboratory**	**Acculab WO#**	**19-AL1206-1**
	544 Ohohia Street #10		
	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Metals in Soil by EPA 6020B/EPA3050B

Accu Lab Batch# AL120919-11

Client sample ID					**2732-DU1-A**	**2732-DU1-A-1**	**2732-DU1-A-2**	**2732-DU1-B**	**2732-DU2-A**
Lab ID	**MRL**	**Unit**	**MTH BLK**	**LCS**	19-AL1206-1-1	19-AL1206-1-2	19-AL1206-1-3	19-AL1206-1-4	19-AL1206-1-5
Matrix			Soil	Soil	Soil	Soil	Soil	Soil	Soil
Date Digested			12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019
Arsenic (As)	2.0	mg/kg	nd	102%	3.4	nd	4.4	5.4	22
Barium (Ba)	2.0	mg/kg	nd	106%	36	67	80	80	56
Cadmium (Cd)	1.0	mg/kg	nd	106%	nd	nd	nd	nd	nd
Chromium (Cr)	2.0	mg/kg	nd	102%	31	65	51	52	99
Lead (Pb)	1.0	mg/kg	nd	108%	3.1	2.8	4.8	5.5	8.5
Selenium (Se)	2.0	mg/kg	nd	102%	nd	nd	nd	nd	nd
Silver (Ag)	1.0	mg/kg	nd	106%	nd	nd	nd	nd	nd
Mercury (Hg)	0.50	mg/kg	nd	101%	nd	nd	nd	nd	nd

Acceptable Recovery Limits:

LCS	*80-120%*
MS/MSD	*75-125%*
Acceptable RPD limit:	*20%*

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	544 Ohohia Street #10		
	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Metals in Soil by EPA 6020B/EPA3050B

Accu Lab Batch# AL120919-11

Client sample ID			**2732-DU2-B**	**2732-DU3-A**	**2732-DU3-B**	**2732-DU4-A**	**2732-DU4-B**
Lab ID	**MRL**	**Unit**	19-AL1206-1-6	19-AL1206-1-7	19-AL1206-1-8	19-AL1206-1-9	19-AL1206-1-10
Matrix			Soil	Soil	Soil	Soil	Soil
Date Digested			12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019	12/10/2019	12/10/2019
Arsenic (As)	2.0	mg/kg	18	9.9	7.7	nd	nd
Barium (Ba)	2.0	mg/kg	57	34	34	19	11
Cadmium (Cd)	1.0	mg/kg	nd	nd	nd	nd	nd
Chromium (Cr)	2.0	mg/kg	100	76	63	34	38
Lead (Pb)	1.0	mg/kg	9.0	6.8	5.7	nd	nd
Selenium (Se)	2.0	mg/kg	nd	nd	nd	nd	nd
Silver (Ag)	1.0	mg/kg	nd	nd	nd	nd	nd
Mercury (Hg)	0.50	mg/kg	nd	nd	nd	nd	nd

Acceptable Recovery Limits:

LCS	*80-120%*
MS/MSD	*75-125%*
Acceptable RPD limit:	*20%*

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	Honolulu, HI, 96819	Date Sampled	1121-22/2019
Project Manager	Uwe Baumgartner/ Elisa Young	Date Received	12/6/2019
Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Metals in Soil by EPA 6020B/EPA3050B

Accu Lab Batch# AL120919-11

Client sample ID	**MRL**	**Unit**	**MS 2732-DU1-A**	**MSD 2732-DU1-A**	**RPD 2732-DU1-A**
Lab ID			19-AL1206-1-1	19-AL1206-1-1	19-AL1206-1-1
Matrix			Soil	Soil	Soil
Date Digested			12/9/2019	12/9/2019	12/9/2019
Date Analyzed			12/10/2019	12/10/2019	12/10/2019
Arsenic (As)	2.0	mg/kg	94%	98%	4%
Barium (Ba)	2.0	mg/kg	110%	111%	1%
Cadmium (Cd)	1.0	mg/kg	99%	108%	9%
Chromium (Cr)	2.0	mg/kg	83%	84%	2%
Lead (Pb)	1.0	mg/kg	106%	113%	6%
Selenium (Se)	2.0	mg/kg	117%	117%	0.2%
Silver (Ag)	1.0	mg/kg	116%	115%	0.4%
Mercury (Hg)	0.50	mg/kg	109%	110%	1%

Acceptable Recovery Limits:

LCS	*80-120%*
MS/MSD	*75-125%*
Acceptable RPD limit:	*20%*

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	Honolulu, HI, 96819	Date Sampled	1121-22/2019
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Project Name	**2732 Kona Community Hospital Misc. Small Projects**	Date Reported	12/11/2019
Client Project#			
Project#	**U903**		

Data Qualifiers and Comments:

Results reported on dry-weight basis for soil samples.

MRL- Method Reporting Limit
nd- Indicates the analyte is not detected at the listing reporting limit.
C- Coelution with other compounds.
M- % Recovery of surrogate, MS/MSD is out of the acceptable limit due to matrix effect.
B- Indicates the analyte is detected in the method blank associated with the sample.
J- The analyte is detected at below the reporting limit.
E- The result reported exceeds the calibration range, and is an estimate.
D- Sample required dilution due to matrix. Method Reporting Limits were elevated due to dilutions.
H- Sample was received or analyzed past holding time
Q- Sample was received with head space, improper preserved or above recommended temperature.
I- Due to insufficient sample, LCS/LCS DUP were analyzed in place of MS/MSD.
R- The recovery of this analyte in QC sample failed high, but the analyte was not detected in all related samples. No action was taken.
R-1- The RPD value for the MS/MSD was outside of QC acceptance limits however both recoveries were acceptable. All related samples were "nd". No action was taken.
R-2- The recovery of the surogate in sample failed high, but all related analytes were not detected in the sample. No action was taken.

DIVISION 2 - SITE CONSTRUCTION

SECTION 02050 - DEMOLITION, REMOVAL AND RELOCATION

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all materials, labor and equipment necessary to demolish and remove all concrete slabs, structures, pavement, walls, and all other existing improvements as shown in the drawings and as specified herein.

B. Condition at Site

1. Visit the site, examine and note all existing conditions and extent of work involved for completion of this work.

2. Accept obvious conditions of existing premises on date of bid opening as part of the work, even though they may not be indicated on the drawings or may vary therefrom.

3. Exercise every precaution to preserve and protect from damage all existing walks, structures, plants, trees, walls, private and public utilities above and below ground, etc., that are to remain. Repair any damage to the satisfaction of the Project Engineer.

C. Permits, Notices, Etc.

1. Procure and pay for all necessary permits or certificates required in connection with this work.

2. Serve proper notices and consult with the Project Engineer regarding any temporary disconnections of electrical or other utility lines which may interfere with this work. Properly disconnect all such lines where necessary before commencing with the work.

D. Existing Utility Lines

1. Existence of underground utility lines other than those shown is not definitely known. The Contractor shall tone the areas to be excavated or trenched through to determine if existing utility lines are present. Should any be encountered, immediately notify the Project Engineer and follow his direction as to procedure at no additional cost to the State of Hawaii.

PART 2 - PRODUCTS

2.01 MATERIALS

A. None

PART 3 - EXECUTION

3.01 DEMOLITION, REMOVAL AND RELOCATION

A. Execute all work in an orderly manner, with proper safety precautions observed at all times. Provide warning signs, lights, barricades, etc. as required or as directed by the Project Engineer.

B. Demolish all improvements indicated on the drawings completely on the site. Break up and remove pavement in areas noted on the drawings. Since the work involves separate areas on the site, demolition shall be done at each work site immediately before commencing the work at that site. Demolished areas shall not be left inactive for longer than seven (7) days.

C. Sawcutting shall be with a wet saw only. No dry cutting shall be allowed. Water rates shall be per saw manufacturer's recommendations. All sawcutting slurry shall be contained and disposed of properly. Cut portions of concrete curbs, sidewalks and pavements which are to remain to a depth of 1-1/2" with a power-driven abrasive saw. The saw cut shall be neat and true with no shattering or spalling of the portion of concrete to remain in place or to be joined with the new work.

D. Relocate existing improvements as indicated on the drawings.

E. Removed material having no salvage value, as determined by the Project Engineer, shall become the property of the Contractor and shall be removed from the premises. Removed material with salvage value, as determined by the Project Engineer, shall be stored where directed.

F. Backfill all voids, trenches, holes, depressions and pits created by the removal of such miscellaneous improvements as required in the EARTHWORK section.

G. Provide new bypass utility lines and connections as required to maintain utility service to existing structures.

H. Schedule all work involving excessive noise, dust, dirt, or any other detrimental aspect of this work in order that there will be a minimum disruption of the normal housing operations.

3.02 WORK LIMITS

A. The Work Limits shown on the drawings indicate only in general, limits of the work involved. Perform any and all necessary and incidental work which may fall outside of these demarcation lines. Confine all construction activities within the Work Limits and do not spread equipment and materials indiscriminately about the area.

3.03 MAINTAINING TRAFFIC

A. Conduct operations and schedule work for minimum interference to streets, driveways, sidewalks, etc. Confine all work, equipment, materials and personnel, as much as possible, to the work area as indicated so as not to interfere with the normal function of adjacent streets and housing operations.

B. Construct and maintain adequate dust barriers to minimize fugitive dust from leaving the site. Dust barriers shall be capable of withstanding wind loads of fifteen (15) miles per hour.

3.04 DUST CONTROL

A. Keep the work area thoroughly wetted down to prevent dirt and dust from rising. Provide all waterlines required for this purpose. Grade to fill all depressions or pits and to remove high spots after grubbing and removing all debris. Do not allow excess dust control watering to leave the project site.

3.05 DEBRIS

A. Remove all debris existing or accumulated from this work completely and promptly from the site to the satisfaction of the Project Engineer. Burning of debris on the site is not permitted.

B. Disposal of construction debris in the facility's trash bins is not permitted.

3.06 CLEANING

A. Keep the premises clean, neat and orderly at all times. Promptly remove all tools, debris, materials, apparatus, temporary toilets, lights, barriers, etc. from the site upon completion of this work or completion of any phase of work requiring these items.

3.07 DISPOSITION OF MATERIALS

A. All materials resulting from removal work shall become the property of the Contractor and shall be removed from the limits of the State property. Non-

combustible and combustible materials shall be disposed of outside the limits of the State controlled lands at the Contractor's expense at an acceptable solid waste disposal site. The Contractor is encouraged to recycle materials to the maximum extent possible to avoid disposal at a landfill.

END OF SECTION

SECTION 02270 - SOIL EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish all materials, labor, material, services, and equipment and related items necessary to control water pollution through the use of retention basins, berms, silt fences, fiber mats, netting, gravel pads and filters, grassing, slope drains, surface covering and other erosion control devices or methods as shown in the drawings and as specified herein.

1.02 GENERAL REQUIREMENTS

A. It shall be the responsibility of the Contractor to visit, examine and note all existing site conditions and extent of work involved for completion of this work.

B. Erosion and siltation control measures shall be applied to any erodible material within the project site, including local material sources and work areas.

C. The Contractor shall be responsible for providing the necessary erosion control measures shown on the erosion control plan and as ordered by the Hospital. All grading operations shall be performed in conformance with applicable provisions of the “Water Pollution Control and Water Quality Standards” contained in the “Public Health Regulations,” State Department of Health. For project areas larger than one (1) acre, the Contractor shall complete the work as required by the approved “Notice of General Permit Coverage (NGPC)” under the “National Pollutant Discharge Elimination System (NPDES)” from the State Department of Health, Clean Water Branch.

D. The Contractor shall be responsible for removing all silt and debris deposited in drainage facilities, streams, roadways, adjacent lands and other areas resulting from his work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Silt fence shall be geotextile fabric with the bottom portion embedded six (6) inches in the ground and posted with wood stakes provided at intervals. The geotextile fabric shall be specifically formulated for the retention of silt and sediment.

B. Gravel pad for construction equipment ingress and egress shall be eight (8)-inch thick No. 2 gravel constructed on a geotextile fabric base.

C. Mulches as temporary surface covering shall be bagasse, hay straw, fiber mats, fiber nettings or other suitable material acceptable to the Hospital and shall be reasonably clean and free of noxious weeds and deleterious materials.

D. Slope drains shall be constructed of pipe, fiber mats, rubble, portland concrete, bituminous asphaltic concrete, plastic sheets or other materials acceptable to the Hospital.

E. Grass shall be common Bermuda grass, suitable to the area and shall provide a permanent ground cover.

PART 3 - EXECUTION

3.01 TEMPORARY EROSION CONTROL

A. The Contractor shall protect the project from inundation from offsite runoff and shall provide barriers or other means to prevent erosion of exposed project areas. The protective measures shall not cause collateral damage to the remaining improvements at the housing project.

B. The Hospital will have the authority to limit the amount of surface area exposed by clearing and grubbing and demolition operations.

C. No work shall be done until temporary erosion control measures, including silt fences, gravel ingress and egress, drain inlet filters, sediment and water quality basins, etc. are in place.

D. The Hospital may also direct the Contractor to provide immediate, permanent or temporary pollution control measures to prevent the contamination of streams, drainage facilities, roads, adjacent lands and other areas. The Contractor shall determine the appropriate erosion control measure to use. Such work may involve the construction of temporary berms, retention basins or involve the construction of other measures or devices as necessary to control erosion.

E. The Contractor shall limit the surface area exposed by grubbing, stripping of topsoil and grading to that which is necessary for him to perform the next operation and which is within his capability and progress in keeping with the construction contract schedule.

F. The exposed bare earth area shall not exceed 15 acres, or the maximum limit established by County Code or Ordinances, whichever is less.

G. Any area bared or exposed for a period of 10 days and is not within the limits of active construction shall be immediately hydromulched and seeded without additional cost to the Hospital. All areas where finish grading is

complete shall be grassed within three (3) calendar days after completion of grading for the area.

H. The Contractor shall at the end of each work day, shape the earthwork in such a manner as to minimize the erosion of soils. He shall construct earth berms to intercept and control runoff at the limits of grubbing or grading. Erodible areas such as stockpiles of graded material, topsoil or imported material shall be covered with an impermeable material.

I. Construction of berms, cofferdams or other erosion control structures near streams or waterways shall be of approved materials.

J. Temporary erosion control measures shall remain in place until permanent measures such as grassing or pavement are completed and established.

K. The temporary erosion control measures outlined in these specifications are minimum requirements and shall not preclude construction of additional measures the Contractor may deem necessary. Damages caused by the erosion of soils from the project site on downstream areas shall be the responsibility of the Contractor and he shall bear the cost of repairing, correcting, replacing and cleaning damaged or polluted facilities.

END OF SECTION

SECTION 02513 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish labor, equipment and materials to complete all asphalt concrete paving work, including laying out, establishing grades, compacting subgrade, laying and compacting subbase course, base course and ac pavement as indicated on the plans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Weed killer as specified in Section 02362 - Soil Treatment for Vegetation Control.

B. Materials for roads shall be constructed in accordance with the below-listed sections of the State Department of Transportation HAWAII STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION dated 2005 and STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, dated September 1984 as revised, except as amended in the plans and/or specifications herewith. (Paragraphs concerning Measurements and Payments in the Sections are not applicable to this project.)

1. Excavation & Embankment (Subgrade).....Section 203

2. Aggregate Base Course ..... Section 304

3. Aggregate Subbase Course ..... Section 305

4. Asphalt Concrete Pavement ..... Section 401
Mix shall be No. IV

5. Tack Coat ..... Section 407

6. Prime Coat ..... Section 408

7. Aggregate ..... Section 703

8. Water ..... Section 712

9. Cullet and Cullet-Made Materials .....Section 717

PART 3 - EXECUTION

3.01 INSTALLATION

A. The Contractor shall stake out the areas to be paved, using grade stakes on which the final finish elevations, base course and subgrade elevations are clearly marked. All such stakes and elevations shall be approved by the Project Engineer before any work is done.

B. Driveways and parking areas. Installation shall be in accordance with the applicable sections noted hereinbefore.

1. Application of the prime coat specified above over newly constructed base course will not be required where the longitudinal grade of the pavement is less than eight percent (8%) or where the asphaltic concrete pavement thickness is greater than four (4) inches.

2. Where a prime coat is provided, the Contractor shall control runoff and protect adjacent work, property, utilities, waterways, etc. against damage. Damaged work, etc. shall be repaired and restored to their original condition at no additional cost to the State.

C. Existing weed growth shall be treated with weed killer prior to paving. Weed killer shall be applied per the manufacturer's directions.

D. The Contractor shall notify the Project Engineer 72 hours in advance before application of weed killer.

E. Deep Patch.

1. The excavation shall extend at least one (1) foot into the good pavement surrounding the area to be patched.

2. The finished subgrade shall have a density of at least 95% of its maximum density for a depth of 6 inch or more.

3. If shrinkage cracks appear in the subgrade, the subgrade shall be scarified and thoroughly moisture conditioned (between optimum moisture content and 3% wet of optimum moisture content) and re-compacted.

4. If any soft/wet areas that exhibit pumping or rutting are encountered, the base course/subgrade shall be over-excavated and replaced with 8-inches of aggregate base course, geogrid or woven geotextile.

5. During construction, it is important that the subgrade is not overstressed. Heavy trucks or equipment are not allowed to travel on

the unprotected subgrade.

F. Traffic.

1. All required work on the reconstructed areas shall be completed by the end of the work day so that the entire roadway can be opened to traffic.

3.02 REPAIR OF EXISTING A.C. PAVEMENTS

A. Any existing asphaltic concrete pavements including roads, walkways, driveways, and parking areas that have been damaged by construction activities shall be repaired to the original condition and to the satisfaction of the Project Engineer. Damage done by heavy equipment, especially on roads and yards not stable for such equipment, shall be repaired to the original condition and to the satisfaction of the Project Engineer.

END OF SECTION 02513

SECTION 02515 - PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Furnish labor, material and equipment to layout, establish grades and compact subgrade, and install base course and concrete slabs, concrete curbs and sidewalks as indicated on the plans.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall be in accordance with the below listed Sections of the Counties' STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, dated September 1986, and STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION, dated September 1984, as revised, except as amended in the drawings and specifications herewith. Paragraphs concerning Measurements and Payments in the sections are not applicable to this project.

1. Subgrade.....Section 29

2. Base Course (4" and 6” compacted thickness).....Section 31

3. Portland Cement Concrete Pavement (4" and 6” thick).....Section 37

4. Concrete Curb.....Section 41

5. Concrete Sidewalk.....,,,,,,,,,,,,,,,.....Section 42

PART 3 - EXECUTION

3.01 INSTALLATION

A. Stake out the areas to be paved, using wooden stakes on which the final finish elevations, base course, and subgrade elevations are clearly marked. All such stakes and elevations shall be approved by the Project Engineer before any work is done.

B. Spray weed killer on the prepared subgrade of walkways at a uniform rate of 2 gallons per 100 square feet. Notify the Project Engineer 72 hours before application of weed killer.

C. Install walkways in accordance with the applicable sections noted herein.

3.02 ADJUSTMENT OF EXISTING UTILITY STRUCTURES TO FINISHED GRADE

A. Adjust existing utility structures to finished grade in accordance with Section 36 of the Counties' STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, dated September 1986. Paragraphs concerning Measurements and Payments in the section are not applicable to this project.

3.03 REPAIR OF EXISTING PAVEMENTS

A. Repair to the original condition and to the satisfaction of the Project Engineer, all existing pavements (including roads and walkways) that have been damaged by construction activities, including damage done by heavy equipment.

B. Restore pavements and other improvements in accordance with Section 38 of the Counties' STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, dated September 1986. Paragraphs concerning Measurements and Payments in the section are not applicable to this project.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures including vapor barrier, and finishes.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, silica fume.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Reinforcing steel - Certified mill test results or laboratory test results. Indicate bar size, yield strength, ultimate tensile strength, elongation, and bend test. Provide chemical composition for rebars that are to be welded.

B. Design Mixes: For each concrete mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mix water to be withheld for later addition at Project site.

C. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Form materials and form-release agents.
2. Steel reinforcement and reinforcement accessories.
3. Curing materials.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077, ASTM E 329, and ASTM E 1745 to conduct the testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. ACI Publications: Comply with the following, unless more stringent provisions are indicated and maintain a copy at the field office.

1. ACI 301, “Specification for Structural Concrete.”
2. ACI 117, “Specifications for Tolerances for Concrete Construction and Materials.”
3. ACI 347R “Guide to Formwork for Concrete.”

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

B. Smooth-Formed Finished Concrete: Comply with ACI 347R. Provide new or good finish form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other ACI 347R approved panel materials.

C. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least 2 edges and one side for tight fit.

D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces. Form oils or waxes shall not be used for concrete surfaces intended to be painted.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60.

2.3 REINFORCEMENT ACCESSORIES

A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place that will not puncture the vapor retarder. Use plastic straps or brightly colored tie wires to secure reinforcing. Manufacture bar supports according to CRSI’s “Manual of Standard Practice” from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports. Refer to item entitled “STEEL REINFORCEMENT” herein below for chair support spacing.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or Type II.

B. Normal-Weight Aggregate: ASTM C 33/C 33M, uniformly graded, as follows:

1. Class: Moderate weathering region, but not less than 3M.
2. Aggregate Size: No. 67 (3/4 inch to No. 4).

C. Water: Potable and complying with ASTM C 1602/C 1602M or non potable meeting ASTM C 1602/C 1602M Acceptance Criteria for Questionable Water Supply. Use only potable water for job site mixing.

2.5 CONCRETE MIXES

A. Prepare design mixes of concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. Water-to-cement ratio shall not exceed 0.50.

C. Slabs-on-grade, and Footings: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 3,000 psi.

2.6 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.

B. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.

C. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.

D. Water-Reducing and Accelerating Admixture: ASTM C 494/C 494M, Type E.

E. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

2.7 CURING MATERIALS AND EVAPORATION RETARDERS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.8 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI’s “Manual of Standard Practice.”

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and ASTM C 1116/C 1116M and furnish batch ticket information. Batch ticket information shall include design mix reference, water that can be added at the jobsite, and admixtures. For transit mixing, complete not less than 70 revolutions of the drum at the manufacturer's rated mixing speed. Discharge concrete into its final position within 90 minutes after introduction of batch water to the cement. If a retarder admixture is used, the discharge time limit of 90 minutes may be increased by the time specified for retardation by the admixture manufacturer or the concrete supplier. Mix concrete a minimum of one minute at mixing speed immediately prior to discharge.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, Class A, 1/8 inch.

D. Construct forms to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to one vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds. Maintain the integrity of the vapor retarder membrane.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.
2. Install inserts, hangers, metal ties, nailing strips, blocking, and other fastening devices needed for attachment of other work.

B. Obtain Contracting Officer’s approval to install conduit or pipe penetrations of the structural member.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork, for sides of walls, columns, footings and similar parts of the Work, that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete provided concrete is hard enough to not be damaged by form-removal operations and provided curing and protection operations are maintained. The 24 hour period may be reduced to 12 hours in compliance with ACI 347R with prior approval from the Contracting Officer.

B. Clean and repair surfaces of forms to be used in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Contracting Officer.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Shop or field-weld reinforcement according to AWS D1.4, where indicated.
2. Support slab reinforcing bars and welded wire fabric (WWF) as follows:

BAR SIZE	MAXIMUM DISTANCE BETWEEN SUPPORTS
#4	3 feet
#5 and larger	4 feet

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least 1/4 of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed. Provide one day notification to the Contracting Officer for each scheduled pour.

B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301. Up to 2 gallons of water per cubic yard of concrete may be added at the jobsite provided the approved design mix accommodates the additional water.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.

C. Convey concrete from mixer to the place of final deposit rapidly by methods that prevent segregation or loss of ingredients and will insure the required quality of concrete. Use conveying equipment, conveyors, hoppers, baffles, chutes, pumps that are sized and designed to prevent cold joints from occurring and prevent segregation in discharged concrete. Clean conveying equipment before each placement.

D. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

E. Deposit concrete in forms in horizontal layers with proper consolidation onto previous layers and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layer of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
3. Make construction joints only where located on Drawings unless otherwise approved by the Contracting Officer.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding ACI 347R limits for class of surface specified.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch in height.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, damp proofing, veneer plaster, or painting.
2. Do not apply rubbed finish to smooth-formed finish.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent

formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1 R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Contracting Officer before application.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive hot temperatures. Comply with recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by one or a combination of the curing methods listed in paragraph entitled "Unformed Surfaces" herein below.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than 7 days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture- Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than 7 days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas. Remove and replace concrete that cannot be repaired and patched to the Contracting Officer's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to 2 and 1/2 parts fine aggregate passing a No. 16 (1.2-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than one inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by the Contracting Officer.

D. Perform structural repairs of concrete, subject to Contracting Officer's approval, using epoxy adhesive and patching mortar.

E. Repair materials and installation not specified above may be used, subject to Contracting Officer's approval.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement according to requirements specified in this Article.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 50 cu. yd. or fraction thereof of each concrete mix placed each day.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
3. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
4. Compressive Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of 4 standard cylinder specimens for each composite sample.
    a. Cast and field cure one set of 4 standard cylinder specimens for each composite sample.
5. Compressive-Strength Tests: ASTM C 39/C 39M; test 2 laboratory-cured specimens at 7 days and 2 at 28 days.
    a. Test 2 field-cured specimens at 7 days and 2 at 28 days.
    b. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at age indicated.

C. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

D. Strength of each concrete mix will be satisfactory if every average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

E. Test results shall be reported in writing to Contracting Officer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-and 28-day tests.

F. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by the Contracting Officer but will not be used as sole basis for approval or rejection of concrete.

G. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by the Contracting Officer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by the Contracting Officer.

END OF SECTION 03300

SECTION 11131 - LOADING DOCK BUMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes loading dock bumpers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of loading dock bumper.

B. Shop Drawings: For dock bumpers. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 LOADING DOCK BUMPERS

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Safety Systems and Signs Hawaii, GNR Technologies Park-It Car Stop, Yellow Stripe Model 14101 or a comparable product.
2. Source Limitations: Obtain from single source from single manufacturer.

B. Rubber Loading Dock Bumpers:

1. Fabricated from recycled rubber with embedded reflective tape, UV resistant.
2. Size: 4 by 6 inches,4 feet length.
3. Color: Black with yellow reflective tape.

C. Anchorage Devices: Galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as recommended by manufacturer and as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Loading Dock Bumpers: Attach loading dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.3 ADJUSTING

A. After completing installation of exposed, factory-finished dock bumpers, inspect exposed finishes and repair damaged finishes.

END OF SECTION 11131

SECTION 16000 - ELECTRICAL BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work included in 16000, Electrical Basic Requirements applies to Division 16, Electrical work to provide materials, labor, tools, permits, incidentals, and other services to provide and make ready for Owner's use of electrical systems for proposed project.

B. Contract Documents include, but are not limited to, Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Drawings, Addenda, Owner/Architect Agreement, and Owner/Contractor Agreement. Confirm requirements before commencement of work.

C. Definitions:

1. Provide: To furnish and install, complete and ready for intended use.
2. Furnish: Supply and deliver to project site, ready for unpacking, assembly and installation.
3. Install: Includes unloading, unpacking, assembling, erecting, installation, applying, finishing, protecting, cleaning and similar operations at project site as required to complete items of work furnished.
4. Approved or Approved Equivalent: To possess the same performance qualities and characteristics and fulfill the utilitarian function without any decrease in quality, durability or longevity. For equipment/products defined by the Contractor as "equivalent", substitution requests must be submitted to Engineer for consideration, in accordance with Division 01, General Requirements, and approved by the Engineer prior to submitting bids for substituted items.
5. Authority Having Jurisdiction (AHJ): Indicates reviewing authorities, including local fire marshal, Owner's insurance underwriter, Owner's Authorized Representative, and other reviewing entity whose approval is required to obtain systems acceptance.

1.2 RELATED SECTIONS

A. Contents of Section applies to Division 16, Electrical Contract Documents.

B. Related Work:

1. Additional conditions apply to this Division including, but not limited to:
   a. Specifications including Division 00, Procurement and Contracting Requirements and Division 01, General Requirements.
   b. Drawings
   c. Addenda
   d. Owner/Architect Agreement
   e. Owner/Contractor Agreement
   f. Codes, Standards, Public Ordinances and Permits

1.3 REFERENCES AND STANDARDS

A. References and Standards per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, individual Division 16, Electrical Sections and those listed in this Section.

B. Codes to include latest adopted editions, including current amendments, supplements and local jurisdiction requirements in effect as of the date of the Contract Documents, of/from:

1. State of Hawaii:
    a. IBC - International Building Code, with Hawaii Amendments
    b. IECC - International Energy Conservation Code, with Hawaii Amendments
    c. NEC - National Electrical Code, with Hawaii Amendments

C. Reference standards and guidelines include but are not limited to the latest adopted editions from:

1. ABA - Architectural Barriers Act
2. ADA - Americans with Disabilities Act
3. ANSI - American National Standards Institute
4. APWA - American Public Works Association
5. ASCE - American Society of Civil Engineers
6. ASHRAE Guideline 0, the Commissioning Process
7. ASTM - ASTM International
8. CFR - Code of Federal Regulations
9. EPA - Environmental Protection Agency
10. ETL - Electrical Testing Laboratories
11. FCC - Federal Communications Commission
12. FM - FM Global
13. IBC - International Building Code
14. IEC - International Electrotechnical Commission
15. IEEE - Institute of Electrical and Electronics Engineers
16. IES - Illuminating Engineering Society
17. ISO - International Organization for Standardization
18. MSS - Manufacturers Standardization Society
19. NEC - National Electric Code
20. NECA - National Electrical Contractors Association
21. NEMA - National Electrical Manufacturers Association
22. NETA - National Electrical Testing Association
23. NFPA - National Fire Protection Association
24. OSHA - Occupational Safety and Health Administration
25. UL - Underwriters Laboratories Inc.

D. See Division 16, Electrical individual Sections for additional references.

1.4 SUBMITTALS

A. See Division 01, General Requirements for Submittal Procedures as well as individual Division 16, Electrical Sections.

B. Provide drawings in format and software release equal to the design documents. Drawings to be the same sheet size and scale as the Contract Documents.

C. In addition:

1. "No Exception Taken" constitutes that review is for general conformance with the design concept expressed in the Contract Documents for the limited purpose of checking for conformance with information given. Any action is subject to the requirements of the Contract Documents. Contractor is responsible for the dimensions and quantity and will confirm and correlate at the job site, fabrication processes and techniques of construction, coordination of the work with that of all other trades, and the satisfactory performance of the work.

2. Provide product submittals and shop drawings in electronic format only. Electronic format must be submitted via zip file via e-mail. For electronic format, provide one file per division containing one bookmarked PDF file with each bookmark corresponding to each Specification Section. Arrange bookmarks in ascending order of Specification Section number. Individual submittals sent piecemeal in a per Specification Section method will be returned without review or comment. All transmissions/submissions to be submitted to Architect. Provide separate submittals for power system study (per Specification Section 16475) and electrical equipment (for example, switchboards and panelboards). Provide separate submittals for lighting control cutsheets, and for lighting control shop drawings. Deviations will be returned without review.

3. Product Data: Provide manufacturer's descriptive literature for products specified in Division 16, Electrical Sections.

4. Identify/mark each submittal in detail. Note what differences, if any, exist between the submitted item and the specified item. Failure to identify the differences will be considered cause for disapproval. If differences are not identified and/or not discovered during the submittal review process, Contractor remains responsible for providing equipment and materials that meet the specifications and drawings.
    a. Label submittal to match numbering/references as shown in Contract Documents. Highlight and label applicable information to individual equipment or cross out/remove extraneous data not applicable to submitted model. Clearly note options and accessories to be provided, including field installed items. Highlight connections by/to other trades.
    b. Include technical data, installation instructions and dimensioned drawings for products, fixtures, equipment and devices installed, furnished or provided. Reference individual Division 16, Electrical specification Sections for specific items required in product data submittal outside of these requirements.
    c. See Division 16, Electrical individual Sections for additional submittal requirements outside of these requirements.

5. Maximum of two reviews of complete submittal package. Arrange for additional reviews and/or early review of long-lead items; Bear costs of these additional reviews at Engineer's hourly rates. Incomplete submittal packages/submittals will be returned to contractor without review.

6. Resubmission Requirements: Make corrections or changes in submittals as required, and in consideration of Engineer’s comments. Identify Engineer’s comments and provide an individual response to each of the Engineer’s comments. Cloud changes in the submittals and further identify changes which are in response to Engineer’s comments.

7. Structural/Seismic: Provide weights, dimensions, mounting requirements and like information required for mounting, seismic bracing, and support. Indicate manufacturer's installation and support requirements to meet ASCE 7-10 requirements for non-structural components. Provide engineered seismic drawings and equipment seismic certification. Equipment Importance Factor as specified in Division 01 and in Structural documents.

8. Trade Coordination: Include physical characteristics, electrical characteristics, device layout plans, wiring diagrams, and connections as required per Division 16, Electrical Coordination Documents. For equipment with electrical connections, furnish copy of approved submittal for inclusion in Division 16, Electrical submittals. Electric motors are supplied and installed by Division 15 unless otherwise specified. During shop drawing stage of the project, verify correct disconnect sizes, conductor sizes, etc., and bring any discrepancies to the attention of the Mechanical trade. Be responsible for any modifications to electrical equipment or installations as a result of equipment incompatibility discovered after shop drawing review.

9. Make provisions for openings in building for admittance of equipment prior to start of construction or ordering of equipment.

10. Substitutions and Variation from Basis of Design:
    a. The Basis of Design designated product establishes the qualities and characteristics for the evaluation of any comparable products by other listed acceptable manufacturers if included in this Specification or included in an approved Substitution Request as judged by the Design Professional.
    b. If substitutions and/or equivalent equipment/products are being proposed, it is the responsibility of parties concerned, involved in, and furnishing the substitute and/or equivalent equipment to verify and compare the characteristics and requirements of that furnished to that specified and/or shown. If greater capacity and/or more materials and/or more labor is required for the rough-in, circuitry or connections than for the item specified and provided for, then provide compensation for additional charges required for the proper rough-in, circuitry and connections for the equipment being furnished. No additional charges above the Base Bid, including resulting charges for work performed under other Divisions, will be allowed for such revisions. Coordinate with the requirements of "Submittals". For any product marked "or approved equivalent", a substitution request must be submitted to Engineer for approval prior to purchase, delivery or installation.

11. Shop Drawings: Provide coordinated shop drawings which include physical characteristics of all systems, device layout plans, and control wiring diagrams. Reference individual Division 16, Electrical specification Sections for additional requirements for shop drawings outside of these requirements.
    a. Provide Shop Drawings indicating access panel locations, size and elevation for approval prior to installation.

12. Samples: Provide samples when requested by individual Sections.

13. Resubmission Requirements:
    a. Make any corrections or change in submittals when required. Provide submittals as specified. The engineer will not be required to edit and/or interpret the Contractor's submittals. Indicate changes for the resubmittal in a cover letter with reference to page(s) changed and reference response to comment. Cloud changes in the submittals.
    b. Resubmit for review until review indicates no exception taken or "make corrections as noted".

14. Operation and Maintenance Manuals, Owner's Instructions:
    a. Submit, at one time, electronic files (PDF format) of manufacturer's operation and maintenance instruction manuals and parts lists for equipment or items requiring servicing. Submit data when work is substantially complete and in same order format as submittals. Include name and location of source parts and service for each piece of equipment.
        1) Include copy of approved submittal data along with submittal review letters received from Engineer. Data to clearly indicate installed equipment model numbers. Delete or cross out data pertaining to other equipment not specific to this project.
        2) Include copy of manufacturer's standard Operations and Maintenance for equipment. At front of each tab, provide routine maintenance documentation for scheduled equipment. Include manufacturer's recommended maintenance schedule and highlight maintenance required to maintain warranty. Furnish list of routine maintenance parts, including part numbers, sizes, quantities, relevant to each piece of equipment.
        3) Include Warranty per Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.
        4) Include product certificates of warranties and guarantees.
        5) Include copy of complete parts list for equipment. Include available exploded views of assemblies and sub assemblies.
        6) Include commissioning reports.
        7) Include copy of startup and test reports specific to each piece of equipment.
        8) Engineer will return incomplete documentation without review. Engineer will provide one set of review comments in Submittal Review format. Contractor must arrange for additional reviews; Contractor to bear costs for additional reviews at Engineer's hourly rates.
    b. Thoroughly instruct Owner in proper operation of equipment and systems. Where noted in individual Sections, training will include classroom instruction with applicable training aids and systems demonstrations. Field instruction per Section 16000, Electrical Basic Requirements, Demonstration.
    c. Copies of certificates of code authority inspections, acceptance, code required acceptance tests, letter of conformance and other special guarantees, certificates of warranties, specified elsewhere or indicated on Drawings.

15. Record Drawings:
    a. Maintain at site at least one set of drawings for recording “As-constructed” conditions. Indicate on drawings changes to original documents by referencing revision document, and include buried elements, location of conduit, and location of concealed electrical items. Include items changed by field orders, supplemental instructions, and constructed conditions.
    b. Record Drawings are to include equipment and fixture/connection schedules that accurately reflect "as constructed or installed" for project.
    c. At completion of project, input changes to original project on CAD Drawings and make one set of black-line drawings created from CAD Files in version/release equal to contract drawings. Submit CAD disk and drawings upon substantial completion.
    d. See Division 16, Electrical individual Sections for additional items to include in record drawings.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Work and materials installed to conform with all local, State and Federal codes, and other applicable laws and regulations. Where code requirements are at variance with Contract Documents, meet code requirements as a minimum requirement and

include costs necessary to meet these in Contract. Machinery and equipment are to comply with OSHA requirements, as currently revised and interpreted for equipment manufacturer requirements. Install equipment provided per manufacturer recommendations.

B. Whenever this Specification calls for material, workmanship, arrangement or construction of higher quality and/or capacity than that required by governing codes, higher quality and/or capacity take precedence.

C. Drawings are intended to be diagrammatic and reflect the Basis of Design manufacturer's equipment. They are not intended to show every item in its exact dimensions, or details of equipment or proposed systems layout. Verify actual dimensions of systems (i.e. distribution equipment, duct banks, light fixtures, etc.) and equipment proposed to assure that systems and equipment will fit in available space. Contractor is responsible for design and construction costs incurred for equipment other than Basis of Design, including, but not limited to, architectural, structural, electrical, HVAC, fire sprinkler, and plumbing systems.

D. Manufacturer's Instructions: Follow manufacturer's written instructions. If in conflict with Contract Documents, obtain clarification. Notify Engineer/Architect, in writing, before starting work.

E. Items shown on Drawings are not necessarily included in Specifications or vice versa. Confirm requirements in all Contract Documents.

F. Provide products that are UL listed.

1.6 WARRANTY

A. Provide written warranty covering the work for a period of one year from date of Substantial Completion in accordance with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Sections under this Division can require additional and/or extended warranties that apply beyond basic warranty under Division 01, General Requirements and the General Conditions. Confirm requirements in all Contract Documents.

1.7 COORDINATION DOCUMENTS

A. Prior to construction, coordinate installation and location of HVAC equipment, ductwork, grilles, diffusers, piping, plumbing equipment/fixtures, fire sprinklers, plumbing, lights, cable tray and electrical services with architectural and structural requirements, and other trades (including ceiling suspension and tile systems), and provide maintenance access requirements. Coordinate with submitted architectural systems (i.e. roofing, ceiling, finishes) and structural systems as submitted, including footings and foundation. Identify zone of influence from footings and ensure systems are not routed within the zone of influence.

B. Advise Architect in event a conflict occurs in location or connection of equipment. Bear costs resulting from failure to properly coordinate installation or failure to advise Architect of conflict.

C. Verify in field exact size, location, and clearances regarding existing material, equipment and apparatus, and advise Architect of discrepancies between that indicated on Drawings and that existing in field prior to installation related thereto.

D. Submit final Coordination Drawings with changes as Record Drawings at completion of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Articles, fixtures, and equipment of a kind to be standard product of one manufacturer.

2.2 STANDARDS OF MATERIALS AND WORKMANSHIP

A. Base contract upon furnishing materials as specified. Materials, equipment, and fixtures used for construction are to be new, latest products as listed in manufacturer's printed catalog data and are to be UL approved or have adequate approval or be acceptable by state, county, and city authorities. Equipment/fixture supplier is responsible for obtaining State, County, and City acceptance on equipment/fixtures that are not UL approved or are not listed for installation.

B. Names and manufacturer's names denote character and quality of equipment desired and are not to be construed as limiting competition.

C. Hazardous Materials:

1. Comply with local, State of Hawaii, and Federal regulations relating to hazardous materials.
2. Comply with Division 00, Procurement and Contracting Requirements and Division 01, General Requirements for this project relating to hazardous materials.
3. Do not use any materials containing a hazardous substance. If hazardous materials are encountered, do not disturb; immediately notify Owner and Architect. Hazardous materials will be removed by Owner under separate contract.

2.3 ACCESS PANELS

A. See Division 01, General Requirements and Division 08, Openings for products and installation requirements.

B. Confirm Access Panel requirements in Division 01, General Requirements, Division 08, Openings and individual Division 16, Electrical Sections. In the absence of specific requirements, comply with the following:

1. Provide flush mounting access panels for service of systems and individual components requiring maintenance or inspection. Where access panels are located in fire-rated assemblies of building, rate access panels accordingly.
   a. Ceiling access panels to be minimum of 24-inch by 24-inch.
   b. Wall access panels to be minimum of 12-inch by 12-inch.
   c. Provide screwdriver operated catch.

d. Manufacturers and Models:
    1) Drywall: Karp KDW.
    2) Plaster: Karp DSC-214PL.
    3) Masonry: Karp DSC-214M.
    4) 2 hour rated: Karp KPF-350FR.
    5) Manufacturers: Milcor, Elmdor, Acudor, or approved equivalent.

PART 3 - EXECUTION

3.1 ACCESSIBILITY AND INSTALLATION

A. Confirm Accessibility and Installation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Install equipment requiring access (i.e., junction boxes, light fixtures, power supplies, motors, etc.) so that they may be serviced, reset, replaced or recalibrated by service people with normal service tools and equipment. Do not install equipment in passageways, doorways, scuttles or crawlspaces which would impede or block the intended usage.

C. Install equipment and products complete as directed by manufacturer's installation instructions. Obtain installation instructions from manufacturer prior to rough-in of equipment and examine instructions thoroughly. When requirements of installation instructions conflict with Contract Documents, request clarification from Architect prior to proceeding with installation. This includes proper installation methods, sequencing, and coordination with other trades and disciplines.

D. Earthwork:

1. Confirm Earthwork requirements in Contract Documents. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:
    a. Perform excavation, dewatering, shoring, bedding, and backfill required for installation of work in this Division in accordance with related earthwork Sections. Contact utilities and locate existing utilities prior to excavation. Repair any work damaged during excavation or backfilling.
    b. Excavation: Do not excavate under footings, foundation bases, or retaining walls.
    c. Provide protection of underground systems. Review the project Geotechnical Report for references to corrosive or deleterious soils which will reduce the performance or service life of underground systems materials.

E. Firestopping:

1. Confirm requirements in Division 07, Thermal and Moisture Protection. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:
    a. Coordinate location and protection level of fire and/or smoke rated walls, ceilings, and floors. When these assemblies are penetrated, seal around piping and equipment with approved firestopping material. Install firestopping material complete as directed by manufacturer's installation instructions. Meet requirements of ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

F. Plenums:

1. In plenums, provide plenum rated materials that meet the requirements to be installed in plenums. Immediately notify Architect/Engineer of discrepancy.

G. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

H. Provide miscellaneous supports/metals required for installation of equipment and conduit.

3.2 SEISMIC CONTROL

A. Confirm Seismic Control requirements in Division 01, General Requirements, Structural documents, and individual Division 16 Electrical Sections.

B. General:

1. Earthquake resistant designs for Electrical (Division 16) equipment and distribution, i.e. power distribution equipment, generators, UPS, etc. to conform to regulations of jurisdiction having authority.
2. Restraints which are used to prevent disruption of function of piece of equipment because of application of horizontal force to be such that forces are carried to frame of structure in such a way that frame will not be deflected when apparatus is attached to a mounting base and equipment pad, or to structure in normal way, utilizing attachments provided. Secure equipment and distribution systems to withstand a force in direction equal to value defined by jurisdiction having authority.
3. Provide stamped shop drawings from licensed Structural Engineer of seismic bracing and seismic movement assemblies for conduit and equipment. Submit shop drawings along with equipment submittals.
4. Provide stamped shop drawings from licensed Structural Engineer of seismic flexible joints for conduit crossing building expansion or seismic joints. Submit shop drawings along with seismic bracing details.
5. Provide means to prohibit excessive motion of electrical equipment during earthquake.

3.3 REVIEW AND OBSERVATION

A. Confirm Review and Observation requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Notify Architect, in writing, at following stages of construction so that they may, at their option, visit site for review and construction observation:

1. Underground conduit installation prior to backfilling.
2. Prior to covering walls.
3. Prior to ceiling cover/installation.
4. When main systems, or portions of, are being tested and ready for inspection by AHJ.

C. Final Punch:

1. Prior to requesting a final punch visit from the Engineer, request from Engineer the Electrical Precloseout Checklist, complete the checklist confirming completion of systems' installation, and return to Engineer. Request a final punch visit from the Engineer, upon Engineer's acceptance that the electrical systems are ready for final punch.
2. Costs incurred by additional trips required due to incomplete systems will be the responsibility of the Contractor.

3.4 CONTINUITY OF SERVICE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 16, Electrical Sections and the following:

1. During remodeling or addition to existing structure, while existing structure is occupied, present services to remain intact until new construction, facilities or equipment is installed.
2. Prior to changing over to new service, verify that every item is thoroughly prepared. Install new wiring, and wiring to point of connection.
3. Coordinate transfer time to new service with Owner. If required, perform transfer during off-peak hours. Once changeover is started, pursue to its completion to keep interference to a minimum.
    a. If overtime is necessary, there will be no allowance made by Owner for extra expense for such overtime or shift work.
4. No interruption of services to any part of existing facilities will be permitted without express permission in each instance from Owner. Requests for outages must state specific dates, hours and maximum durations, with outages kept to these specific dates, hours and maximum durations. Obtain written permission from Owner for any interruption of power, lighting or signal circuits and systems.
    a. Organize work to minimize duration of power interruption.
    b. Coordinate utility service outages with utility company.

3.5 CUTTING AND PATCHING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 16, Electrical Sections and the following:

1. Proposed floor cutting/core drilling/sleeve locations to be approved by Project Structural Engineer. Submit proposed locations to Architect/Project Structural Engineer. Where slabs are of post tension construction, perform x-ray scan of proposed penetration locations and submit scan results including proposed penetration locations to Project Structural Engineer/Architect for approval. Where slabs are of waffle type construction, show column cap extent and cell locations relative to proposed penetration(s).
2. Cutting, patching and repairing for work specified in this Division including plastering, masonry work, concrete work, carpentry work, and painting included under this Section will be performed by skilled craftsmen of each respective trade in conformance with appropriate Division of Work.
3. Additional openings required in building construction to be made by drilling or cutting. Use of jack hammer is specifically prohibited. Patch openings in and through concrete and masonry with grout.
4. Restore new or existing work that is cut and/or damaged to original condition. Patch and repair specifically where existing items have been removed. This includes repairing and

painting walls, ceilings, etc. where existing conduit and devices are removed as part of this project. Where alterations disturb lawns, paving, and/or walks, surfaces to be repaired, refinished and left in condition matching existing prior to commencement of work.

5. Additional work required by lack of proper coordination will be provided at no additional cost to the Owner.

3.6 EQUIPMENT SELECTION AND SERVICEABILITY

A. Replace or reposition equipment which is too large or located incorrectly to permit servicing, at no additional cost to Owner.

3.7 DELIVERY, STORAGE AND HANDLING

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:

1. Handle materials delivered to project site with care to avoid damage. Store materials on site inside building or protected from weather, dirt and construction dust. Products and/or materials that become damaged due to water, dirt, and/or dust as a result of improper storage and handling to be replaced before installation.
2. Protect equipment to avoid damage. Close conduit openings with caps or plugs. Keep motors and bearings in watertight and dustproof covers during entire course of installation.
3. Protect bus duct and similar items until in service.

3.8 DEMONSTRATION

A. Confirm Demonstration requirements in Division 00, Procurement and Contracting Requirements, Division 01, General Requirements, and individual Division 16, Electrical Sections.

B. Upon completion of work and adjustment of equipment, test systems and demonstrate to Owner's Authorized Representative, Architect, and Engineer that equipment furnished and installed or connected under provisions of these Specifications functions in manner required. Provide field instruction to Owner's Maintenance Staff as specified in Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

C. Manufacturer's Field Services: Furnish services of a qualified person at time approved by Owner, to instruct maintenance personnel, correct defects or deficiencies, and demonstrate to satisfaction of Owner that entire system is operating in satisfactory manner and complies with requirements of other trades that may be required to complete work. Complete instruction and demonstration prior to final job site observations.

3.9 CLEANING

A. Confirm Cleaning requirements in Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Upon completion of installation, thoroughly clean electrical equipment, removing dirt, debris, dust, temporary labels and traces of foreign substances. Throughout work, remove construction debris and surplus materials accumulated during work.

3.10 INSTALLATION

A. Confirm Installation requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Install equipment and fixtures in accordance with manufacturer's installation instructions, plumb and level and firmly anchored to vibration isolators. Maintain manufacturer's recommended clearances.

C. Start up equipment, in accordance with manufacturer's start-up instructions, and in presence of manufacturer's representative. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

D. Provide miscellaneous supports/metals required for installation of equipment.

3.11 PAINTING

A. Confirm requirements in Division 01, General Requirements and Division 09, Finishes. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:

1. Ferrous Metal: After completion of work, thoroughly clean and paint exposed supports constructed of ferrous metal surfaces (i.e., hangers, hanger rods, equipment stands, etc.) with one coat of black asphalt varnish for exterior or black enamel for interior, suitable for hot surfaces.
2. In Electrical Room, on roof or other exposed areas, equipment not painted with enamel to receive two coats of primer and one coat of rustproof enamel, colors as selected by Architect.
3. See individual equipment Specifications for other painting.
4. Structural Steel: Repair damage to structural steel finishes or finishes of other materials damaged by cutting, welding or patching to match original.
5. Conduit: Clean, primer coat and paint interior/exterior conduit exposed in public areas with two coats paint suitable for metallic surfaces. Color selected by Architect.
6. Covers: Covers such as manholes, vaults and the like will be furnished with finishes which resist corrosion and rust.

3.12 ACCESS PANELS

A. Confirm Access Panel requirements in Division 01, General Requirements. In the absence of specific requirements in Division 01, General Requirements, comply with individual Division 16, Electrical Sections and the following:

1. Coordinate locations/sizes of access panels with Architect prior to work.

3.13 DEMOLITION

A. Confirm requirements in Division 01, General Requirements and Division 02, Existing Conditions. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:

1. It is the intent of these documents to provide necessary information and adjustments to electrical system required to meet code, and accommodate installation of new work.
2. Coordinate with Owner so that work can be scheduled not to interrupt operations, normal activities, building access or access to different areas. Owner will cooperate to best of their ability to assist in coordinated schedule, but will remain final authority as to time of work permitted.
3. Examination:
    a. Determine exact location of existing utilities and equipment before commencing work, compensate Owner for damages caused by failure to locate and preserve utilities. Replace damaged items with new material to match existing.
    b. Verify that abandoned wiring and equipment serve only abandoned facilities.
    c. Demolition drawings are based on casual field observation and existing record documents.
        1) Verify accuracy of information shown prior to bidding and provide such labor and material as is necessary to accomplish work.
        2) Verify location and number of electrical outlets, luminaires, panels, etc. in field.
    d. Report discrepancies to Architect before disturbing existing installation.
        1) Promptly notify Owner if utilities are found which are not shown on Drawings.
4. Execution:
    a. Remove existing luminaires, switches, receptacles, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless shown as retained or relocated on Drawings.
    b. Provide temporary wiring and connections to maintain electrical continuity of existing systems during construction. Remove or relocate electrical boxes, conduit, wiring, equipment, and luminaires, as encountered in removed or remodeled areas in existing construction affected by this work.
    c. Remove and restore wiring which serves usable existing outlets clear of construction or demolition.
    d. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, provide new conduit and wire to bypass inaccessible junction boxes and abandoned outlets.
    e. If existing conduits pass through partitions or ceiling which are being removed or remodeled, provide new conduit and wire to reroute clear of construction or demolition and maintain service to existing load.
    f. Extend circuiting and devices in existing walls to be furred out.
    g. Remove abandoned wiring to source of supply.
    h. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
    i. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.
    j. Disconnect and remove abandoned panelboards and distribution equipment.
    k. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

l. Existing lighting which is to remain, leave luminaires in proper working order.
m. Repair adjacent construction and finishes damaged during demolition work.
n. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

3.14 ACCEPTANCE

A. Confirm requirements in Division 00, Procurement and Contracting Requirements and Division 01, General Requirements. In the absence of specific requirements, comply with individual Division 16, Electrical Sections and the following:

1. System cannot be considered for acceptance until work is completed and demonstrated to Architect that installation is in strict compliance with Specifications, Drawings and manufacturer's installation instructions, particularly in reference to following:
   a. Cleaning
   b. Operation and Maintenance Manuals
   c. Training of Operating Personnel
   d. Record Drawings
   e. Warranty and Guaranty Certificates
   f. Start-up/Test Document and Commissioning Reports

3.15 FIELD QUALITY CONTROL

A. Confirm Field Quality Control requirements in Division 01, General Requirements, Section 16000, Electrical Basic Requirements and individual Division 16, Electrical Sections.

B. Tests:

1. Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in operation and maintenance manuals.
2. During site evaluations by Architect or Engineer, provide appropriate personnel with tools to remove and replace trims, covers, and devices so that proper evaluation of installation can be performed.

3.16 LETTER OF CONFORMANCE

A. Provide Letter of Conformance, copies of manufacturers' warranties and extended warranties with a statement that Electrical items were installed in accordance with manufacturer's recommendations, UL listings and FM Global approvals. Include Letter of Conformance, copies of manufacturers' warranties and extended warranties in Operation and Maintenance Manuals.

3.17 SALVAGED EQUIPMENT AND RECYCLED MATERIAL

A. Salvage the following equipment not being reused and return to Owner:

1. Luminaires
2. Panelboards
3. Breakers
4. Transformers

B. Electrical equipment that cannot be salvaged for reuse, sell/give to recycling company. Recycle following excess, removed, or demolished electrical material:

1. Copper or aluminum conductors, buses, and motor/transformer windings.
2. Steel and aluminum from raceways, boxes, enclosures, and housings.
3. Acrylic and glass from luminaire lenses/refractors.

C. Provide separate on-site storage space for recycled and salvaged material. Clearly label space.

D. Confirm additional salvaged equipment and recycled materials in the Contract Documents.

END OF SECTION 16000

SECTION 16075 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Equipment Nameplates
2. Device Labels
3. Wire Markers
4. Conduit Markers
5. Underground Warning Tape

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals not required for this Section.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, meet the following:
1. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required.
2. Manufacturer's standard products of categories and types required for each application as referenced in other Division 16, Electrical Sections. Where more than a single type is specified for application, provide single selection for each product category.
3. Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices unless otherwise indicated.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Equipment Nameplates:

1. B & I Nameplates
2. Intellicum
3. JBR Associates
4. Or approved equivalent.

B. Device Labels:

1. Kroy
2. Brady
3. Or approved equivalent.

C. Wire Markers:

1. Brady
2. Panduit
3. Sumitomo
4. Or approved equivalent.

D. Conduit Markers:

1. Allen Systems
2. Brady
3. Or approved equivalent.

E. Underground Warning Tape:

1. Allen Systems
2. Brady
3. Or approved equivalent.

2.2 EQUIPMENT NAMEPLATES

A. Engraved phenolic plastic, laminate, minimum 1/8-inch thick in the size indicated, with beveled edge border matching letter color. Federal specification L-P-387. All upper case letters in engraver standard letter style of the size and wording indicated. Punched for mechanical fastening, except where adhesive mounting is necessary due to substrate. Embossed tape style labels are not acceptable.

B. Color:

1. Normal (Utility): White letters on black background.
2. Life Safety/Critical (Emergency Systems): Black letters on orange background.

3. Equipment Branch (Legally Required Standby Systems): Black letters on yellow background.

C. Letter Size:

1. Use 1/2-inch letters minimum for identifying major equipment and loads, including switchgear, switchboards, etc.
2. Use 1/2-inch letters minimum for identifying panels, breakers, etc.
3. Use 3/16-inch minimum for identifying source, voltage, current, phase, and wire configurations.

D. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

E. The Architect, Engineer, Commissioning Agent and Owner reserve the right to make modifications to the nameplates as necessary.

F. Locations:

1. Switchgear, switchboards, sub-distribution switchboards, distribution panels, and branch panels.
2. Main breakers and distribution breakers in switchgear, switchboards, and distribution panels.
3. Equipment including, but not limited to, motor controllers, disconnects, and VFDs.
4. Low-voltage equipment enclosures including, but not limited to, fire alarm panels, access control panels, and lighting control panels.
5. Distribution transformers.

2.3 DEVICE LABELS

A. Extra strength, laminated, adhesive tape, with 3/16-inch black letters on clear background. Use only for identification of individual wall switches, receptacles, control device stations, etc. Indicate source panel and circuits. Wall switches with engraved buttons do not require labeling. Embossed tape style labels are not acceptable.

B. Label all junction boxes to show system identification, source circuit, or raceway origin. In finished areas, utilize device label. In unfinished areas or above ceilings, use of permanent ink marker is acceptable.

2.4 WIRE MARKERS

A. Description: Vinyl-cloth self-adhesive type wire markers.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, junction boxes, and each load connection.

C. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings and source panel.

D. Control Circuits: control wire number indicated on schematic and interconnection diagrams on drawings or shop drawings.

2.5 CONDUIT MARKERS

A. Description: Self-sticking vinyl.

B. Location: Furnish markers for each conduit longer than 6-feet.

C. Spacing: 20-feet on center.

D. Color:

1. 480 Volt System: Black letters on Orange background
2. 208 Volt System: Black letters on Orange background
3. Fire Alarm System: Red
4. Telephone System: _____
5. _____ System: _____

2.6 UNDERGROUND WARNING TAPE

A. Description: 6-inch wide inert polyethylene plastic tape, 4-mil thick, detectable type, colored per APWA recommendations unless otherwise noted with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate designations used on Drawings with equipment nameplates and device labels.

B. Install nameplates and labels parallel to equipment lines.

C. Identify empty conduit and boxes with intended use.

D. Provide typewritten branch panel schedules with protective clear transparent covers accounting for every breaker installed. Use actual room designations assigned by name or number near completion of the work, and not the designations shown on drawings.

E. Where changes are made in existing panels, distribution boards, etc., provide new labeling and typewritten schedules to accurately reflect the changes.

F. Provide color coded boxes as follows:

1. Fire Alarm: Red.

2. All device and junction boxes for emergency systems (life safety and critical) to be substantially Orange in color, inside and out, per WAC 296-46B-700.

3.2 EQUIPMENT NAMEPLATES

A. Degrease and clean surfaces to receive nameplates.

B. Secure equipment nameplates to equipment front using self-tapping stainless steel screws.

C. Secure equipment nameplates to inside surface of door on panelboard that is recessed in finished locations.

D. Verify emergency system distribution equipment nameplate colors with Architect/Owner.

E. Switchgear, switchboards, and panels to include name source, voltage, current phase, wire configuration and fault current rating. Transformers to include source KVA, and secondary voltage, phase, and wire configuration.

F. Provide nameplates for flush mounted branch panelboards identifying name on front door. On inside of door provide nameplate as noted above. Verify with Architect/Owner if nameplate on outside of door is required.

G. Provide a second label at branch panelboards listing the means of identification of branch circuit conductors. This identification legend to consist of the color code used for each voltage system (208Y/120V and 480Y/277V). See Specification Section 16125, Low-Voltage Electrical Power Conductors and Cables, for required conductor color code for this project. Include identification of both voltage systems on each label, regardless of the voltage of the panelboard to which the label is affixed. Comply with requirements of NEC 210.5.

3.3 DEVICE LABELS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Degrease and clean surfaces to receive labels.

3.4 WIRE MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Provide wire markers on each conductor for power, control, signalling and communications circuits.

D. Where switches control remote lighting or power outlets, or where switches or outlets in same location serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide plates with 1/8-inch black letters indicating function of each switch or outlet. Also label the function of light switches where two or more are mounted in same locations.

3.5 CONDUIT MARKERS

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

3.6 UNDERGROUND WARNING TAPE

A. Reference 3.01, General Installation Requirements.

B. Install per manufacturer's instructions and recommendations.

C. Identify underground raceways using underground warning tape. Install one continuous tape per underground raceway at 6- to 8-inches below finish grade. Where multiple underground raceways are buried in a common trench and exceeds 16-inch width, install multiple warning tapes not over 10-inches apart (edge to edge) over the entire group of underground raceways.

END OF SECTION 16075

SECTION 16125 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Lugs and Pads
2. Wires and Cables
3. Splices
4. Connectors

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Cable insulation test reports in project closeout documentation.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lugs and Pads:

1. Anderson
2. Ilsco
3. Panduit
4. Thomas & Betts
5. 3M
6. Or approved equivalent.

B. Wires and Cables:

1. General:
   a. General Cable
   b. Okonite
   c. Southwire
   d. Or approved equivalent.
2. Metal Clad Cable - Type HCF-MC:
   a. Alflex
   b. AFC
   c. General Cable
   d. Southwire
   e. Or approved equivalent.

C. Splices:

1. Branch Circuit Splices:
   a. Ideal
   b. 3M Scotchlok
   c. Uraseal, Inc.
   d. Or approved equivalent.
2. Feeder Splices:
   a. Not allowed.

D. Connectors:

1. Anderson Power Products
2. Burndy
3. Ilsco
4. 3M
5. Thomas & Betts
6. Or approved equivalent.

2.2 LUGS AND PADS

A. Ampacity: Cross-sectional area of pad for multiple conductor terminations to match ampere rating of panelboard bus or equipment line terminals.

B. Copper Pads: Drilled and tapped for multiple conductor terminals.

C. Lugs: Compression type for use with stranded branch circuit or control conductors; mechanical lugs for use with solid branch and feeder circuit conductors.

2.3 WIRES AND CABLES

A. Building Wires:

1. Copper: Soft-drawn with conductivity of not less than 98 percent IACS at 20 degrees C (68 degrees F). 600 volt rated throughout. Conductors 12 AWG and 10 AWG, solid. Conductors 8 AWG and larger, stranded. 12 AWG minimum conductor size. Minimum insulation rating of 90 degrees C. Insulation Type: THHN/THWN-2.
2. Aluminum conductors are not permitted unless written approval is received from the Engineer.
3. Aluminum (if permitted): Insulation type and rating to match copper wiring. Compact stranded. Aluminum Association 8000(AA-8000) Series alloy conductor material built to ASTM B801 specifications.

B. Phase color to be consistent at feeder terminations; A-B-C, top to bottom, left to right, front to back.

C. Color Code Conductors as Follows:

PHASE	208 VOLT WYE	480 VOLT
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray or White w/colored strip
Ground	Green	Green

D. MC Cable:

1. Standard: High strength aluminum flexible armor. Full length minimum size No. 12 copper ground wire, copper dual rated THHN/THWNC, full length tape marker phase/circuit identification on cable armor. Short circuit throat insulators, mechanical compression termination.
2. Hospital Care Facility: High strength galvanized steel flexible armor. Full length minimum size No. 10 copper ground wire, Conductors to be 600V rated, copper, THHN (90C). Provide full length tape marker phase/circuit identification and overall green finish on interlocked cable armor. Short circuit throat insulators, mechanical compression termination.

E. AC Cable (Armored Cable): Not allowed.

F. NMB Cable: Not allowed.

2.4 SPLICES

A. Branch Circuits: Twist on, high temperature, grounding type wing nuts.

1. Ideal Industries Wing-Nut Twist-On Connectors.
2. 3M Scotchlok Twist-On Wire Connectors.

2.5 CONNECTORS

A. Split bolt connectors not allowed.

B. Conductor Branch Circuits: Wire nuts with integral spring connectors for conductors 12 AWG through 8 AWG. Push-in type connectors where conductors are not required to be twisted together are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Install per manufacturer instructions and NEC.

B. Field Quality Control:

1. Test conductor insulation on feeders of 100 amp and greater for conformity with 1000 volt megohmmeter. Use Insulated Cable Engineers Association testing procedures. Minimum insulation resistance acceptable is 1 megohm for systems 600 volts and below. Notify Architect if insulation resistance is less than 1 megohm.
2. Test Report: Prepare a typed tabular report indicating the testing instrument, the feeder tested, amperage rating of the feeder, insulation type, voltage, the approximate length of the feeder, conduit type, and the measured resistance of the megohmmeter test. Submit test reports with project closeout documents.
3. Inspect and test in accordance with NETA Standard ATS, except Section 4.
4. Perform inspections and tests listed in NETA Standard ATS, Section 7.3.2.

3.2 LUGS AND PADS

A. Thoroughly clean surfaces to remove all dirt, oil, great or paint.

B. Use torque wrench to tighten per manufacturer's directions.

3.3 WIRES AND CABLES

A. General:

1. Do not install or handle thermoplastic insulated wire and cable in temperatures below -10 degrees C (14 degrees F). Do not handle thermoset insulated wire and cable in temperatures below -40 degrees C (-40 degrees F).
2. Install conductors in raceways having adequate, code size cross-sectional area for wires indicated.
3. Install conductors with care to avoid damage to insulation.
4. Do not apply greater tension on conductors than recommended by manufacturer during installation.
5. Use of pulling compounds is permitted. Clean residue from exposed conductors and raceway entrances after conductor installation. Do not use pulling compounds for installation of conductors connected to GFCI circuit breakers or GFCI receptacles.
6. Conductor Size and Quantity:
    a. Install no conductors smaller than 12 AWG unless otherwise shown.
    b. Provide required conductors for a fully operable system.
    c. Power Circuits: No. 12 AWG minimum, except as follows:
        1) No. 10 AWG for 15A, 120V circuits longer than 100 ft.
        2) No. 8 AWG for 15A, 120V circuits longer than 150 ft.
        3) No. 10 AWG for 20A, 120V circuits longer than 70 ft.
        4) No. 8 AWG for 20A, 120V circuits longer than 100 ft.
    d. When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop, based on 80 percent of the circuit protective device, does not exceed 3 percent. Increase wire size from #12AWG, if necessary, to ensure that the 3 percent voltage drop is not exceeded.
7. Provide dedicated neutrals (one neutral conductor for each phase conductor) in all 120V circuits.

B. Conductors in Cabinets:

1. Cable and tree wires in panels and cabinets for power and control. Use plastic ties in panels and cabinets.
2. Tie and bundle feeder conductors in wireways of panelboards.
3. Hold conductors away from sharp metal edges.

C. Homeruns:

1. Do not change intent of branch circuit homeruns without approval. Homeruns for 20A branch circuits may be combined to a maximum of six current carrying conductors including neutral conductors in homeruns. Apply derating factors as required per NEC. Increase conductor size as needed.
2. MC cable homeruns are not allowed unless indicated on drawings.

D. Identify wire and cable under the provisions of Section 16075, Identification for Electrical Systems. Identify each conductor with its panel and circuit number as indicated.

E. Exposed cable is not allowed.

F. All cable must be run parallel or perpendicular to building lines and hidden from view when possible. Where installed in tray each power cable is to be identified with Lamacoid nametag engraved with identification of equipment being fed. Tag to be fastened to cable using tie-wraps. Provide nametag at each floor level.

G. Do not install PVC jacketed cables in return air plenums, unless they are specially rated plenum cables.

H. Use of MC Cable is limited to the following conditions. Installations that do not comply with the following conditions are to be removed and replaced with no additional expense to the Owner.

1. 15 and 20 amp branch wiring where following conditions apply:
    a. MC cable is allowed for branch circuits, including both lighting and power outlets, as allowed by code and restricted below.
    b. Where there is a suspended ceiling with accessible space above (example: suspended acoustic ceiling tile).
    c. Use MC cable for final flexible connections from junction or outlet boxes to recessed fixtures. Do not use MC cables to loop between fixtures, except where it is not practical to provide conduit connections between boxes or where existing inaccessible ceilings prevent installation of conduit runs. Each individual luminaire is to be serviced by an individual cable drop from the associated junction box in the ceiling space. Maximum length 6-feet of MC cable. Luminaire drops secured to, and supported by, the building structure with nylon tie wraps. The use of the ceiling suspension system for support of any type of cabling is not permitted.
    d. Use MC cable for branch circuit wiring and short home runs under 50-feet in length. Provide minimum of one 12 by 12 junction box per room. Connect junction boxes where required and provide homeruns using multicircuit MC cable.

3.4 SPLICES

A. Make splices complete and promptly after wire installation. Provide single wire pigtails for luminaire and device connections. Wire nuts may be used for luminaire wire connections to single wire circuit conductor pigtails.

B. Make splices for No. 8 and larger wires with mechanically applied pressure type connectors. Make all taped joints with Scotch 33+ or equal, applied in half-lap layers without stretching to deform. Uraseal splice kits are also acceptable through 250 KCMIL.

C. Remove insulation with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. Leave all conductors nick-free.

3.5 CONNECTORS

A. Install to assure a solid and safe connection.

B. Select hand twist connectors for wire size and install tightly on conductors.

C. Install compression connectors using methods and tools recommended by the manufacturer.

D. Do not install stranded conductors under screw terminals unless compression lugs are installed.

E. Do not connect wiring without UL listed connectors that are listed for the purposes.

F. Additional requirements for Aluminum connectors (if permitted):

1. Use adequate precaution for the termination or splicing of aluminum conductors, including removal of insulation and separators, cleaning (wire brushing) of stranded conductors, and compatibility and installation of fittings.
2. Use a UL listed joint compound, capable of penetrating the oxide film and preventing its reforming, for terminating or splicing all sizes of stranded aluminum conductors, unless the termination or splice is approved for use without compound and is so marked.
3. Do not terminate or splice aluminum conductors in wet locations unless the termination or splice is adequately protected against corrosion.

END OF SECTION 16125

SECTION 16130 - BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Outlet Boxes
2. Pull and Junction Boxes
3. Box Extension Adapter
4. Weatherproof Outlet Boxes

B. Provide electrical boxes and fittings for a complete installation. Include but not limited to outlet boxes, junction boxes, pull boxes, bushings, locknuts and other necessary components.

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:
1. Section 16135, Raceways
2. Section 16075, Identification for Electrical Systems

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Outlet Boxes:

1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

B. Pull and Junction Boxes:

1. Eaton/Crouse-Hinds
2. Hoffman
3. Or approved equivalent.

C. Box Extension Adapter:

1. Hubbell
2. Thomas & Betts
3. Eaton/Crouse-Hinds
4. Or approved equivalent.

D. Weatherproof Outlet Boxes:

1. Legrand (Pass & Seymour)
2. Hubbell
3. Thomas & Betts
4. Eaton/Crouse-Hinds
5. Intermatic
6. Or approved equivalent.

2.2 OUTLET BOXES

A. Luminaire Outlet: 4-inch octagonal box, 1-1/2-inches deep with 3/8-inch luminaire stud if required. Provide raised covers on bracket outlets and on ceiling outlets.

B. Device Outlet: Installation of one or two devices at common location, minimum 4-inches square, minimum 1-1/2-inches deep for non-USB type devices. Installation of one or two devices at common locations, minimum 4-inches square, minimum 2-inches deep for USB type devices. Single- or two-gang flush device raised covers.

C. Telecom Outlet: Provide 4-inches square, minimum 2-1/8-inch deep box with two-gang plaster ring.

D. Multiple Devices: Three or more devices at common location. Install one-piece gang boxes with one-piece device cover. Install one device per gang.

E. Masonry Boxes: Outlets in concrete.

F. Construction: For interior locations, provide galvanized steel outlet wiring boxes, of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. All surface mounted outlet boxes are to be drawn. Welded boxes are not acceptable.

G. Accessories: Provide outlet box accessories for each installation, including mounting brackets, wallboard hangers, extension rings, luminaire studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

H. Noise Control: Provide acoustic putty pad to back side of each outlet box installed in acoustic rated walls.

2.03 PULL AND JUNCTION BOXES

A. Construction (Indoor Locations): Provide ANSI 49 gray enamel painted sheet steel junction and pull boxes, with screw-on covers; of type shape and size, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

B. Construction (Outdoor Locations): Same as above, except NEMA 4X Stainless Steel.

C. Location:

1. Provide junction boxes above accessible ceilings for drops into walls for receptacle outlets from overhead.

2. Provide junction boxes and pull boxes to facilitate installation of conductors and limiting accumulated angular sum of bends between boxes, cabinets and appliances to 270 degrees.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Construction: Galvanized cast iron.
2. Cover: Smooth cover with neoprene gasket and stainless steel cover screws.
3. Cover Legend: ELECTRIC.

2.4 BOX EXTENSION ADAPTER

A. Construction: Diecast aluminum.

B. Location: Install over flush wall outlet boxes to permit flexible raceway extension from flush outlet to fixed or movable equipment.

2.5 WEATHERPROOF OUTLET BOXES

A. Construction: Provide corrosion-resistant cast metal weatherproof outlet wiring boxes, of the type, shape and size, including depth of box, with threaded conduit ends, cast metal faceplate with spring-hinged waterproof cap suitably configured for each application, including faceplate, gasket, blank plugs and corrosion proof fasteners. Weatherproof boxes to be constructed to have smooth sides, gray finish.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate locations of floor boxes and wall mounted wiring device boxes with architectural and structural floor plans prior to rough-in.

B. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1, Standard Practice of Good Workmanship in Electrical Construction.

C. Secure boxes rigidly to substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.

D. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NEC. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.

E. Set wall mounted boxes at elevations to accommodate mounting heights shown on Architectural Elevations.

F. Electrical boxes are shown on drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10-feet if required to accommodate intended purpose.

G. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

H. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

I. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

J. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12-inches of box.

K. Box Color Coding and Marking: Reference Section 16075, Identification for Electrical Systems.

L. Adjust boxes to be parallel with building lines. Boxes not plumb to building lines are not acceptable.

M. Install knockout closures in unused box openings.

N. Clean interior of boxes to remove dust, debris, and other material.

O. Clean exposed surfaces and restore finish.

3.2 OUTLET BOXES INSTALLATION

A. Mount outlet boxes, unless otherwise required by ADA, or noted on drawings, following distances above finished floor:

1. Control Switches:
   a. 48-inches to the top of outlet box.
   b. 4-inches above top of backsplash at countertops/workstations, not-to-exceed 44-inches above finished floor to the top of outlet box per ADA requirements.
2. Receptacles: 15-inches to the bottom of outlet box.
3. Telecom Outlets: 15-inches to the bottom of outlet box.
4. Other Outlets: As indicated in other sections of specifications or as detailed on drawings.

B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Flush Outlets in Insulated Spaces: Maintain integrity of insulation and vapor barrier.

D. Coordinate electrical device locations and elevations (switches and receptacles) with architectural drawings to prevent mounting devices in mirrors, back splashes, and behind cabinets.

E. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

F. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices. Adjacent boxes not aligned vertically to be adjusted at no additional cost to Owner.

G. Use flush mounting outlet box in finished areas.

H. Do not install flush mounting box back-to-back in walls; provide minimum 6-inches separation. Provide minimum 24-inches in acoustic rated walls.

I. In acoustical walls, apply acoustic putty pad on outlet box prior to installation of acoustical blanket.

J. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

K. Use stamped steel bridges to fasten flush mounting outlet box between studs.

L. Use adjustable steel channel fasteners for hung ceiling outlet box.

M. Use gang box where more than one device is mounted together. Do not use sectional box.

N. Use gang box with plaster ring for single device outlets.

O. Adjust flush-mounting outlets to make front flush with finished wall material.

3.3 PULL AND JUNCTION BOXES INSTALLATION

A. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

B. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6-inches from ceiling access panel or from removable recessed luminaire.

C. Do not fasten boxes to ceiling support wires.

D. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.4 BOX EXTENSION ADAPTER INSTALLATION

A. Match material to box.

B. Install gaskets at exterior and wet locations.

3.5 WEATHERPROOF OUTLET BOXES INSTALLATION

A. Use cast outlet box in exterior locations exposed to weather and wet locations.

B. Install gaskets.

END OF SECTION 16130

SECTION 16135 - RACEWAYS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Rigid Metal Conduit (RMC)
2. Electrical Metallic Tubing (EMT)
3. Flexible Metal Conduit (FMC)
4. Liquidtight Flexible Metal Conduit (LFMC)
5. Electrical Polyvinyl Chloride (PVC) Conduit
6. Conduit Fittings

B. Provide a complete system of conduit and fittings, with associated couplings, connectors, and fittings, as shown on drawings and described in these specifications.

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following:

1. Section 16130, Boxes
2. Section 16543, Electrical Vaults and Underground Raceways

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.7 DEFINITIONS

A. Raceway system is defined as consisting of conduit, tubing, duct, and fittings including but not limited to connectors, couplings, offsets, elbows, bushings, expansion/deflection fittings, and other components and accessories. Complete electrical raceway installation before starting the installation of conductors and cables.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Rigid Metal Conduit (RMC):

1. Allied Tube & Conduit
2. Beck Manufacturing Inc.
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

B. Electrical Metallic Tubing (EMT):

1. Allied Tube & Conduit
2. Beck Manufacturing WL
3. Picoma
4. Wheatland Tube Company
5. Or approved equivalent.

C. Flexible Metal Conduit (FMC):

1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

D. Liquidtight Flexible Metal Conduit (LFMC):

1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. Or approved equivalent.

E. Electrical Polyvinyl Chloride (PVC) Conduit:

1. AFC Cable Systems Inc.
2. Electri-Flex Company
3. International Metal Hose
4. JM Eagle
5. Or approved equivalent.

F. Conduit Fittings:

1. Bushings:
   a. Insulated Type for Threaded Raceway Without Factory Installed Plastic Throat Conductor Protection:
      1) Thomas & Betts 1222 Series
      2) O-Z Gedney B Series
      3) Or approved Equivalent.
2. Raceway Connectors and Couplings:
   a. Thomas & Betts Series
   b. O-Z Gedney Series
   c. Or approved Equivalent.
3. Expansion/Deflection Fittings:
   a. EMT: O-Z Gedney Type TX
   b. RMC: O-Z Gedney Type AX, DX and AXDX, Crouse & Hinds XD
   c. PVC: O-Z Gedney Type DX with PVC adapters, Carlon E945 Series, Kraloy OPEJ Series
   d. Or approved equivalent.

2.2 RIGID METAL CONDUIT (RMC)

A. UL 6, ANSI C80.1. Hot dipped galvanized steel conduit after thread cutting.

1. Fittings: NEMA FB2.10.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Description: UL 797, ANSI C80.3; steel galvanized tubing.

B. Fittings: NEMA FB 1; steel, compression type.

2.4 FLEXIBLE METAL CONDUIT (FMC)

A. Description: UL 1, Interlocked steel construction.

B. Fittings: NEMA FB 2.20.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: UL 360, inner core made from spiral wound strip of heavy gauge, hot dipped galvanized low carbon steel. 3/4-inch through 1-1/4-inch trade sizes to have a square lock core

and contain an integral bonding strip of copper. 1-1/2-inch and larger to have fully interlocked core. Jacket material to be moisture, oil and sunlight resistant flexible PVC.

B. Fittings: NEMA FB 2.20.

2.6 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: UL 651, NEMA TC 2; Schedule 40 PVC.

B. Fittings: NEMA TC 3.

2.7 CONDUIT FITTINGS

A. Bushings:

1. Insulated type for threaded raceway connectors without factory-installed plastic throat conductor protection.
2. Insulated grounding type for threaded raceway connectors.

B. Raceway Connectors and Couplings:

1. Steel connectors, couplings, and conduit bodies, hot-dip galvanized.
2. Connector locknuts to be steel, with threads meeting ASTM tolerances. Locknuts to be hot-dip galvanized.
3. Connector throats (EMT, flexible conduit, metal clad cable and cordset connectors) to have factory installed plastic inserts permanently installed. For normal cable or conductor exiting angles from raceway, the cable jacket or conductor insulation to bear only on plastic throat insert.
4. Steel gland, Tomic or Breagle connectors and couplings are recognized for this Contract as having acceptable raceway to fitting electrical conductance.
5. Set screw connectors and couplings, without integral compression glands, are recognized for this Contract as not having acceptable raceway to fitting electrical conductance. A ground conductor sized per this Specification must be included and bonded within raceway assembly utilizing this type connector or coupling.

C. Provide expansion/deflection fittings for EMT.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Finished Surfaces: Schedule raceway installation to avoid conflict with installed wall and ceiling surfaces. If unavoidable, coordinate work and repairs with Architect. Paint all exterior urface mounted conduits to match building surface finish.

B. Conduit Size:

1. Minimum Size: 3/4-inch for power and control, unless otherwise noted. 3/4-inch for communication/data, unless otherwise noted. 3/4-inch for signal systems, unless otherwise noted.

C. Underground Installations:

1. More than 5-feet from Foundation Wall: Use PVC.
2. Within 5-feet from Foundation Wall: Use PVC coated RMC.
3. In or Under Slab on Grade: Use PVC.
4. Minimum Size: 1-inch.

D. In Slab Above Grade:

1. Use PVC.
2. Maximum Size Conduit in Slab: Contact Structural Engineer for maximum outside diameter of conduit.

E. Provide two pull strings/tapes in empty conduits. Types:

1. Feeders: Polyester measure/pulling tape, Greenlee 4436 or approved.
2. Branch Circuits and Low Voltage: Greenlee Poly Line 431 or approved.
3. If fish tape is used for pulling line or low voltage wiring, fiberglass type to be used. Metal fish tapes will not be allowed.
4. Secure pull string/tape at each end.
5. Provide caps on ends of empty conduit to be used in future.
6. Label both ends of empty conduits with location of opposite end.

F. Elbows: Use fiberglass or PVC coated RMC for underground installations.

G. Elbow for Low Energy Signal Systems: Use long radius factory ells where linking sections of raceway for installation of signal cable.

H. Verify that field measurements are as shown on drawings.

I. Plan locations of conduit runs in advance of the installation and coordinate with ductwork, plumbing, ceiling and wall construction in the same areas.

J. Locate penetrations and holes in advance where they are proposed in the structural sections such as footings, beams, and walls. Penetrations are acceptable only when the following occurs:

1. Where shown on the structural drawings.
2. As approved by the Structural Engineer prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

K. Verify routing and termination locations of conduit prior to rough-in.

L. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

M. Install raceways securely, in neat and workmanlike manner, as specified in NECA 1, Standard Practices for Good Workmanship in Electrical Construction.

N. Install steel conduit as specified in NECA 101, Standard for Installing Steel Conduits.

O. Install nonmetallic conduit in accordance with manufacturer's instructions.

P. Inserts, anchors and sleeves.

1. Coordinate location of inserts and anchor bolts for electrical systems prior to concrete pour.
2. Coordinate location of sleeves with consideration for other building systems prior to concrete pour.

Q. Conduit Supports:

1. Arrange supports to prevent misalignment during wiring installation.
2. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
3. Group related conduits; support using conduit rack. Construct rack using steel channel. Provide space on each for 25 percent additional conduits.
4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
5. Do not attach conduit to ceiling support wires.

R. Flexible steel conduit length not-to-exceed 6-feet, 3-feet in concealed walls. Provide sufficient slack to reduce the effect of vibration.

S. Install conduit seals at boundaries where ambient temperatures differ by 10 degrees F or more as shown on the drawings. Install seals on warm side of partition.

T. Seal raceways stubbing up into electrical equipment. Plug raceways with conductors with duct-seal. Cap spare raceways and plug PVC raceway products with plastic plugs as made by Underground Products, or equal, shaped to fit snugly into the stubup.

U. Seal raceways penetrating an exterior building wall to prevent moisture and vermin from entering into the electrical equipment.

V. Use suitable caps on spare and empty conduits to protect installed conduit against entrance of dirt and moisture.

W. Keep 277/480 volt wiring independent of 120/208 volt wiring. Keep power wiring independent of communication system wiring.

X. Keep emergency system wiring independent of other wiring systems per NEC 700.

Y. Keep emergency system wiring independent of other wiring systems per NEC 700 and NEC 517. Keep life safety, critical branch and equipment systems wiring independent of other systems.

Z. Arrange conduit to maintain headroom and present neat appearance.

AA. Do not install conduits on surface of building exterior, along vapor barrier, across roof, on top of parapet walls, or across floors, unless otherwise noted on drawings.

AB. Exposed conduits are permitted only in following areas:

1. Mechanical rooms, electrical rooms or spaces where walls, ceilings and floors will not be covered with finished material.
2. Existing walls that are concrete or block construction.
3. Where specifically noted on Drawings.
4. Route exposed conduit parallel and perpendicular to walls, tight to finished surfaces and neatly offset into boxes.

AC. Do not install conduits or other electrical equipment in obvious passages, doorways, scuttles or crawl spaces which would impede or block area passage's intended usage.

AD. Install continuous conduit and raceways for electrical power wiring and signal systems wiring.

AE. Below Grade Conduit:

1. See 16543, Electrical Vaults and Underground Raceways.
2. Use PVC, PVC coated RMC, or fiberglass conduit.
3. Provide watertight conduit sleeves and rubber seals for conduit entering building below grade, Link-Seal system by Thunderline Corporation or approved equivalent.

AF. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

AG. Maintain adequate clearance between conduit and piping.

AH. Keep conduits a minimum of 12-inches away from steam or hot water radiant heating lines (at or above 104 degrees F) or 3-inches away from waste or water lines.

AI. Cut conduit square using saw or pipecutter; deburr cut ends.

AJ. Bring conduit to shoulder of fittings; fasten securely.

AK. Use conduit hubs to fasten conduit to cast boxes in damp and wet locations.

AL. Install no more than the equivalent of three 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams.

AM. Use hydraulic one shot bender to fabricate elbows for bends in metal conduit larger than 2-inch size.

AN. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

AO. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control, and expansion joints.

AP. Conduit Terminations for Signal Systems: Provide a plastic bushing on the end of conduit used for signal system wiring.

AQ. Feeders: Do not combine or change feeder runs.

AR. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07, Thermal and Moisture Protection.

AS. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation and installer.

3.2 RIGID METAL CONDUIT (RMC) INSTALLATION

A. Outdoor Locations Above Grade: RMC.

B. Damp Locations: RMC.

C. In areas exposed to mechanical damage: RMC.

D. For security conduits installed exposed and subject to tampering: RMC.

3.3 ELECTRICAL METALLIC TUBING (EMT) INSTALLATION

A. Dry Locations:

1. Concealed: EMT.
2. Exposed: EMT.

B. Dry, Protected: EMT.

3.4 FLEXIBLE METAL CONDUIT (FMC) INSTALLATION

A. Dry Locations: Motors, recessed luminaires and equipment connections subject to movement or vibration, use flexible metallic conduit.

B. Install 12-inch minimum slack loop on flexible metallic conduit.

3.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) INSTALLATION

A. Use PVC coated liquidtight flexible metallic conduit for motors and equipment connections subject to movement or vibration and subjected to any of following conditions: Exterior location, moist or humid atmosphere, corrosive environments, water spray, oil, or grease.

B. Install 12-inch minimum slack loop on liquidtight flexible metallic conduit.

3.6 ELECTRICAL POLYVINYL CHLORIDE (PVC) CONDUIT INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide equipment grounding conductor in PVC conduit runs containing power conductors.

C. Underground Installation:

1. Areas subject to vehicular traffic: Schedule 80 PVC.
2. Other underground applications: Schedule 40 PVC, except where prohibited by the NEC or local codes.

D. Convert PVC conduit to Rigid Metal Conduit (RMC) prior to emerging from underground, concrete encasement, or concrete slab.

E. Provide expansion fittings to compensate for expansion and contraction per NEC 352.44.

F. PVC elbows are not acceptable. Use fiberglass or PVC coated RMC.

G. Trim cut ends inside and outside to remove rough edges.

H. Provide bushings when entering a box, fitting or other enclosure.

3.7 CONDUIT FITTINGS INSTALLATION

A. Conduit Joints: Assemble conduits continuous and secure to boxes, panels, luminaires and equipment with fittings to maintain continuity. Provide watertight joints where embedded in concrete, below grade or in damp locations. Seal metal conduit with metal thread primer. Rigid conduit connections to be threaded, clean and tight (metal to metal). Threadless connections are not permitted for RMC.

B. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

C. Use set screw type fittings only in dry locations. When set screw fittings are utilized provide insulated continuous equipment ground conductor in conduit, from overcurrent protection device to outlet.

D. Use compression fittings in dry locations, damp and rain-exposed locations. Maximum size permitted in damp locations and locations exposed to rain is 2-inches in diameter.

E. Use threaded type fittings in wet locations, hazardous locations, and damp or rain-exposed locations where conduit size is greater than 2-inches.

F. Use PVC coated, threaded type fittings in corrosive environments.

G. Use insulated type bushings with ground provision at switchboards, panelboards, safety disconnect switches, junction boxes that have feeders 60 amperes and greater.

H. Condulets and Conduit Bodies:

1. Do not use condulets and conduit bodies in conduits for signal wiring, in feeders 100 amp and larger, or for conductor splicing.

I. Sleeves and Chases - Floor, Ceiling and Wall Penetrations: Provide necessary rigid conduit sleeves, openings and chases where conduits or cables are required to pass through floors, ceilings or walls.

J. Expansion Joints:

1. Provide conduits crossing expansion joints where cast in concrete with expansion-deflection fittings, installed per manufacturer's recommendations.
2. Secure conduits 3-inches and larger to building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across joint installed per manufacturer's recommendations.
3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.
4. Verify expansion/deflection requirements with Structural Engineer prior to installation.

K. Seismic Joints:

1. No conduits cast in concrete allowed to cross seismic joint.
2. Provide conduits with junction boxes securely fastened on both sides of seismic joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that 15-inches is adequate for designed movement, and if not, increase this length as required.
3. Provide conduits less than 3-inches where not cast in concrete with junction boxes securely fastened on both sides of expansion joint, connected together with 15-inches of slack (minimum of 15-inches longer than straight line length) flexible conduit and copper

green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits 3-inch and larger may be installed.

L. Provide rigid conduit coupling flush with surface of slab or wall for conduit stubbed in concrete slab or wall to serve electrical equipment or an outlet under table or to supply shop tool, etc. Provide plug where conduit is to be used in future.

END OF SECTION 16135

SECTION 16217 - OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Fuses
2. Molded Case Circuit Breakers
3. Fuse Cabinets

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

B. In addition, provide:

1. Product data and instantaneous let-through current curves and average melting time current curves for fuses supplied to project.
2. Product data and time/current trip curves for circuit breakers supplied to project.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements apply to this Section.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Fuses:

1. Bussmann
2. Ferraz-Shawmut
3. Littelfuse
4. McGraw-Edison
5. Or approved equivalent.

B. Molded Case Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

C. Fuse Cabinet:

1. Bussmann
2. Circle AW
3. Ferraz-Shawmut
4. Littelfuse
5. Siemens
6. Schneider Electric/Square D
7. Or approved equivalent.

D. When circuit breakers are called for in existing panelboards, provide circuit breakers from the same manufacturer that are compatible with the existing panelboard.

2.2 FUSES

A. Characteristics:

1. Dual element, time delay, current limiting, nonrenewable type, rejection feature.
2. Combination Loads: UL Class RK1, RK5, or J, 1/10 to 600 amp. UL Class L, above 600 amps.
3. Motor Loads: UL Class RK5, 1/10 to 600 amp.
4. Fuse pullers for complete range of fuses.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. 1-, 2- or 3-pole bolt-on, single handle common trip, 600VAC or 250VAC as indicated on Drawings.

B. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.

C. Calibrate for operation in 40 degrees C ambient temperature.

D. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.

E. 151 to 400 Amp Breakers: Adjustable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

F. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions.

G. Circuit breakers 1200 Amp and Greater: Provide breaker with energy-reducing maintenance switching with local status indicator per NEC Article 240.87(B).

H. Provide ground fault function for breakers greater than 800 amps where applied at 480 volts line-to-line; and where indicated on drawings.

2.4 FUSE CABINET

A. Enclosure:

1. Metallic cabinet surface mounted, with internal shelves, trim cover with hinged and latched door.
2. Size cabinet such that spare fuses required by these Documents do not exceed 50 percent of cabinet volume.

B. Label: Provide engraved label to identify as spare fuse cabinet.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Coordination:

1. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Division 15.
2. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to overcurrent protective devices as necessary to coordinate with the nameplate rating.

B. Install all items in accordance with manufacturers written instructions.

3.2 FUSES

A. Fuses: For each class and ampere rating of fuse installed, provide the following quantities of spares for quantity of fuses installed:

1. 0 to 24: Provide 6 spare.
2. 25 to 48: Provide 9 spare.
3. 49 and Above: Provide 12 spare.

3.3 MOLDED CASE CIRCUIT BREAKERS

A. Provide testing of ground fault interrupting breakers.

B. Provide circuit breakers, as specified and on Drawings, for installation in panelboards, individual enclosures or combination motor starters.

C. Provide ground fault interrupter circuit breakers for equipment in damp or wet locations.

D. Provide device on handle to lock breaker in "ON" position for breakers feeding time switches, night lights and similar circuits required to be continuously energized.

E. Shunt Trip Circuit Breakers: Provide wiring to remote trip switch/contacts as indicated on Drawings.

F. Provide multi-pole branch circuit breakers for multiwire branch circuits for simultaneous disconnection of circuits.

3.4 FUSE CABINETS

A. Install fuse cabinet on wall in the Electrical Room in coordination with electrical equipment.

END OF SECTION 16217

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included:

1. Toggle Type Disconnect Switches
2. Manual Motor Starters
3. Safety Switches
4. Enclosed Circuit Breakers

1.2 RELATED SECTIONS

A. Contents of Division 16, Electrical and Division 01, General Requirements apply to this Section.

B. In addition, reference the following: Section 16475, Overcurrent Protective Device Coordination and other Studies

1.3 REFERENCES AND STANDARDS

A. References and Standards as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.4 SUBMITTALS

A. Submittals as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.5 QUALITY ASSURANCE

A. Quality assurance as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

1.6 WARRANTY

A. Warranty of materials and workmanship as required by Section 16000, Electrical Basic Requirements and Division 01, General Requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toggle Type Disconnect Switches:

1. Cooper
2. Hubbell
3. Leviton
4. Legrand (Pass & Seymour)
5. Slater
6. Or approved equivalent.

B. Manual Motor Starters:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

C. Safety Switches:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

D. Enclosed Circuit Breakers:

1. Eaton Electrical
2. ABB/General Electric
3. Siemens
4. Schneider Electric/Square D
5. Or approved equivalent.

2.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Rating: 120 or 277 volt, 1 or 2 pole, 20 amp, 1 hp maximum.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 4X: Damp or wet locations/Outdoors.

C. Handle lockable in 'off' position.

2.3 MANUAL MOTOR STARTERS

A. Quick-Make, Quick-Break. Thermal overload protection. Device labeled with maximum voltage, current, and horsepower.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 4X: Damp or wet locations/Outdoors.

2.4 SAFETY SWITCHES

A. Heavy duty fusible type and non-fusible type (as indicated on drawings), dual rated, quick-make, quick-break with fuse rejection feature for use with Class R fuses only, unless other fuse type is specifically noted.

B. Clearly marked for maximum voltage, current, and horsepower.

C. Operable handle interlocked to prevent opening front cover with switch in 'on' position.

D. Switches rated for maximum available fault current.

E. Handle lockable in 'off' position.

F. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 4X: Damp or wet locations/Outdoors.

G. Fusible Switch Assemblies: NEMA KS 1, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse clips: Provide fuse rejection feature for Class R or J fuses up to 600 amp. Remove if circuit breaker type is used. Provide switches of 30 to 200 amp with plug-on line side connections.

H. Fusible Switch Assemblies, 800 Amperes and Larger: Bolted pressure contact switches. Fuse Clips: Designed to accommodate Class L fuses. Provide with shunt-trip and ground fault capabilities. Remove if circuit breaker type is used.

2.5 ENCLOSED CIRCUIT BREAKERS

A. Molded case circuit breakers:

1. 1-, 2-, or 3-pole bolt on, single-handle common trip, 600VAC or 250VAC as indicated on drawings.
2. Overcenter toggle-type mechanism, quick-make, quick-break action. Trip indication is by handle position.
3. Calibrate for operation in 40C ambient temperature.
4. 15 to 150 Amp Breakers: Permanent trip unit containing individual thermal and magnetic trip elements in each pole.
5. 151 to 400 Amp Breakers: Variable magnetic trip elements. Provide push-to-trip button on cover of breaker for mechanical tripping.

6. Greater than 401 Amp: Electronic trip type with adjustments for long-time, instantaneous, and short-time functions. Provide ground fault function for breakers greater than 400 amps.
7. Provide handle mechanisms that are lockable in the open (off) position.
8. Circuit breakers to have minimum symmetrical interrupting capacity as indicated on Drawings.

B. Enclosure:

1. NEMA 1: Dry locations/Indoors.
2. NEMA 4X: Damp or wet locations/outdoors.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Obtain and review the submitted product data for equipment furnished by the Owner, and furnished under other Divisions of this contract, particularly under Division 15.

B. Confirm the equipment nameplate maximum overcurrent protection (MOCP) and make accommodations and adjustments to switches, fuses and circuit breakers as necessary to coordinate with the nameplate rating

.

C. Install in accordance with manufacturer's instructions.

D. Provide engraved nameplates per Section 16075, Identification for Electrical Systems.

F. Apply neatly typed adhesive tag on inside door of each fusible switch indicating NEMA fuse class and size installed.

3.2 TOGGLE TYPE DISCONNECT SWITCHES

A. Install fuses in fusible disconnect switches. Coordinate fuse ampere rating with installed equipment. Do not provide fuses of lower ampere rating than motor starter thermal units.

B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.3 MANUAL MOTOR STARTERS

A. Provide disconnecting means within sight of each motor controller and of each motor. Motor controller disconnecting means equipped with lock-out/tag-out padlock provisions do not require a disconnect switch at the controlled motor location. Locate disconnect means in view of and not inside of equipment, such that tools are not needed to remove covers to access the disconnecting means.

B. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

C. See General Installation Requirements above.

3.4 SAFETY SWITCHES

A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

B. See General Installation Requirements above.

3.5 ENCLOSED CIRCUIT BREAKERS

A. Install products, systems and equipments in accordance with manufacturers written instructions and requirements.

B. See General Installation Requirements above.

END OF SECTION 16410