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***Shallow Bedrock Groundwater
Interim Action
Site Preparation
Materials and Performance Specifications***

***Former Powerex, Inc. Facility
Site No. 7-06-006
Auburn, New York***

Prepared for:

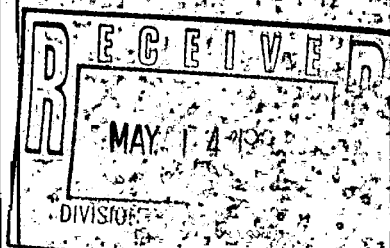
***General Electric Company
Corporate Environmental Programs
1 Computer Drive South
Albany, New York 12205***

Prepared by:

***Radian Engineering, Inc.
155 Corporate Woods
Suite 100
Rochester, New York 14623***

9 May, 1997

Radian Engineering Inc.



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MATERIAL AND PERFORMANCE SPECIFICATIONS
TABLE OF CONTENTS

DIVISION 1 - GENERAL REQUIREMENTS

<u>Section No.</u>	<u>Description</u>
01030	HEALTH AND SAFETY
01300	SUBMITTALS
01500	CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

DIVISION 2 - SITE WORK

<u>Section No.</u>	<u>Description</u>
02030	SELECTIVE DEMOLITION
02050	EXCAVATION
02070	TANK REMOVAL AND CLOSURE
02080	ASBESTOS ABATEMENT
02100	CONTROLLED AND UNCONTROLLED FILLS AND BACKFILLS
02140	DEWATERING
02221	EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES
02713	WATER LINES
02750	WASTE MANAGEMENT
02800	ASPHALTIC CONCRETE PAVEMENT

DIVISION 3 - CONCRETE

<u>Section No.</u>	<u>Description</u>
03200	CONCRETE REINFORCING
03300	CAST-IN-PLACE CONCRETE
03410	STRUCTURAL PRE-CAST CONCRETE

DIVISION 4 - MASONRY

<u>Section No.</u>	<u>Description</u>
04100	MASONRY MORTAR
04200	UNIT MASONRY

DIVISION 5 - METALS

<u>Section No.</u>	<u>Description</u>
05250	STEEL GRATING
05400	LIGHT GAUGE FRAMING
05521	HANDRAILS AND RAILINGS

DIVISION 6 - WOOD AND PLASTICS

<u>Section No.</u>	<u>Description</u>
06100	ROUGH CARPENTRY

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

<u>Section No.</u>	<u>Description</u>
07200	FIBERGLASS BATT INSULATION
07210	SPRAYED ON INSULATION
07620	SHEET METAL FLASHING AND TRIM
07900	CAULKING
07905	PAVING JOINT SEALANTS

DIVISION 8 - DOORS AND WINDOWS

<u>Section No.</u>	<u>Description</u>
08100	METAL DOORS AND FRAMES
08300	SPECIAL DOORS
08700	FINISH HARDWARE

DIVISION 9 - FINISHES

<u>Section No.</u>	<u>Description</u>
09260	GYPSUM BOARD DRYWALL
09650	RESILIENT FLOORING
09705	RESINOUS FLOORING
09900	PAINTING
09980	FIBERGLASS REINFORCED WALL PANELS

DIVISION 15 - MECHANICAL

<u>Section No.</u>	<u>Description</u>
15470	SEWAGE LIFT STATION

DIVISION 16 - ELECTRICAL

<u>Section No.</u>	<u>Description</u>
16010	ELECTRICAL WORK, GENERAL
16100	RACEWAYS, BOXES AND CONDUITS
16140	WIRING DEVICES
16195	ELECTRICAL IDENTIFICATION
16452	GROUNDING
16460	TRANSFORMERS
16470	PANELBOARDS
16476	DISCONNECT SWITCHES AND CIRCUIT BREAKERS
16481	MOTOR CONTROLLERS

ATTACHMENT

FIELD HEALTH AND SAFETY PLAN, FORMER POWEREX, INC. FACILITY (NOVEMBER 20, 1995)

**SECTION 01030
HEALTH AND SAFETY**

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the minimum requirements for health and safety for Hazardous Waste Operations at this Site. Specific requirements for the removal of asbestos-containing materials are included in SECTION 02080: ASBESTOS ABATEMENT.

1.2 APPLICABLE REGULATIONS:

- A. Work performed under this contract shall comply with applicable Federal, State, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, 29 CFR 1910, especially Section .120, "Hazardous Waste Site Operations and Emergency Response" and 29 CFR 1926, especially Section .65, "Hazardous Waste Site Operations and Emergency Response". Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.
- B. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-02(1996) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

2. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z358.1 (1990) Emergency Eyewash and Shower Equipment

3. CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1904 Recording and Reporting Occupational Injuries and Illnesses

29 CFR 1910 Occupational Safety and Health Standards

29 CFR 1926 Safety and Health Regulations for Construction

49 CFR 171 General Information, Regulations, and Definitions

49 CFR 172 Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

4. NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH Pub No. 85-115 (1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

1.3 SUBMITTALS:

The following shall be submitted to the Owner and Engineer for review and approval:

- A. Site Safety and Health Plan for Site Preparation: This Plan shall include procedures to implement Site health and safety in accordance with these specifications. The plan shall include drawings to illustrate initial work zone boundaries [Exclusion Zone (EZ), Contamination Reduction Zone (CRZ), and Support Zone (SZ)] and to show the layout of the personnel and equipment decontamination areas.

1.4 REGULATORY REQUIREMENTS:

Work performed under this contract shall comply with applicable Federal, State, and local safety and occupational health laws and regulations. This includes, but is not limited to, Occupational Safety and Health Administration (OSHA) standards, 29 CFR 1910, especially Section .120, "Hazardous Waste Site Operations and Emergency Response" and 29 CFR 1926, especially Section .65, "Hazardous Waste Site Operations and Emergency Response". Matters of interpretation of standards shall be submitted to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements shall apply.

1.5 SAFETY AND HEALTH PROGRAM:

OSHA Standards 29 CFR 1910, Section .120 (b) and 29 CFR 1926, Section .65 (b) require employers to develop and implement a written safety and health program for employees involved in hazardous waste operations. The site-specific program requirements of the OSHA Standards shall be integrated into one site-specific document, the Site Safety and Health Plan (SSHP). The SSHP shall interface with the employer's overall safety and health program. Any portions of the overall safety and health program that are referenced in the SSHP shall be included as appendices to the SSHP.

1.6 SITE SAFETY AND HEALTH PLAN:

A. PREPARATION AND IMPLEMENTATION:

An SSHP shall be prepared covering onsite work to be performed by the Contractor and all subcontractors. The Safety and Health Manager shall be responsible for the development, implementation and oversight of the SSHP. The SSHP shall establish, in detail, the protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed. The SSHP shall address site-specific safety and health requirements and procedures based upon site-specific conditions. The level of detail provided in the SSHP shall be tailored to the type of work, complexity of operations to be performed, and hazards anticipated. Details about some activities may not be available when the initial SSHP is prepared and submitted. Therefore, the SSHP shall address, in as much detail as possible, anticipated tasks, their related hazards and anticipated control measures. Additional details shall be included in the activity hazard analyses as described in paragraph ACTIVITY HAZARD ANALYSES.

B. ACCEPTANCE AND MODIFICATIONS:

Prior to submittal, the SSHP shall be signed and dated by the Safety and Health Manager and the Site Superintendent. Onsite work shall not begin until the plan has been accepted by the Engineer and the Owner. A copy of the written SSHP shall be maintained onsite. As work proceeds, the SSHP shall be adapted to new situations and new conditions. Changes and modifications to the accepted SSHP shall

be made with the knowledge and concurrence of the Safety and Health Manager, the Site Safety Officer, and the Engineer. Should any unforeseen hazard become evident during the performance of the work, the SSO shall bring such hazard to the attention of the Safety and Health Manager, the SSO, and the Engineer, both verbally and in writing, for resolution as soon as possible. In the interim, necessary action shall be taken to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted SSHP shall be cause for stopping of work until the matter has been rectified.

C. AVAILABILITY:

The SSHP shall be made available in accordance with 29 CFR 1910, Section .120 (b)(1)(v) and 29 CFR 1926, Section .65 (b)(1)(v).

D. ELEMENTS:

Topics required by 29 CFR 1910, Section .120 (b)(4), 29 CFR 1926, Section .65 (b)(4) and those described in this section shall be addressed in the SSHP. Where the use of a specific topic is not applicable to the project, the SSHP shall include a statement to justify its omission or reduced level of detail and establish that adequate consideration was given the topic.

1.7 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION:

A. PROJECT/SITE CONDITIONS:

The information referenced below is provided to assist in preparing the SSHP. This information describes the site and nature of the subsurface contaminants.

1. Site Information:

Site subsurface conditions and contaminants have been described in the Site Preparation Work Plan and all documents referenced therein. The underground storage tank addressed by this project has been confirmed as having contained solvents; however, this tank was decommissioned and closed in 1988 in accordance an NYSDEC-approved Closure Plan.

2. List of Available Documents:

Further health and safety related information is available in the November 16, 1995 document entitled "Field Health and Safety Plan, Shallow Bedrock Groundwater Interim Action, Former Powerex, Inc. Facility, Auburn, New York." A copy of this document is attached to this specification for the Contractor's reference and, as deemed appropriate by the Contractor, use in preparing the SSHP.

3. Plan Requirements:

The SSHP shall include a site description and contamination characterization section that addresses the following elements:

- a. Description of site location, topography, size and past uses of the site.
- b. A list of contaminants which may present occupational health and safety hazards. This list shall be created by evaluating the analytical results available for the site and by

researching sources of information from past site investigation activities. Chemical names, concentration ranges, media in which found, locations onsite, and estimated quantities/volumes to be impacted by site work shall be provided by the Engineer, if known. The contamination characterization shall be reviewed and revised if new chemicals are identified as work progresses.

1.8 HAZARD/RISK ANALYSIS:

The SSHP shall include a safety and health hazard/risk analysis for each site task and operation to be performed. The hazard/risk analysis shall provide information necessary for determining safety and health procedures, equipment, and training to protect onsite personnel, the environment, and the public. Available site information shall be reviewed when preparing the "Hazard/Risk Analysis" section of the SSHP. The following elements, at a minimum, shall be addressed.

A. SITE TASKS AND OPERATIONS (WORK PLAN):

Detailed information on the tasks to be performed for the Site Preparation is provided in the Site Preparation Plan that accompanies these specifications. The SSHP shall include a comprehensive section that addresses the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives. Based on the type of remediation required, the following is a list of anticipated major site tasks and operations to be performed:

1. Removal of contaminated groundwater from the underground storage tank by pumping;
2. Excavation of soil surround the tank to expose the tank for demolition;
3. In-place demolition of the tank using a hoe-ram, or other means deemed appropriate by the Contractor;
4. Removal of broken concrete from the tank;
5. Backfill of the excavation with the excavated soil as well as excess earth and miscellaneous and appropriate construction material from the utility installation and Primary Treatment Room construction work;
6. Excavation of utility trenches;
7. Excavation dewatering;
8. Installation of gas and water piping;
9. Connection of utilities to service mains under West Genesee Street;
10. Backfill of utility trenches with soil material removed during excavation;
11. Surface restoration and seeding and/or paving of utility trenches;
12. Removal of asbestos-containing floor tiles;
13. Removal of loading dock lifts and excavation of soil under the lifts;
14. Installation of a new entrance at the north end of the Primary Treatment Room;
15. Installation of a separator pit and subsurface piping from the inlet separators to the liquid-ring vacuum pumps;
16. Installation of a wet well;
17. Installation of subsurface plumbing associated with the restroom;
18. Installation of subsurface piping for the water treatment system; and
19. Installation of gas, water and electric service to the Primary Treatment Room.

This may not be a complete list of site tasks and operations. Therefore, it shall be expanded and/or revised, during preparation of the SSHP as necessary.

B. HAZARDS:

The following potential hazards may be encountered during site work:

1. Slipping and tripping hazards from steep grades or uneven terrain;
2. Exposure to biological hazards (i.e. poison ivy, biting/stinging insects);
3. Work in remote locations;
4. Exposure to sun (sunburn);
5. Exposure to heat/cold;
6. Excavation hazards, including accidental exposure to buried utilities;
7. Electrical hazards from accidental contact with overhead power lines and use of electrically powered field equipment;
8. Being struck by heavy equipment;
9. Drilling hazards;
10. Noise from heavy equipment;
11. Hazards associated with demolition activities; and
12. Chemical hazards.

This may not be a complete list, therefore, it shall be expanded and/or revised as necessary during preparation of the SSHP

1. Chemical Hazards

A list of the chemicals detected in environmental samples from past site investigations, and their maximum known concentrations in groundwater, soils, and surface water, is provided in Attachment A of the November 16, 1995 document entitled "Field Health and Safety Plan, Shallow Bedrock Groundwater Interim Action, Former Powerex, Inc. Facility, Auburn, New York." The Hazard/Risk Analysis section of the SSHP shall describe the chemical, physical, and toxicological properties of contaminants, sources and pathways of employee exposures, anticipated onsite and offsite exposure level potentials, and regulatory (including Federal, state, and local) or recommended protective exposure standards. The SSHP shall also address employee exposure to hazardous substances brought onsite, and shall comply with the requirements of 29 CFR 1910, Section .1200 and 29 CFR 1926, Section .59, Hazard Communication.

C. ACTION LEVELS:

1. General:

Action levels shall be established for the situations listed below, at a minimum. The action levels and required actions (engineering controls, changes in PPE, etc.) shall be presented in the SSHP in both text and tabular form.

1. Implementation of engineering controls and work practices.
2. Upgrade or downgrade in level of personal protective equipment.
3. Work stoppage and/or emergency evacuation of onsite personnel.
4. Prevention and/or minimization of public exposures to hazards created by site activities.

2. Confined Space Entry:

Entry into and work in a confined space will not be allowed when oxygen readings are less than 19.5% or greater than 23.5% or if the Lower Flammable Limit (LFL) reading is greater than 10%, unless these conditions are adequately addressed in a confined space entry program. In addition, action levels for toxic atmospheres shall be determined.

1.9 ACTIVITY HAZARD ANALYSES:

Prior to beginning each major phase of work, an Activity Hazard Analysis shall be prepared by the Contractor performing that work and submitted to the Owner and the Engineer for review and acceptance. A major phase of work is defined as an operation involving a type of work presenting hazards not experienced in previous operations or where a new subcontractor or work crew is to perform. The analysis shall define the activities to be performed and identify the sequence of work, the specific hazards anticipated, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level. Work shall not proceed on that phase until the activity hazard analysis has been accepted and a preparatory meeting has been conducted by the Contractor to discuss its contents with everyone engaged in the activities. The activity hazard analyses shall be continuously reviewed and when appropriate modified to address changing site conditions or operations, with the concurrence of the Safety and Health Manager, the SSO, and the Engineer. Activity hazard analyses shall be attached to and become a part of the SSHP.

1.10 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES:

An organizational structure shall be developed that sets forth lines of authority (chain of command), responsibilities, and communication procedures concerning site safety, health, and emergency response. This organizational structure shall cover management, supervisors and employees of the Contractor and subcontractors. The structure shall include the means for coordinating and controlling work activities of subcontractors and suppliers. The SSHP shall include a description of this organizational structure as well as qualifications and responsibilities of each of the following individuals. The Contractor shall obtain Engineer's acceptance before replacing any member of the safety and health staff. Requests shall include the names, qualifications, duties, and responsibilities of each proposed replacement.

A. SITE SUPERINTENDENT:

A Site Superintendent, who has responsibility to implement the SSHP, the authority to direct work performed under this Contract, and verify compliance, shall be designated.

B. SAFETY AND HEALTH MANAGER:

1. Qualifications

The services of an Industrial Hygienist certified by the American Board of Industrial Hygiene or a Safety Professional certified by the Board of Certified Safety Professionals shall be utilized. The name, qualifications (education summary and documentation, ABIH/BCEP certificate), and work experience summary shall be included in the SSHP. The Safety and Health Manager shall have the following additional qualifications:

- a. A minimum of 3 years experience in developing and implementing safety and health programs at hazardous waste sites.
- b. Documented experience in supervising professional and technician level personnel.
- c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.

- d. Documented experience in the development of personal protective equipment programs, including programs for working in and around potentially toxic, flammable and combustible atmospheres and confined spaces.
- e. Working knowledge of state and Federal occupational safety and health regulations.

2. Responsibilities

The Safety and Health Manager shall:

- a. Be responsible for the development, implementation, oversight, and enforcement of the SSHP.
- b. Sign and date the SSHP prior to submittal.
- c. Be available for emergencies.
- d. Provide onsite consultation as needed to ensure the SSHP is fully implemented.
- e. Coordinate any modifications to the SSHP with the Site Superintendent, the SSO, and the Engineer.
- f. Provide continued support for upgrading/downgrading of the level of personal protection.
- g. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.
- h. Review accident reports and results of daily inspections.

C. SITE SAFETY OFFICER (SSO):

1. Qualifications

An individual shall be designated the Site Safety Officer (SSO). The name, qualifications (education and training summary and documentation), and work experience of the Site Safety Officer shall be included in the SSHP. The SSO shall have the following qualifications:

- a. A minimum of 2 years experience in implementing safety and health programs at hazardous waste sites where Level C personal protective equipment was potentially required.
- b. Documented experience in construction techniques and construction safety procedures.
- c. Working knowledge of Federal and state occupational safety and health regulations.
- d. Specific training in personal and respiratory protective equipment program implementation, confined space program oversight, and in the proper use of air monitoring instruments, and air sampling methods.

2. Responsibilities

The Site Safety Officer shall:

- a. Assist and represent the Safety and Health Manager in onsite training and the day to day onsite implementation and enforcement of the accepted SSHP.
- b. Be assigned to the site on a full time basis for the duration of field activities. If operations are performed during more than one work shift per day, an SSO shall be present for each shift.
- c. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the SSHP including, but not limited to, activity hazard analyses, air monitoring, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection.
- d. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

- e. Consult with and coordinate any modifications to the SSHP with the Safety and Health Manager, the Site Superintendent, and the Engineer.
- f. Conduct accident investigations and prepare accident reports.
- g. Review results of daily quality control inspections and document safety and health findings.
- h. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

D. OCCUPATIONAL PHYSICIAN:

1. Qualifications

The services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience, is Board eligible, shall be utilized. The physician shall be familiar with this site's hazards and the scope of this project. The medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities shall be included in the SSHP.

2. Responsibilities

The physician shall be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910, Section .120 (f) and 29 CFR 1926, Section .65 (f) and paragraph MEDICAL SURVEILLANCE.

E. PERSONS CERTIFIED IN FIRST AID AND CPR:

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency shall be onsite at all times during site operations. They shall be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030. These persons may perform other duties but shall be immediately available to render first aid when needed.

F. SAFETY AND HEALTH TECHNICIANS:

When necessary, as determined by the Safety & Health Manager, each work crew in the exclusion zone, shall have a designated Safety and Health Technician to perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSO. They shall have appropriate training equivalent to the SSO in each specific area for which they have responsibility and shall report to and be under the supervision of the SSO.

1.11 TRAINING:

Personnel shall receive training in accordance with the Contractor's written safety and health training program and 29 CFR 1910, Section .120, 29 CFR 1926, Section .65, and 29 CFR 1926, Section .21. The SSHP shall include a section describing training requirements.

A. GENERAL HAZARDOUS WASTE OPERATIONS TRAINING:

Personnel entering the exclusion or contamination reduction zones shall have successfully completed: 40 hours of hazardous waste instruction off the site; 3 days actual field experience under the direct supervision of a trained, experienced supervisor; and 8 hours refresher training annually. Onsite supervisors shall have completed the above training and 8 hours of additional, specialized training covering at least the following topics: the employer's safety and health program; personal protective equipment program; spill containment

program; and health hazard monitoring procedures and techniques. Copies of current training certification statements shall be submitted prior to initial entry onto the work site.

B. SITE-SPECIFIC TRAINING:

Site-specific training sessions shall be documented in the Contractor's logs.

1. Initial Session (Pre-Entry Briefing)

Prior to commencement of onsite field activities, all site employees, including those assigned only to the Support Zone, shall attend a site-specific safety and health training session. This session shall be conducted by the SSO to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Procedures and contents of the accepted SSHP and shall be thoroughly discussed.

2. Periodic Sessions

Periodic onsite training (tailgate sessions) shall be conducted by the SSO at least weekly for personnel assigned to work at the site during the following week. The training shall address safety and health procedures, work practices, any changes in the SSHP, activity hazard analyses, work tasks, or schedule, results of previous week's air monitoring, review of safety discrepancies and accidents. Should an operational change affecting onsite field work be made, a meeting prior to implementation of the change shall be convened to explain safety and health procedures. Site-specific training sessions for new personnel, visitors, and suppliers shall be conducted by the SSO using the training curriculum outlines developed by the Safety and Health Manager.

1.12 PERSONAL PROTECTIVE EQUIPMENT:

A. GENERAL:

In accordance with 29 CFR 1910, Section .120 (g)(5) and 29 CFR 1926, Section .65 (g)(5), a written Personal Protective Equipment (PPE) program which addresses the elements listed in that regulation, and which complies with respiratory protection program requirements of 29 CFR 1910, Section .134, is to be included in the employer's safety and health program. The SSHP shall detail the minimum PPE ensembles (including respirators) and specific materials from which the PPE components are constructed for each site-specific task and operation to be performed, based upon the hazard/risk analysis. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Only respirators approved by NIOSH shall be used. Onsite personnel shall be provided with appropriate personal protective equipment. Protective equipment and clothing shall be kept clean and well maintained. The PPE section of the SSHP shall include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE.

B. LEVELS OF PROTECTION:

The Safety and Health Manager shall establish appropriate levels of protection for each work activity based on review of historical site information, existing data, an evaluation of the potential for exposure (inhalation, dermal, ingestion, and injection) during each task, past air monitoring results, and a continuing safety and health monitoring program. The Safety and Health Manager shall also establish action levels for upgrade or downgrade in levels of PPE from the following specified minimum levels of protection. Protocols and the communication network for changing the level of protection shall be described in the SSHP. The PPE reassessment protocol shall address air monitoring results, potential for exposure, changes

in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc.

1. Components of Levels of Protection

The following items constitute minimum protective clothing and equipment ensembles to be utilized during this project:

Level D

1. Long pants or coveralls;
2. Safety glasses with side shields;
3. Steel-toed boots; and
4. Hearing protection (if noisy equipment is in use nearby).

Modified Level D

1. Disposable coveralls;
2. Safety glasses with side shields
3. Hard hats;
4. Nitrile gloves (if handling items covered with contaminated soil or fluids);
5. Steel-toed boots; and
6. Hearing protection (if noisy equipment is in use nearby).

Level C

1. Chemical-resistant Tyvek® coveralls, taped at the bottom of the sleeves and legs;
2. Chemical-resistant safety boots or slip-ons;
3. Nitrile outer gloves with latex inner gloves, or double-layered NDEX (nitrile) gloves inside work gloves;
4. Air purifying respirators with combination organic vapor cartridges and high efficiency particulate filters;
5. Safety glasses with side shields;
6. Hard hats;
7. Nitrile gloves (if handling items covered with contaminated soil or fluids);
8. Steel-toed boots; and
9. Hearing protection (if noisy equipment is in use nearby).

Level B

1. Chemical-resistant Tyvek® coveralls, taped at the bottom of the sleeves and legs;
2. Chemical-resistant safety boots or slip-ons;
3. Nitrile outer gloves with latex inner gloves, or double-layered NDEX (nitrile) gloves inside work gloves;
4. Supplied air respirator;
5. Safety glasses with side shields;
6. Hard hats;
7. Nitrile gloves (if handling items covered with contaminated soil or fluids);
8. Steel-toed boots; and
9. Hearing protection (if noisy equipment is in use nearby).

1.13 MEDICAL SURVEILLANCE:

The Safety and Health Manager, in conjunction with the Occupational Physician, shall detail, in the employer's safety and health program and the SSHP, the medical surveillance program that includes scheduling of examinations, certification of fitness for duty, compliance with OSHA requirements, and information provided to

the physician. Examinations shall be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place. Medical surveillance protocols and examination and test results shall be reviewed by the Occupational Physician. The medical surveillance program shall contain the requirements specified below. Personnel working in contaminated areas of the site shall have been examined as prescribed in 29 CFR 1910, Section .120, and 29 CFR 1926, Section .65, and determined medically fit to perform their duties.

A. FREQUENCY OF EXAMINATIONS:

Employees shall have been provided with: medical examinations, as specified, within the past 12 months and shall receive exams annually thereafter (if Contract duration exceeds 1 year); on termination of employment; reassignment in accordance with 29 CFR 1910, Section .120 (f)(3)(i), and 29 CFR 1926, Section .65 (f)(3)(i)(C); if the employee develops signs or symptoms of illness related to workplace exposures; if the physician determines examinations need to be conducted more often than once a year; and when an employee develops a lost time injury or illness during the period of this Contract. The supervisor shall be provided with a written statement signed by the physician prior to allowing the employee to return to the work site after injury or illness resulting in a lost workday, as defined in 29 CFR 1904, Section .12 (f).

B. CONTENT OF EXAMINATIONS:

The following elements shall be included in the medical surveillance program. Additional elements may be included at the discretion of the occupational physician responsible for reviewing the medical surveillance protocols.

- a. Complete medical and occupational history (initial exam only).
- b. General physical examination of major organ systems.
- c. Pulmonary function testing including FVC and FEV1.0.
- d. CBC with differential.
- e. Blood chemistry screening profile (e.g. SMAC 20/25).
- f. Urinalysis with microscopic examination.
- g. Audiometric testing (as required by Hearing Conservation Program).
- h. Visual acuity.
- i. Chest x-ray. (This test should be performed no more frequently than every 4 years, unless directed by Occupational Physician.)
- j. Electrocardiogram (as directed by Occupational Physician).

C. INFORMATION PROVIDED TO THE OCCUPATIONAL PHYSICIAN:

The physician shall be furnished with the following:

- a. Site information from paragraph, SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION.
- b. Information on the employee's anticipated or measured exposure.
- c. A description of any PPE used or to be used.
- d. A description of the employee's duties as they relate to the employee's exposures (including physical demands on the employee and heat/cold stress).
- e. A copy of 29 CFR 1910, Section .120, or 29 CFR 1926, Section .65.
- f. Information from previous examinations not readily available to the examining physician.
- g. A copy of Section 5.0 of NIOSH Pub No. 85-115.
- h. Information required by 29 CFR 1910, Section .134.

D. PHYSICIAN'S WRITTEN OPINION:

Before work begins a copy of the physician's written opinion for each employee shall be obtained and furnished to the Safety and Health Manager and the employee. The opinion shall address the employee's ability to perform hazardous remediation work and shall contain the following:

- a. The physician's recommended limitations upon the employee's assigned work and/or PPE usage.
- b. The physician's opinion about increased risk to the employee's health resulting from work; and
- c. A statement that the employee has been informed and advised about the results of the examination.

E. MEDICAL RECORDS:

Documentation of medical exams shall be provided as part of the Certificate of Worker or Visitor Acknowledgment. Medical records shall be maintained in accordance with 29 CFR 1910, Section .120, and 29 CFR 1926, Section .65.

1.14 EXPOSURE MONITORING/AIR SAMPLING PROGRAM:

The Safety and Health Manager shall prepare and implement an exposure monitoring/air sampling program to identify and quantify safety and health hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Minimum initial requirements for the program consist of the following:

A. ORGANIC VAPOR MONITORING:

Monitoring for total organic vapors shall be performed at 30-minute intervals during intrusive activities into the soil. The monitor will be either a flame ionization detector (FID), and organic vapor analyzer (OVA) or photoionization detector (PID) with an 11.7 eV lamp. Readings of total hydrocarbons (THC) will be taken in the breathing zone of employees closest to the intrusive activities and/or the vapor/water stream. The instrument shall be calibrated, at a minimum, at the start and end of each workday. Calibration data and breathing zone readings shall be maintained in the field logbook. Exposure measurement criteria and response plan shall be at least as stringent as follows:

<10 ppm THC:	Limited hazard. No special action. Continue taking readings at least once every 30 minutes.
10-25 ppm THC:	Institute continuous monitoring. Institute contingency monitoring for vinyl chloride. SSO and Site Supervisor determine additional engineering controls to reduce potential exposure.
25-250 ppm THC:	Level C protection required. Notify Safety and Health Manager. Take action to reduce organic vapor concentrations. Conduct perimeter monitoring downwind of Exclusion Zone.
>250 ppm THC:	Stop work. Take action to reduce vapor levels. Notify the Owner and Engineer.

When the response plan calls for contingency monitoring for vinyl chloride, monitoring shall be performed with a Draeger hand-held pump and vinyl chloride detector tubes in the range of 0.25 to 6.0 ppm. Response plan shall be as follows:

>0.5 ppm Vinyl chloride: Notify Safety and Health Manager to determine if integrated sampling or real-time surveys are needed.

>1.0 ppm Vinyl chloride: Stop work. Take action to reduce vapor levels and notify the Safety and Health Manager, the Owner and the Engineer, who will determine further action.

B. COMBUSTIBLE GAS INDICATOR SURVEYS:

During tank pumping and intrusive activities, readings shall be taken, at a minimum, with a combustible gas indicator (CGI) if organic vapor readings are continuously greater than 100 ppm. Above 100 ppm, an explosive atmosphere could potentially develop; the CGI will indicate if dangerous levels are present. The response plan below shall, at a minimum, be implemented:

0 to 10% LEL: Limited explosion hazard. Continue monitoring until THC readings drop below 100 ppm.

10 to 20% LEL: Potential explosion hazard. Take action to reduce vapor levels and notify Safety and Health Manager and the Engineer.

>20% LEL: Stop work. Evacuate work area. Notify the Safety and Health Manager, the Engineer and the Owner.

C. PARTICULATE MONITORING:

During tank demolition activities, readings shall be taken with a particulate monitor to determine if contaminated dust from the former Waste Solvent Tank is migrating from the tank demolition area. Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM_{10}). The action level will be established at $150 \mu\text{g}/\text{meter}^3$ over the integrated period. If measured levels exceed the action level, the upwind background level must be measured immediately using the same instrument. If the working site particulate measurement is greater than $100 \mu\text{g}/\text{meter}^3$ above background, dust suppression techniques must be implemented.

Available site information shall be reviewed and the exposure monitoring/air sampling program shall be expanded and/or revised for submittal as part of the SSHP.

1.15 HEAT AND COLD STRESS MONITORING:

The Safety and Health Manager shall develop a heat stress and cold stress monitoring program for onsite activities. Details of the monitoring program, including schedules for work and rest, and physiological monitoring requirements, shall be described in the SSHP. Personnel shall be trained to recognize the symptoms of heat and cold stress. The SSO and an alternate person shall be designated, in writing, to be responsible for the heat and cold stress monitoring program.

A. HEAT STRESS:

Physiological monitoring shall commence when the ambient temperature is above 70 degrees F. Monitoring frequency shall increase as the ambient temperature increases or as slow recovery rates are observed. An adequate supply of cool drinking water shall be provided for the workers. NIOSH Pub No. 85-115 may be consulted for guidance in determining protocols for prevention of heat stress.

B. COLD STRESS:

To guard against cold injury, appropriate clothing and warm shelter for rest periods shall be provided. Procedures to monitor and avoid cold stress shall be followed in accordance with the current TLVs for Cold Stress as recommended in ACGIH-02.

1.16 SAFETY PROCEDURES, ENGINEERING CONTROLS AND WORK PRACTICES:

The SSHP shall describe the standard operating safety procedures, engineering controls and safe work practices to be implemented for the work covered. These shall include, but not be limited to, the following:

A. GENERAL SITE RULES/PROHIBITIONS:

General site rules/prohibitions (buddy system, eating, drinking, and smoking restrictions, etc.). At a minimum, the rules contained in the November 16, 1995 document entitled "Field Health and Safety Plan, Shallow Bedrock Groundwater Interim Action, Former Powerex, Inc. Facility, Auburn, New York" shall be included.

B. WORK PERMIT REQUIREMENTS:

Excavation and confined space work permits may be required for the Waste Solvent Tank removal. Hot work permits may be required during Waste Solvent Tank for removal of metal reinforcing structures or piping.

C. MATERIAL HANDLING PROCEDURES:

Safety procedures for handling liquids from the Waste Solvent Tank and from excavation dewatering shall be developed. The Waste Solvent Tank shall be pumped empty by use of a vacuum truck, double diaphragm pump, or centrifugal suction-lift pump. All tank contents shall immediately be pumped to an on-site temporary liquid storage tank(s) or to a tank truck(s) for transfer to the on-site temporary liquids storage tank(s). The temporary tank(s) shall be capable of isolation of the contents from the atmosphere.

D. SPILL CONTROL:

Written spill containment/control procedures shall be developed and implemented. These procedures shall at a minimum contain the information contained in Attachment C of the November 16, 1995 document entitled "Field Health and Safety Plan, Shallow Bedrock Groundwater Interim Action, Former Powerex, Inc. Facility, Auburn, New York" attached to these specifications. This includes spill prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials shall be appropriately bermed, diked and/or contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, and/or human health or the environment are threatened, the National Response Center, the State, the Engineer and the Owner shall be notified as soon as possible. Procedures for documenting spills shall also be developed and implemented.

E. MATERIALS TRANSFER SAFETY:

Liquids and residues shall be removed from the tanks using a vacuum truck, double diaphragm pump or centrifugal suction-lift pump. Use of a hand pump will be permitted to remove the last of the liquid from the bottom of the tank. If a vacuum truck is used for removal of liquids or residues, the area of operation for the vacuum truck shall be vapor free. LEL/O₂ monitoring shall be performed during pumping operations. The vacuum pump exhaust gases shall be discharged through a hose of adequate size and length downwind of the

truck and tank area. After the materials have been transferred and the tank has been exposed, fittings and lines leading to the tank shall be disconnected and drained of their contents. The contents of the lines shall not spill to the environment during cutting or disconnecting of tank fittings. Materials drained shall be transferred into the on-site temporary liquid storage tank(s) for future processing off-site or in the Interim Action treatment system.

F. CONFINED SPACE ENTRY PROCEDURES:

It is possible that permit required confined spaces will be encountered during the course of the project. Entry into these spaces will be prohibited, unless approved by the Engineer. The interior of the Waste Solvent Tank and each excavation into impacted soil will be considered a permit required confined space. The Waste Solvent Tank will be considered a permit required confined space until it is completely demolished. Excavations will be permit required confined spaces unless air monitoring indicates the absence of hazardous vapors. The SSHP shall specify procedures for entry into confined spaces if it becomes necessary.

G. HOT WORK:

Hot work shall not be permitted on or within the Waste Solvent Tank except as outlined herein. Prior to conducting hot work, a hot work permit shall be prepared and submitted. The permit shall describe compliance with the following procedures. Hot work shall not be performed unless monitoring indicates atmosphere within and immediately surrounding the tanks is less than 10% of the LEL; continuous monitoring shall continue until the hot work is completed. The hot work prohibition includes welding, cutting, grinding, sawing, or other similar operations which could be expected to potentially generate combustion-producing temperatures or sparks, or which could produce potentially hazardous fumes or vapors. An individual at each hot work site shall be designated as a fire watch. This person's sole responsibility shall be to monitor the hot work and have immediate access to the fire extinguisher located at each hot work site. A new permit shall be obtained at the start of each work shift during which hot work will be conducted.

H. WASTE DISPOSAL:

Tank liquids will be transferred to an on-site temporary liquid storage tank(s) and processed through the Interim Action treatment system when it becomes operational. Soils from the excavation shall be backfilled into the excavation per Section 02100 after the Waste Solvent Tank is removed. Debris from the Waste Solvent Tank, including broken concrete, reinforcing steel, and piping shall be disposed of at an approved hazardous waste facility.

I. TANK ATMOSPHERE TESTING:

Prior to initiating any Waste Solvent Tank demolition activities, the air within the tank shall be monitored to ensure the space is below the action levels indicate under paragraph COMBUSTIBLE GAS INDICATOR SURVEYS. In both instances, monitoring shall be performed at the top, bottom, and middle areas of the tank or tank compartments to ensure stratification has not occurred. Monitoring results shall be reported to project personnel to ensure safe operations. Data shall be recorded as specified in paragraph EXPOSURE MONITORING / AIR SAMPLING PROGRAM.

J. TANK DEMOLITION:

Personnel and equipment used to excavate the tank shall remain behind the excavation safety line, as shown on the Contract Drawings. The tank excavated as part of this project shall be demolished before being removed from the site. Demolition shall involve destruction of the tank with a backhoe-mounted hoe-ram, or other means deemed acceptable by the Contractor. Plans and procedures, including a list of materials and supplies, for safely and effectively demolishing the tank shall be submitted in the SSHP.

1.17 SITE CONTROL MEASURES:

In order to prevent the spread of contamination and control the flow of personnel, vehicles, and materials into and out of work areas, site control measures shall be established and described in the SSHP. The SSHP shall describe the methodology to be used by the Safety and Health Manager and SSO in determining work zone designations and their modifications, and procedures to limit the spread of contamination. The SSHP shall include procedures for the implementation and enforcement of safety and health rules for all persons on the site, including employers, employees, outside Contractors, government representatives, and visitors

A. WORK ZONES:

Work zone boundaries (Exclusion Zone, Contamination Reduction Zone, and Support Zone) and access points shall be established and the boundary delineations shall be included on the drawings and in the SSHP. Delineation of work zone boundaries shall be based on the contamination characterization data and the hazard/risk analysis to be performed as described in paragraph HAZARD/RISK ANALYSIS. As work progresses and field conditions are monitored, work zone boundaries may be modified with approval of the Engineer. Work zones shall be clearly identified and marked in the field (using fences, tape, signs, etc.). A site map, showing work zone boundaries and locations of decontamination facilities, shall be posted in the onsite office. Work zones shall consist of the following:

1. **Exclusion Zone (EZ):** The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Entry into this area shall be controlled and exit may only be made through the CRZ.
2. **Contamination Reduction Zone (CRZ):** The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas shall be separate and unique areas located in the CRZ.
3. **Support Zone (SZ):** The Support Zone is defined as areas of the Site, other than Exclusion Zones and Contamination Reduction Zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. The Support Zone shall be secured against active or passive contamination. Site offices, parking areas, and other support facilities shall be located in the Support Zone.

B. SITE CONTROL:

A log of personnel visiting, entering, or working on the site shall be maintained. The log shall include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the Exclusion Zone (if applicable), and personal protective equipment utilized. Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they shall show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed). This visitor information, including date, shall be recorded in the log. The level of protection required of visitors shall be determined by the SSO.

C. COMMUNICATION:

An employee alarm system that has adequate means of on-site and off-site communication shall be provided and installed in accordance with 29 CFR 1910, Section .165. The means of communication shall be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals shall be distinctive and recognizable as messages to evacuate or to perform critical operations. This includes air horns, equipment horns, or vehicle horns.

D. SITE SECURITY:

The following site security shall be provided:

1. The majority of the work area subject to the Site Preparation Plan is currently fenced. Exceptions to this is work associated with the excavation of the utility trenches from West Genesee Street; and
2. Additional fencing shall be provided to prevent general access to designated Exclusion Zones and open excavations.

Signs shall be printed in bold large letters on contrasting backgrounds in English. Signs shall be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

1.18 PERSONAL HYGIENE AND DECONTAMINATION:

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids shall adhere to the following personal hygiene and decontamination provisions. Decontamination shall be performed in the CRZ prior to entering the Support Zone from the Exclusion Zone. Chapter 10.0 of NIOSH Pub. No. 85-115 shall be consulted when preparing decontamination procedures. A detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers shall be submitted as part of the SSHP. Employees shall be trained in the procedures and the procedures shall be enforced throughout site operations. Persons disregarding these provisions of the SSHP shall be barred from the site.

A. DECONTAMINATION FACILITIES:

A personnel decontamination station shall be provided in the CRZ. This station shall be used by both Contractor personnel and Engineer and Owner representatives. At a minimum, the decontamination station shall consist of a plastic-covered work area with decontamination supplies, galvanized steel or plastic tubs to hold detergent solution and rinse water, and a scrub brush.

B. PROCEDURES:

Minimum decontamination procedures listed below shall be used to decontaminate personnel leaving a Level C or B work area:

1. Place equipment on a plastic sheet;
2. Scrub outer boots with a brush;
3. Remove disposable protective garments (i.e. outer gloves, boot covers) and dispose of in labeled container;
4. Remove respiratory protection and place on a plastic sheet;
5. Remove and dispose of inner gloves; and
6. Thoroughly wash face and hands in fresh potable water.

Personnel must take the following steps to decontaminate PPE being removed from a Level C or B work area:

1. Wash reusable equipment in detergent solution, then rinse;
2. Dry sample containers with paper towels (if necessary) and place on a clean plastic sheet;
3. Remove and discard spent respirator cartridges. Wash respirator with detergent water and rinse in clean water; and
4. Treat respirator with a commercially available disinfectant designed for respirator cleaning. Store clean respirator in a closed plastic bag, away from sources of contamination.

Personnel must take the following steps to clean up following completion of work in a Level C or B work area:

1. Dispose of all washing and rinsing solutions in a drum labeled "Decontamination Solution." Mark the drum with the date of first accumulation.
2. Place all PPE and related waste materials (disposable gloves and garments, tape, plastic sheets, etc.) into labeled containers for proper management. Mark the container "PPE/Debris" and include the date of first accumulation.

Available site information shall be reviewed and these procedures shall be expanded and/or revised for submittal as part of the SSHP.

1.19 EQUIPMENT DECONTAMINATION:

Vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site. The procedures for decontamination of vehicles and equipment shall be addressed in the SSHP.

A. DECONTAMINATION FACILITIES:

A vehicle/equipment decontamination station shall be provided within the CRZ for decontaminating vehicles and equipment leaving the EZ. The decontamination station shall be as shown on the drawings and shall include the following:

1. A traffic surface consisting of an asphalt surface or a minimum of 12 inches of crushed rock. The crushed rock shall be underlaid by a chemically resistant impermeable flexible membrane, such as HDPE, PVC or VLDPE with a minimum thickness of 40 mils. The liner shall be protected from damage on top with a geotextile. The base layer of soil on which the membrane is placed shall be free of objects greater than 0.375 inches in diameter and any other materials which could puncture or damage the membrane.
2. The pad shall be constructed to capture decontamination water, including overspray, and shall allow for collection and removal of the decontamination water using sumps, dikes and ditches as required.
3. High pressure water wash area for equipment and vehicles and a steam cleaning system for use after the mud and/or site material has been cleaned from the equipment.
4. A designated "clean area" in the CRZ for performing equipment maintenance. This area shall be used when personnel are required by normal practices to come in contact with the ground, i.e., crawling under a vehicle to change engine oil. Equipment within the EZ or CRZ shall be decontaminated before maintenance is performed.

B. PROCEDURES:

Procedures for equipment decontamination shall be developed and utilized to prevent the spread of contamination into the SZ and off-site areas. These procedures shall address disposal of contaminated products and spent materials used on the site, including containers, fluids, oils, etc. Any item taken into the EZ shall be assumed to be contaminated and shall be inspected and/or decontaminated before the item leaves the area. Vehicles, equipment, and materials shall be cleaned and decontaminated prior to leaving the site. Construction material shall be handled in such a way as to minimize the potential for contaminants being spread and/or carried offsite. Prior to exiting the site, vehicles and equipment shall be monitored to ensure the adequacy of decontamination.

1.20 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS:

The SSHP shall describe the emergency and first aid equipment to be available onsite. The following items, as a minimum, shall be maintained onsite and available for immediate use:

- a. First aid equipment and supplies approved by a physician.
- b. Emergency eyewashes which comply with ANSI Z358.1.
- c. Emergency-use respirators. These shall be dedicated for emergency use only and maintained onsite in the Contamination Reduction Zone.
- d. Fire extinguishers with a minimum rating of 20-A:120-B:C shall be provided at site facilities and in all vehicles and at any other on-site locations where flammable or combustible materials present a fire risk.

1.21 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES:

An Emergency Response Plan, that meets the requirements of 29 CFR 1910, Section .120 (l) and 29 CFR 1926, Section .65 (l), shall be developed and implemented as a section of the SSHP. In the event of any emergency associated with remedial action, the Contractor shall, without delay: alert all onsite employees that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Engineer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Employees that are required to respond to hazardous emergency situations shall be trained in how to respond to expected emergencies. The plan shall be rehearsed regularly as part of the overall training program for site operations. The plan shall be reviewed periodically and revised as necessary to reflect new or changing site conditions or information. Copies of the accepted SSHP and revisions shall be provided to the affected local emergency response agencies. The following elements, as a minimum, shall be addressed in the plan:

- a. Pre-emergency planning. The local emergency response agencies shall be contacted and met with during preparation of the Emergency Response Plan. A list of these agencies is provided in the November 16, 1995 document entitled "Field Health and Safety Plan, Shallow Bedrock Groundwater Interim Action, Former Powerex, Inc. Facility, Auburn, New York." At these meetings, the agencies shall be notified of upcoming site activities and potential emergency situations. The response agencies' capabilities shall be ascertained and written response commitments obtained. The Contractor shall ensure the Emergency Response Plan for the site is compatible and integrated with the disaster, fire and/or emergency response plans of local, state, and Federal agencies.
- b. Personnel roles, lines of authority, communications for emergencies.
- c. Emergency recognition and prevention.
- d. Site topography, layout, and prevailing weather conditions.
- e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).
- f. Specific procedures for decontamination and medical treatment of injured personnel.

- g. Route maps to nearest pre-notified medical facility. Site-support vehicles shall be equipped with maps. At the beginning of project operations, drivers of the support vehicles shall become familiar with the emergency route and the travel time required.
- h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies, as well as the Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).
- i. Criteria for initiating community alert program, contacts, and responsibilities.
- j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate regulatory agencies shall be immediately notified. In addition, the Engineer and Owner shall be verbally notified immediately and receive a written notification within 24 hours. The report shall include the following items:
 - (1) Name, organization, telephone number, and location of the Contractor.
 - (2) Name and title of the person(s) reporting.
 - (3) Date and time of the incident.
 - (4) Location of the incident, i.e., site location, facility name.
 - (5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.
 - (6) Cause of the incident, if known.
 - (7) Casualties (fatalities, disabling injuries).
 - (8) Details of any existing chemical hazard or contamination.
 - (9) Estimated property damage, if applicable.
 - (10) Nature of damage, effect on contract schedule.
 - (11) Action taken to ensure safety and security.
 - (12) Other damage or injuries sustained, public or private.
- k. Procedures for critique of emergency responses and follow-up.

1.23 INSPECTIONS:

The SSO shall perform daily inspections of the job site and the work in progress to ensure compliance with the safety and health program, the SSHP and other occupational health and safety requirements of the Contract, and to determine the effectiveness of the SSHP. Procedures for correcting deficiencies (including actions, timetable and responsibilities) shall be described in the SSHP. Follow-up inspections to ensure correction of deficiencies shall be conducted and documented. Daily safety inspection logs shall be used to document the inspections, noting safety and health deficiencies, deficiencies in the effectiveness of the SSHP, and corrective actions taken. Within 2 working days of any reportable accident, an Accident Report shall be completed and submitted.

1.24 SAFETY AND HEALTH PHASE-OUT REPORT:

A Safety and Health Phase-Out Report shall be submitted within 10 working days following completion of the work, prior to final acceptance of the work. The following minimum information shall be included:

- A. Summary of the overall performance of safety and health (accidents or incidents including near misses, unusual events, lessons learned, etc.).

- B. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and onsite facilities.
- C. Summary of exposure monitoring and air sampling accomplished during the project.
- D. Signatures of Safety and Health Manager and SSHO.

PART 2 - PRODUCTS: (NOT USED)

PART 3 - EXECUTION: (NOT USED)

END OF SECTION

**SECTION 01300
SUBMITTALS**

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
1. Contractor's construction schedule.
 2. Submittal schedule.
 3. Daily construction reports.
 4. Shop Drawings.
 5. Product Data.
 6. Samples.
 7. Quality assurance submittals.
- B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
1. Permits.
 2. Applications for Payment.
 3. Performance and payment bonds.
 4. Insurance certificates.
 5. List of subcontractors.

1.3 DEFINITIONS:

- A. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- B. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.

1.4 SUBMITTAL PROCEDURES:

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

- a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
 - a. Allow 2 weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
 - b. If an intermediate submittal is necessary, process the same as the initial submittal.
 - c. Allow 2 weeks for reprocessing each submittal.
 - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
 1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
 2. Include the following information on the label for processing and recording action taken.
 - a. Project name.
 - b. Date.
 - c. Name and address of the Engineer.
 - d. Name and address of the Contractor.
 - e. Name and address of the Subcontractor (if any).
 - f. Name and address of the Supplier.
 - g. Name of the Manufacturer.
 - h. Number and title of appropriate Specification Section.
 - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than the Contractor.
 1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE:

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit within 30 days after the date established for "Commencement of the Work."
 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
 2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.
 3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

SUBMITTALS

01300

Page 2

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.
 5. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
 6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.
- B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.
- C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparation of payment requests.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.6 SUBMITTAL SCHEDULE:

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.
1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.
 2. Prepare the schedule in chronological order. Provide the following information:
 - a. Scheduled date for the first submittal.
 - b. Related Section number.
 - c. Submittal category (Shop Drawings, Product Data, or Samples).

SUBMITTALS

01300

Page 3

- d. Name of the subcontractor.
 - e. Description of the part of the Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for the Engineer's final release or approval.
- B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
- 1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.7 DAILY CONSTRUCTION REPORTS:

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Engineer at weekly intervals:
- 1. List of subcontractors at the site.
 - 2. Approximate count of personnel at the site.
 - 3. High and low temperatures, general weather conditions.
 - 4. Accidents and unusual events.
 - 5. Meetings and significant decisions.
 - 6. Stoppages, delays, shortages, and losses.
 - 7. Meter readings and similar recordings.
 - 8. Emergency procedures.
 - 9. Orders and requests of governing authorities.
 - 10. Change Orders received, implemented.
 - 11. Services connected, disconnected.
 - 12. Equipment or system tests and startups.
 - 13. Partial Completions, occupancies.
 - 14. Substantial Completions authorized.

1.8 SHOP DRAWINGS:

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
- 1. Dimensions.
 - 2. Identification of products and materials included by sheet and detail number.
 - 3. Compliance with specified standards.
 - 4. Notation of coordination requirements.
 - 5. Notation of dimensions established by field measurement.
 - 6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220

SUBMITTALS

01300

Page 4

- mm).
7. Initial Submittal: Submit one correctable, translucent, reproducible print and one blue- or black-line print for the Engineer's review. The Engineer will return the reproducible print.
 8. Initial Submittal: Submit 2 blue- or black-line prints for the Engineer's review. The Engineer will return one print.
 9. Final Submittal: Submit 3 blue- or black-line prints; submit 5 prints where required for maintenance manuals. The Engineer will retain 2 prints and return the remainder.
 10. Final Submittal: Submit 3 blue- or black-line prints and 2 additional prints where required for maintenance manuals, plus the number of prints needed by the Engineer for distribution. The Engineer will retain 2 prints and return the remainder.
 - a. One of the prints returned shall be marked up and maintained as a "Record Document."
 11. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.9 PRODUCT DATA:

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
 - a. Manufacturer's printed recommendations.
 - b. Compliance with trade association standards.
 - c. Compliance with recognized testing agency standards.
 - d. Application of testing agency labels and seals.
 - e. Notation of dimensions verified by field measurement.
 - f. Notation of coordination requirements.
 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
 3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
 4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Engineer will retain one and will return the other marked with action taken and corrections or modifications required.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
 - a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
 - b. Do not permit use of unmarked copies of Product Data in connection with construction.

SUBMITTALS

01300

Page 5

1.10 SAMPLES:

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Engineer's sample. Include the following:
 - a. Specification Section number and reference.
 - b. Generic description of the Sample.
 - c. Sample source.
 - d. Product name or name of the manufacturer.
 - e. Compliance with recognized standards.
 - f. Availability and delivery time.
 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
 - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
 - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
 - c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
 - d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
 3. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
 - a. The Engineer will review and return preliminary submittals with the Engineer's notation, indicating selection and other action.
 4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Engineer will return one set marked with the action taken.
 5. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
 - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
 - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

SUBMITTALS

01300

Page 6

- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
 - 1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
 - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.11 QUALITY ASSURANCE SUBMITTALS:

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.
- B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.
 - 1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

1.12 ENGINEER'S ACTION:

- A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
 - 2. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:
 - 1. Final Unrestricted Release: When the Engineer marks a submittal "Approved," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
 - 2. Final-But-Restricted Release: When the Engineer marks a submittal "Approved as Noted," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
 - 3. Returned for Resubmittal: When the Engineer marks a submittal "Not Approved, Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
 - a. Do not use, or allow others to use, submittals marked "Not Approved, Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
 - 4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Action Not Required."

C. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

PART 2 – PRODUCTS: (Not Applicable)

PART 3 – EXECUTION: (Not Applicable)

END OF SECTION

SUBMITTALS

01300

Page 8

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL:

1.1 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. This Section includes requirements for construction facilities and temporary controls, including temporary utilities, support facilities, and security and protection.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Temporary electric power and light.
 - 3. Temporary heat (if needed).
 - 4. Telephone service.
 - 5. Sanitary facilities, including temporary restrooms and drinking water.
- C. Support facilities include, but are not limited to, the following:
 - 1. Field offices and storage sheds.
 - 2. Temporary roads and paving.
 - 3. Dewatering facilities and drains.
 - 4. Temporary enclosures.
 - 5. Waste disposal services.
 - 6. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities include, but are not limited to, the following:
 - 1. Temporary fire protection.
 - 2. Barricades, warning signs, and lights.
 - 3. Sidewalk bridge.
 - 4. Environmental protection.

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01500

Page 1

1.3 SUBMITTALS:

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- B. Implementation and Termination Schedule: Within 15 days of the date established for commencement of the Work, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE:

- A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to, the following:
 - 1. Building code requirements.
 - 2. Health and safety regulations.
 - 3. Utility company regulations.
 - 4. Police, fire department, and rescue squad rules.
 - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities."
 - 1. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code."
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS:

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Relocate temporary services and facilities as the Work progresses. Do not overload facilities or permit them to interfere with progress. Take necessary fire-prevention measures. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

PART 2 - PRODUCTS:

2.1 MATERIALS:

- A. General: Provide new materials. If acceptable to the Engineer, the Contractor may use undamaged, previously used materials in serviceable condition. Provide materials suitable for use intended.
- B. Lumber and Plywood:
 - 1. For signs and directory boards, provide exterior-type, Grade B-B high-density concrete form overlay plywood of sizes and thicknesses indicated.
 - 2. For fences and vision barriers, provide minimum 3/8-inch- (9.5-mm-) thick exterior plywood.
 - 3. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch- (16-mm-) thick exterior plywood.
- C. Paint: For sign panels and applying graphics, provide exterior-grade alkyd gloss enamel over exterior primer.
- D. Tarpaulins: Provide waterproof, fire-resistant, UL-labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures, provide translucent, nylon-reinforced, laminated polyethylene or polyvinyl chloride, fire-retardant tarpaulins.
- E. Water: Provide potable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 0.120-inch- (3-mm-) thick, galvanized 2-inch (50-mm) chainlink fabric fencing 6 feet (2 m) high with galvanized barbed-wire top strand and galvanized steel pipe posts, 1-1/2 inches (38 mm) I.D. for line posts and 2-1/2 inches (64 mm) I.D. for corner posts.

2.2 EQUIPMENT:

- A. General: Provide new equipment. If acceptable to the Engineer, the Contractor may use undamaged, previously used equipment in serviceable condition. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4-inch (19-mm), heavy-duty, abrasion-resistant, flexible rubber hoses 100 feet (30 m) long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shutoff nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-Volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button, and pilot light for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords. Use hard-service cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered-glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM, or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Toilet Units: Provide self-contained, single-occupant toilet units of the chemical, aerated recirculation, or combustion type. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- H. Fire Extinguishers: Provide hand-carried, portable, UL-rated, Class A fire extinguishers for temporary offices and similar spaces. In other locations, provide hand-carried, portable, UL-rated, Class ABC, dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for the exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION:

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with company recommendations.
 - 1. Arrange with company and existing users for a time when service can be interrupted, if necessary, to make connections for temporary service.
 - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
 - 3. Obtain easements to bring temporary utilities to the site where the Owner's easements cannot be used for that purpose.
 - 4. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Engineer. Neither the Owner nor Engineer will accept cost or use charges as a basis of claims for Change Authorization Requests (CARs).
- B. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction until permanent water service is in use.
 - 1. Sterilization: Sterilize temporary water piping prior to use.

- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnects, automatic ground-fault interrupters, and main distribution switch gear.
 - 1. Install electric power service underground, except where overhead service must be used.
 - 2. Power Distribution System: Install wiring overhead and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 Volts, ac 20 Ampere rating, and lighting circuits may be nonmetallic sheathed cable where overhead and exposed for surveillance.
- D. Temporary Lighting: When overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 - 1. Install and operate temporary lighting that will fulfill security and protection requirements without operating the entire system. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Heat: Provide temporary heat required by construction activities for curing or drying of completed installations or for protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.
- F. Heating Facilities: Except where the Owner authorizes use of the permanent system, provide vented, self-contained, LP-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open flame, or salamander heating units is prohibited.
- G. Temporary Telephones: Provide temporary telephone service throughout the construction period for all personnel engaged in construction activities. Install telephone on a separate line for each temporary office and first-aid station.
 - 1. Separate Telephone Lines: Provide additional telephone lines for the following:
 - a. Provide at least one telephone line strictly for voice communication;
 - b. Provide a dedicated telephone line for a fax machine in the field office.
 - c. Provide a separate line for the Owner/Engineer's use.
 - 2. At each telephone, post a list of important telephone numbers, especially those specified in the Health and Safety Plan.
- H. Sanitary facilities include temporary toilets, wash facilities, and drinking-water fixtures. Comply with regulations and health codes for the type, number, location, operation, and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
 - 1. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Provide covered waste containers for used material.
- I. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.

1. Provide separate facilities for male and female personnel.
- J. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
1. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
- K. Drinking-Water Fixtures: Provide drinking-water fountains where indicated, including paper cup supply.
- L. Drinking-Water Facilities: Provide containerized, tap-dispenser, bottled-water drinking-water units, including paper supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7 to 13 deg C).
- M. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

3.3 SUPPORT FACILITIES INSTALLATION:

- A. Locate field offices, storage sheds, and other temporary construction and support facilities for easy access.
1. Maintain support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project Site. Keep the office clean and orderly for use for small progress meetings. Furnish and equip offices as follows: Furnish with a desk and chairs, a 4-drawer file cabinet, plan table, plan rack, and a 6-shelf bookcase. Equip with a water cooler and private toilet complete with water closet, lavatory, and medicine cabinet unit with a mirror.
- C. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading adequately and to withstand exposure to traffic during the construction period. Locate temporary paving for roads, storage areas, and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Engineer.
1. Paving: Comply with Division 2 Section "Hot-Mixed Asphalt Paving" for construction and maintenance of temporary paving.
 2. Coordinate temporary paving development with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.
 3. Install temporary paving to minimize the need to rework the installations and to result in permanent roads and paved areas without damage or deterioration when occupied by the Owner.
 4. Delay installation of the final course of permanent asphalt concrete paving until immediately before

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01500

Page 6

Substantial Completion.

5. Coordinate with weather conditions to avoid unsatisfactory results.
 6. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration, and supervision.
- D. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations, and construction free of water.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.
1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Install Tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 sq. ft. (2.3 sq. m) or less with plymood or similar materials.
 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing, wood frames.
 4. Where temporary wood or plywood enclosure exceeds 100 sq. feet (9.2 sq. m) in area, use UL-labeled, fire-retardant, treated material for framing and main sheathing.
- F. Temporary Exterior Lighting: Install exterior yard and sign lights so signs are visible when Work is being performed.
- G. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F (27 deg C). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material lawfully.
- H. Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with a protective covering of plywood or similar material so finishes will be undamaged at the time of acceptance.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION:

- A. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer, as requested by the Engineer.
- B. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations."

1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
 2. Store combustible materials in containers in fire-safe locations.
 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire-exposure areas.
 4. Provide supervision of welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- E. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways, and subsoil might be contaminated or polluted or that other undesirable effects might result. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site.

3.5 OPERATION, TERMINATION, AND REMOVAL:

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
 2. Protection: Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Engineer requests that it be maintained longer, remove each temporary facility when the need has ended, when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are the Contractor's property. The Owner reserves the right to take possession of project identification signs.
 2. Remove temporary paving not intended for or acceptable for integration into permanent

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

01500

Page 8

paving. Where the area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at the temporary entrances, as required by the governing authority.

3. At Substantial Completion, clean and renovate permanent facilities used during the construction period including, but not limited to, the following:
 - a. Replace air filters and clean inside of ductwork and housings.
 - b. Replace significantly worn parts and parts subject to unusual operating conditions.
 - c. Replace lamps burned out or noticeably dimmed by hours of use.

END OF SECTION

**SECTION 02030
SELECTIVE DEMOLITION**

PART 1 - GENERAL:

1.1 SCOPE:

The Contractor shall furnish all labor, materials, tools and equipment and perform all operations necessary for the selective demolition of the Primary Treatment Room, as indicated on the Contract Drawings and as specified herein.

1.2 APPLICABLE STANDARDS:

- A. Equipment and operation of the demolition work shall comply with all ANSI, ASTM, AWWA, AFI, ASME, OSHA and all other applicable Federal, State and Municipal Codes, including revisions to the date of Contract.
- B. The Contractor shall obtain all required permits and pay all fees.

1.3 PRODUCT HANDLING:

- A. The Contractor shall keep all equipment necessary for performance of demolition work confined to those areas where work is in progress.
- B. The Contractor shall properly tag, protect and store in approved locations, all material to be salvaged or re-used.
- C. The Contractor shall remove all non-salvaged material resulting from demolition each day, and properly dispose of same.

1.4 ENVIRONMENTAL CONDITIONS:

- A. The Contractor shall take necessary measures to assure proper continued operation of any heating, cooling, ventilation, humidity control, sanitation, water supply, drainage, power, lighting communication and special systems throughout the building while work is in progress.
- B. The Contractor shall arrange with the proper authorities for use of above listed systems in work areas.
- C. Verification of Dimensions: The Contractor shall become familiar with all details of the work, verify dimensions in the field, and shall advise the Engineer of all discrepancies before performing the work.

1.5 PROTECTION:

- A. The Contractor shall provide all necessary temporary barriers, covers, dropcloths, and other protective measures to avoid damage to adjacent surfaces and equipment, and to limit noise, dirt, and other disturbances to the work areas.

PART 2 - PRODUCTS:

2.1 MATERIALS:

The Contractor shall cooperate with Owner and Engineer in identifying all materials to be salvaged or re-used.

2.2 EQUIPMENT:

- A. Use tools and equipment best suited for the type of demolition work involved, giving consideration to minimizing noise, dirt and other disturbances.

PART 3 - EXECUTION:

3.1 PREPARATION:

The Contractor shall provide all required protective measures in each work area prior to proceeding with work in that area.

3.2 WORKMANSHIP:

- A. The Contractor shall properly schedule work, provide proper tools and equipment, and furnish adequate work crews to expedite work in each area.
- B. Use skilled workers and minimize damage to adjacent surfaces and equipment.
- C. No demolition shall be permitted except as is absolutely necessary to perform the Work.
- D. All existing items to be abandoned are to be properly capped off and unused portions shall be removed as far as is reasonably possible.
- E. In removing existing items, care shall be taken to protect all remaining equipment and all adjacent surfaces and finishes from damage.
- F. All removed items, except those specifically noted otherwise, will be considered the property of the Contractor for salvage or disposal and will be his responsibility to remove from the premises and properly dispose of.
- G. Upon completion of work, any damage resulting from demolition shall be repaired and any equipment and finish surfaces restored to original condition.

3.3 CLEANING:

- A. The Contractor shall remove all trash upon completion of demolition.
- B. The Contractor shall remove all tools and equipment.
- C. The Contractor shall leave all surfaces and equipment clean and ready for patching, repair and installation of new work.

END OF SECTION

SELECTIVE DEMOLITION

02030

Page 2

**SECTION 02050
EXCAVATION**

PART 1 - GENERAL:

1.1 SCOPE:

- A. The Contractor shall furnish all labor, materials, tools and equipment, and perform all operations necessary for excavation work indicated on the Contract Drawings, and specified herein, as directed by the Engineer.
- B. Whenever any subsurface structure is encountered or suspected of being in an area of excavation, the Engineer may direct that excavation shall proceed by hand tools.

1.2 SUBMITTALS:

- A. The Contractor shall furnish a description of the earth moving and excavation equipment that it proposes to use in performing the Work, and the proposed methods of excavation. The Contractor shall also submit proposed method of dewatering, if dewatering is required.
- B. The Contractor shall identify the permitted disposal facility scheduled to receive any excavated materials that is not returned to the excavation and shall provide the required analytical data on the excavated material requested by the intended disposal facility. The disposal facility shall be approved by the Engineer and Owner prior to the start of Work.
- C. The Contractor shall identify all underground and overhead utilities and structures to be maintained. Locations of the utilities and structures shall be verified by the agencies of concern prior to breaking ground.

1.3 RELATED WORK:

SECTION 02100	CONTROLLED AND UNCONTROLLED FILLS OR BACKFILLS
SECTION 02140	DEWATERING SYSTEM
SECTION 02750	REMOVAL OF INDUSTRIAL WASTE

1.4 EARTH AND ROCK EXCAVATION CLASSIFIED:

- A. Earth, referring to materials of excavation as classified for payment, shall mean all materials of whatever nature encountered, except rock as defined in Paragraph (b) below, and the removal of masonry as defined in Paragraph 3.16. The following will, among other things, be classified as earth excavation: soil, filled ground (including rock fill), foundations and vaults of buildings, boulders, and other materials requiring blasting, trees and shrubs, old timbers and planking, wood, concrete or steel piles, pavements, abandoned street surface railroads (including foundations), abandoned elevated railroad column piers and footings, curbs and sidewalks with their foundations, valve chambers, pipe galleries, manholes, gasoline and oil tanks, basins, sewers, ducts and conduits, pipes, tubes and drains. Soft, decomposed or disintegrated rock, which in the opinion of the Engineer, can be removed by means other than blasting, channeling, wedging, barring or other method ordinarily used to remove hard ledge rock, will be classified as earth excavation.
- B. Rock, referring to materials of excavation as classified for payment, shall mean the hard ledge rock in its natural bed, which is removed by blasting, channeling, wedging or barring. Such methods must be

submitted for approval. Excavation of the material claimed as rock shall not be performed until the area has been surveyed, cross-sections taken by the Contractor, and approved by the Engineer.

1.5 PROTECTION AGAINST DUST HAZARD:

Equipment for the elimination of dust produced by excavation, rock or masonry drilling or other operations, shall be installed, maintained and effectively operated by the Contractor for the protection of property against dust and workmen against the inhalation of harmful dust. Examples are equipment using suction methods and/or wet methods of drilling. All such equipment must be approved by the New York State Department of Labor and the New York State Department of Health. In the event that conditions are encountered in any areas,, which in the determination of the Engineer, render the use of suction methods ineffective or impracticable, the work of rock or masonry drilling or other operations in such area shall be performed by methods and in such manner as may be approved by the Engineer. If some other device or method is developed that will protect property against dust and the workmen against the inhalation of harmful dust, such device or method, if approved by the said Departments of Labor and Health, may be used.

1.6 DISPOSAL OF MATERIALS EXCAVATED:

All disposal shall be as specified in SECTION 02750: WASTE MANAGEMENT. Excavated soil shall, to the extent possible, be replaced into the excavation from which they were taken or other excavations on site. Excess soils shall be placed in the Waste Solvent Tank excavation, disposed of at the excess soil management area shown on the Contract Drawings, or stored onsite for future management and/or disposal. Excess non-soil material shall be removed expeditiously and, except as otherwise provided, shall be disposed of in accordance with SECTION 02750: WASTE MANAGEMENT.

1.7 TEST PITS:

If ordered by the Engineer, the Contractor shall dig test pits at the locations and to the depths directed alongside the foundations of any building to aid in determining the necessity for maintaining, protecting or underpinning the building, or for the purpose of determining the location of sewer or other subsurface structures, or for other purposes as determined by the Engineer.

1.8 INSPECTION:

When the excavations have been carried to the required depth as shown on the drawings, the Contractor shall do no more work until after approval by the Engineer, who shall order the work to proceed, or further excavation, as the condition indicate.

1.9 VEHICLES TO BE TIGHT:

All trucks, buckets and other vehicles used by the Contractor for the removal of material, shall be tight and so arranged and so loaded as not to spill. All permitted trucks shall be covered with canvas to prevent spilling of excavated materials. Whenever a truck, bucket or other vehicle so used is leaky or unsuitable, it shall provide the necessary labor and materials to clean up the effected areas.

1.10 TRANSPORTATION OF PLANT AND MATERIALS:

The Contractor shall determine for itself the most advantageous method in connection with the transportation of plant and material, and subsequent disposal of material and plant, subject to the approval of the Engineer. The Contractor shall coordinate and schedule his deliveries, so that trucks arrive and depart at proper intervals that will not block or otherwise interfere with normal street traffic.

PART 2 - PRODUCTS:

2.1 SHEET PILING:

All steel sheet piling used or incorporated in the construction of the Project shall conform to the Standard Specification for Steel Sheet Piling of the American Society for Testing and Materials, Serial Designation A328.

2.2 TIMBER FOR SHEETING AND BRACING:

All timber used for sheeting, shoring, bracing, product containment or other temporary purposes, shall be sound and free from any defects that may impair its strength. Timber shall be spruce, douglas fir, white or yellow Lodgepole or Ponderosa pine, or western hemlock plank, planed on one side and either tongued and grooved or splined. Species, grades of timber and allowable stress shall be indicated on working drawings. Timber shall not be less than nominal 4 inches thick and lumber shall not be less than nominal 2-inches thick. All sheeting and timber used temporarily shall be put in place by competent mechanics, shall be keyed tight by wedges where necessary and so arranged as to be withdrawn readily without endangering the adjoining soil.

2.3 STRUCTURAL STEEL:

Structural steel shall conform to ASTM Serial Designations A36.

PART 3 - EXECUTION:

3.1 WIDTH AND DEPTH:

- A. Special care shall be taken to avoid damage wherever excavation is being done. The width of such excavation shall not exceed the width actually necessary for the proper execution of the Work. All excavations shall be of such width, in addition to that of the Project as shall be necessary, for the proper and expeditions progress of the Work and to permit the laying and readjusting of all sewers, mains, subways, and other subsurface structures encountered along the route and contiguous to the Project.
- B. Excavations below the elevation of the invert of the existing subway structures shall be done by a method insuring against a possible loss of ground under the existing structures.

3.2 SHEETING AND BRACING:

- A. The sides of the excavations shall be maintained and secured by suitable sheet piling or sheeting, held in place by soldier beams, braces, tiebacks, shores or swales with special precautions being taken where there is additional pressure due to the presence of buildings or other structures. The sustaining members in the bracing system shall be designed to furnish sufficient reaction against the side banks to maintain stability in such banks as well as prevent loss of ground adjacent to the excavation. Such reaction in the members shall be obtained by preloading or, by the use of suitable wedges properly driven into the joints between such members until the necessary reaction is produced against the banks or by such other method as may be approved by the Engineer. Wherever necessary, steel plates and wedges shall be used in driving up the members to produce such reaction. End banks of bulkheads shall be sheered and braced in such manner that the compression stresses from such banks are transmitted through diagonal braces into sidewalls or the subgrade, or both, as necessary. Special care shall be taken to assure the stability of the foundations of the vertical supporting posts.

- B. Wherever the connection with the construction of the trench, it is advisable in the opinion of the Engineer, to use steel sheet piling and/or steel bracing in lieu of wood or timber to support the excavation or any other purpose, upon the written order of the Engineer, the Contractor shall furnish and install such steel sheet piling, steel sheeting and/or steel bracing as may be ordered. Such sheet piling, sheeting and bracing ordered by the Engineer shall be left in place until removal is permitted by the written order of the Engineer. Where removal of braces is permitted during construction, the Contractor must ensure that no loss of stability of the excavation wells or loss of ground behind the wells occurs.
- C. If the Engineer so directs, the sheeting shall be left in at any place as may be determined for special reasons.

3.4 SHEETING:

- A. The sheeting shall be designed by a Professional Engineer licensed in the State of New York and placed as to prevent as far as possible the natural ground behind the sheeting from moving and shall furnish a full bearing against the banks, voids behind the sheeting being filled when necessary to obtain such bearing. Sheeting shall be started at the surface or, according to local conditions, at such depths below the surface as may be necessary.
- B. Where excavation is near or adjacent to a building, the sheeting shall be started at such depth in relation to the foundations of each such building as may be necessary to prevent displacement of the soil which supports the building.

3.5 WELDING TEMPORARY STEEL:

Field welding of temporary steel members is permitted in connection with the bracing and decking systems, such welding shall conform to the requirements for welding specified in the latest edition of the "Code for Welding in Building Construction" formulated by the American Welding Society, Committee on Building Codes.

3.6 ROCK TO BE STRIPPED:

Whenever rock is encountered in the trench, it shall be stripped of earth and the Engineer shall be duly notified in order that it may measure or cross-section the same.

3.7 SUBSURFACE STRUCTURES:

Whenever any subsurface structure is encountered in or alongside of the trench, the Engineer may direct that all rock within 5 feet of the same shall be removed by means other than blasting.

3.9 EXCESS EXCAVATION:

- A. Any excess excavation in the bottom of the trench below the net lines of excavation between supporting walls and columns shall, if the excavation is in earth, be replaced by properly compacted backfilled in accordance with SECTION 02100: CONTROLLED AND UNCONTROLLED FILLS AND BACKFILLS, except where indicated on the Contract Drawings. If the excavation is in rock, by solid materials such as concrete below columns and supporting walls; and with broken stone properly compacted, in other areas.

- B. Any excess excavation and disturbed earth in bottom of the trench below the net lines of excavation beneath supporting walls and columns shall, if the excavation is in earth, be replaced by approved strength concrete; if the excavation is in rock, all loose rock shall be removed and space filled with approved strength concrete.
- C. In case any rock core is removed, or in case the over-breakage of the rock at the sides of the trench shall exceed two feet, in any and all such cases as determined by the Engineer, construction of greater strength and additional waterproofing below water shall be provided by the Contractor in lieu of ramming the concrete to the rock.

3.10 SAFEGUARDING EXISTING SEWERS:

- A. The Contractor shall take all precautions that may be necessary to safely maintain the integrity of existing sewers wherever the flow in such sewers is temporarily maintained in the trenches. In case any existing sewers so maintained are intermittently subjected to flow under pressure, the Contractor shall, unless otherwise permitted by the Engineer, construct new sewers or siphons, as the case may be, and divert the flow into them before contiguous excavation for the Project is removed to a depth where the breaking of an existing sewer might endanger the Project or the temporary sheet supporting the shoring systems. All temporary sewers shall be closed flumes.
- B. The exact condition of existing sewers shown on the Contract Drawings cannot be determined in advance except at great expense and inconvenience to the public. All sewers may at time flow under pressure. Generally, sewers are not designed and constructed to function when lateral or circumferential support is removed. Whenever any existing sewers are disturbed by the Contractor's operations adjacent to or in the vicinity of such sewers so as to partly or entirely removed their lateral or circumferential support, the sewer may become damaged or broken, thereby causing expense to the Contractor and damage to the Project and to abutting property.

3.11 SURFACE DRAINAGE:

At all times gutters shall be kept open for surface drainage and the street and sidewalks shall be kept clear and free for the passage of vehicles or pedestrians and as otherwise provided in these Specifications.

3.12 OFF-LINE TRENCHES TO BE BRIDGED:

Where any cross-walk or roadway is cut by a collection trench, such trench shall be temporarily bridged over according to the direction and approval of the Engineer to the extent necessary to provide facilities for traffic and to afford access and fire protection to property along the trench. The Work shall at times be conducted so as to cause as little inconvenience as practicable to the public and the Owner.

3.13 STREETS TO BE FREE FROM OBSTRUCTIONS:

All curb, cutter, flagging, paving and macadam stones, necessary to be removed, which in the judgement of the Engineer are suitable to be used again, shall be stored in such places as the Engineer shall direct, or, if unsuitable, shall be removed and disposed of. In all cases a passageway of approved width on the sidewalks and in the roadway shall be preserved from obstructions in accordance with a Work Permit from the New York State Department of Transportation.

3.14 PUMPING:

- A. The Contractor shall take precautions to prevent water from entering upon or flooding the Project. The work shall be conducted so as to assure protection against the occurrence of water entering upon or flooding the Project, and all materials and the necessary equipment shall be at hand at all times for use in emergency or at times of heavy rainfall or for normal groundwater. The Contractor shall submit a pumping scheme for the approval of the Engineer prior to start of the Work, as specified in SECTION 02140: DEWATERING SYSTEM.
- B. Whenever water is encountered in the structure or utility trenches, it shall be removed by bailing, pumping or other approved means with great care being taken when pumping so that the surrounding areas is induced. If necessary to prevent such disturbance, the pumping shall be done by a series of driven wells whose points are protected by fine wire cloths, the rate at flow at each well being so slow as not to removed the particles of soil. The discharge from all pumps shall be so arranged at to be readily inspected at all times to ascertain whether the water is free from particle of soil.
- C. Whenever the Contractor is permitted to discharge water into the sanitary sewers, approved methods of treatment shall be employed to ensure regulated materials do not exceed permitted discharge concentrations.

3.15 REMOVAL OF MASONRY:

The Contractor shall cut out, removed and dispose of the concrete or other masonry (including waterproofing, ducts, steel rods, beams, columns or other steel imbedded in such masonry) of the existing structure as indicated on the Contract Drawings and as ordered by the Engineer. The masonry shall be cut to the exact lines. Any excess removal of material outside the net lines ordered shall be replaced by new material provided and placed at the Contractor's own expense.

3.16 CONCRETE MASONRY UNITS IN BUILDING VAULTS:

- A. Wherever vaults of abutting property are broken through or otherwise disturbed, the Contractor shall provide all materials for an erect a concrete masonry unit wall laid in Portland cement mortar, as a temporary partition, on or about the building line, or as directed, that will afford proper protection to the Owner or occupant of the adjoining premises. Upon the completion of the work adjacent to the vault such wall shall, unless otherwise directed by the Engineer, be immediately removed and disposed of by the Contractor.

3.17 DRILLING HOLES IN MASONRY:

The Contractor shall, where indicated on the Contract Drawings or as ordered, drill hole for dowels in the masonry of the existing structure for securing the new construction thereto.

END OF SECTION

**SECTION 02070
TANK REMOVAL AND CLOSURE**

PART 1 - GENERAL:

1.1 SCOPE:

The Contractor shall furnish all labor, material, tools and equipment and perform all operations necessary for the removal of the 21,000-gallon Waste Solvent Tank, as indicated on the Contract Drawings and specified herein. This work includes: the removal of contaminated groundwater from the tank by pumping; excavation of soil surrounding the tank to expose the tank for demolition; removal of all piping within the limits of the excavation work; dewatering of the excavation; in-place demolition of the tank; and removal and proper disposal of broken concrete from the tank excavation.

1.2 SUBMITTALS:

The Contractor shall furnish the following to the Engineer:

- A. A description of the earth moving, excavation, and demolition equipment that it proposes to use in the performance of the Work.
- B. Identification of the proposed disposal facility for the removed concrete;
- C. Copies of manifests required to transport any waste materials shall be furnished to the Engineer no later than the day following their preparation.
- D. Documentation of acceptance of waste materials by a facility legally permitted to treat or dispose of those materials shall be furnished to the Engineer not later than 7 days following delivery of those materials to the facility.
- E. Letters of acceptance from the facility and haulers acknowledging agreement to accept the waste material shall be furnished to the Engineer not more than 14 days before transporting any hazardous or toxic materials.

1.3 RELATED WORK:

- A. The following specifications sections:

SECTION 01030 - HEALTH AND SAFETY
SECTION 02050 - EXCAVATION
SECTION 02100 - CONTROLLED AND UNCONTROLLED FILLS AND BACKFILLS
SECTION 02140 - DEWATERING SYSTEM
SECTION 02750 - REMOVAL OF INDUSTRIAL WASTE

- B. Coordinate with subcontractors to assure loading, transport, and offsite disposal of broken concrete, piping, and other debris from the tank demolition in accordance with applicable regulations.
- C. Coordination and staging of a temporary on-site storage tank(s) to contain tank liquids.

1.4 GENERAL REQUIREMENTS:

- A. Verification of Dimensions: The Contractor shall become familiar with all details of the Work, verify all dimensions in the field, and shall advise the Engineer of any discrepancies before performing the Work.
- B. Health and Safety: All Work shall be performed in accordance with the SECTION 01030: HEALTH AND SAFETY
- C. Protection: Protect existing structures and utilities from damage. Provide adequate barricades and protection from flying debris during tank demolition. Ensure safe passage of personnel around the area of excavation.

1.5 APPLICABLE REGULATIONS:

- A. All Work shall comply with the applicable laws and regulations including United States Environmental Protection Agency regulations, New York State Solid and Hazardous Waste regulations, United States Occupational Safety and Health Administration (OSHA) regulations, and all other applicable Federal, State, and municipal codes, including revisions to date of Contract.

PART 2 - PRODUCTS: (not used)

PART 3 - EXECUTION:

3.1 TANK CONTENTS REMOVAL:

- A. The tank shall be pumped empty by use of a vacuum truck, double diaphragm pump, or centrifugal suction-lift pump.
- B. All tank contents shall immediately be pumped to an on-site temporary liquid storage tank(s) or to a tank truck for transfer to the on-site temporary liquid storage tank(s). The temporary tank(s) shall be capable of isolation of the contents from the atmosphere. The tank(s) shall remain on-site until the treatment system is operational.
- C. Care should be taken to locate equipment and personnel upwind of the Waste Solvent Tank during pumping operations, and eliminate all sources of ignition. LEL/O₂ and organic vapor monitoring shall be performed during tank pumping operations.
- D. Tank atmosphere testing and air monitoring in the Exclusion Zone shall be performed to determine the initial status of the tank atmosphere and the surrounding area. Monitoring shall be performed continuously during tank pumping to determine that a safe condition exists.

3.2 ABOVE-GRADE, AT-GRADE, AND BELOW-GRADE DEMOLITION:

- A. Raze all items as indicated on the Contract Drawings.
- B. Demolish structures (i.e. concrete dike walls and tank supports) and dispose as specified in SECTION 02750: WASTE MANAGEMENT.
- C. Break down and remove concrete slabs-on-grade, unless otherwise shown to remain.

TANK REMOVAL AND CLOSURE

02070

Page 2

- D. Break out and remove foundations to the depth below finish grade as directed by the Engineer.
- E. Remove Waste Solvent Tank piping to the west wall of the former Drum Storage Building.

3.3 BURIED TANK DEMOLITION AND REMOVAL

- A. Carefully excavate, demolish, and haul away the concrete Waste Solvent Tank, as shown on Contract Drawings in the following general step-wise sequence. The Engineer shall direct the Contractor to make minor variations in the sequence as required.
 - 1. Excavate overburden soil material only as necessary to demolish the tank and prevent sidewall collapse from mixing with the concrete from the tank. All personnel and equipment shall remain outside of the excavation safety lines shown on the Contract Drawings. Stockpile soil in the temporary soil stockpile area identified.
 - 2. Test the tank atmosphere and surrounding atmosphere with an LEL/O₂ meter prior to tank demolition to determine that non-explosive conditions exist. If testing indicates explosive conditions exist, tank shall be mechanically vented to remove vapors with explosion proof blowers. Explosion proof blowers shall be electrically bonded to the tanks.
 - 3. Demolish the concrete tank using a backhoe-mounted ram or other appropriate demolition device.
 - 4. Load the broken concrete and haul to the pre-arranged approved hazardous waste disposal facility, in accordance with SECTION 02750: WASTE MANAGEMENT. Vehicles used to haul broken concrete shall comply with all applicable federal and state hazardous waste and transportation regulations.
- B. The Contractor shall not exceed the limits of excavation as shown on the Contract Drawings without permission from the Engineer. Excavations which expose building foundations, well casings, or other structures to remain in place can only be authorized by the Engineer.

3.4 EXCAVATION DEWATERING

- A. The tank excavation shall be maintained dry and free of standing water by pumping water from the excavation in accordance with SECTION 02140: DEWATERING.
- B. Liquids generated from dewatering activities shall be pumped directly to the on-site temporary liquid storage tank(s) or to a tank truck for transfer to the on-site temporary liquids storage tank(s).

END OF SECTION

TANK REMOVAL AND CLOSURE

02070

Page 3

**SECTION 02080
ASBESTOS ABATEMENT**

PART 1 - GENERAL:

1.1 REFERENCES:

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 61	National Emissions Standards for Hazardous Air Pollutants
40 CFR 763	Asbestos
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 171	General Information, Regulations and Definitions
49 CFR 173	Shippers - General Requirements for Shipments and Packagings

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 340/1-90-018	(1990) Asbestos/NESHAP Regulated Asbestos Containing Materials Guidance
EPA 340/1-90-019	(1990) Asbestos/NESHAP Adequately Wet Guidance
EPA 560/5-85-024	(1985) Guidance for Controlling Asbestos-Containing Materials in Buildings

NEW YORK STATE CODES, RULES AND REGULATIONS

12 NYCRR 56	Asbestos
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1.2 DESCRIPTION OF WORK:

The work covered by this section includes the removal of asbestos-containing materials (ACM) which are encountered during demolition and renovation activities associated with this project and describes procedures required to protect workers and occupants of the regulated area from contact with airborne asbestos fibers and ACM dust and debris. Activities include OSHA Class II work operations involving ACM. The work also includes containment, storage, transportation and disposal of the generated ACM wastes. The specific ACM to be abated is identified on the detailed plans and project drawings.

1.3 SUBMITTALS:

The Contractor shall prepared and submit an Asbestos Abatement Plan to the Engineer and Owner for approval. The Asbestos Abatement Plan shall include all information required by 12 NYCRR Part 56, including, but not limited to the following:

- a. The personal protective equipment to be used;
- b. The location and description of regulated areas including clean and dirty areas, access tunnels, and decontamination unit (clean room, shower room, equipment room, storage areas such as load-out unit);
- c. Initial exposure assessment in accordance with 29 CFR 1926 Section .1101;
- d. Level of supervision;
- e. Method of notification of other employers at the worksite;
- f. Abatement method to include containment and control procedures;
- g. Interface of trades involved in the construction;
- h. Sequencing of asbestos related work;
- i. Storage and disposal procedures and plan;
- j. Type of wetting agent and asbestos encapsulant to be used;
- k. Location of local exhaust equipment;
- l. Air monitoring methods (personal, environmental and clearance);
- m. Bulk sampling and analytical methods (if required);
- n. A detailed description of the method to be employed in order to control the spread of ACM wastes and airborne fiber concentrations;
- o. Fire and medical emergency response procedures;

1.4 QUALIFICATIONS:

1.4.1 Written Qualifications and Organization Report

The Contractor shall furnish a written qualifications and organization report providing evidence of qualifications of the Contractor, Contractor's Project Supervisor, Designated Competent Person, supervisors and workers; Designated Industrial Hygienist (IH); independent testing laboratory (including name of firm, principal and analyst(s) who will perform analyses); all subcontractors to be used including disposal transportation and disposal facility firms, subcontractor supervisors, subcontractor workers; and any others assigned to perform asbestos abatement and support activities. The report shall include an organization chart showing the Contractor's staff organization for this project by name and title, chain of command and reporting relationship with all subcontractors. The report shall be signed by the Contractor, the Contractor's onsite project manager, Designated Competent Person, Designated IH, designated testing laboratory and the principals of all subcontractors to be used. The Contractor shall include the following statement in the report: "By signing this report I certify that the personnel I am responsible for during the course of this project fully understand the contents of 29 CFR 1926 Section .1101, 40 CFR 61 Subpart M, and the federal, state and local requirements for those asbestos abatement activities that they will be involved in local requirements.

1.4.2 Federal, State or Local Citations on Previous Projects

The Contractor and all subcontractors shall submit a statement, signed by an officer of the company, containing a record of any citations issued by Federal, State or local regulatory agencies relating to asbestos activities (including projects, dates, and resolutions); a list of penalties incurred through non-compliance with asbestos project specifications including liquidated damages, overruns in scheduled time limitations and resolutions; and situations in which an asbestos-related contract has been terminated (including projects, dates, and reasons for terminations). If there are none, there will be a negative declaration signed by an officer of the company.

1.5 LICENSES, PERMITS AND NOTIFICATIONS:

1.5.1 General Requirements

Necessary licenses, permits and notifications shall be obtained in conjunction with the project's asbestos abatement, transportation and disposal actions and timely notification furnished of such actions as required by federal, state, regional, and local authorities. The Contractor shall notify the Regional Office of the USEPA and the New York State Department of Labor, Division of Safety and Health in writing, at least 30 days prior to the commencement of work in accordance with 40 CFR 61 Subpart M, and state and local requirements to include the mandatory "Notification of Demolition and Renovation Record" form and other required notification documents. Notification shall be by Certified Mail, Return Receipt Requested. The Contractor shall furnish copies of the receipts to the Engineer, in writing, prior to the commencement of work. Local fire department shall be notified 3 days before fire-proofing material is removed from a building and the notice shall specify when the material contains asbestos. A copy of the rental company's written acknowledgment and agreement shall be provided as required by paragraph Rental Equipment. For licenses, permits and notifications that the Contractor is responsible for obtaining, the Contractor will pay any associated fees or other costs incurred.

1.5.2 Litigation and Notification

The Contractor shall notify the Engineer if any of the following occur:

- a. The Contractor or any of the subcontractors are served with notice of violation of any law, regulation, permit or license which relates to this Contract;
- b. Proceedings are commenced which could lead to revocation of related permits or licenses; permits, licenses or other Government authorizations relating to this Contract are revoked;
- c. Litigation is commenced which would affect this contract;
- d. The Contractor or any of the subcontractors become aware that their equipment or facilities are not in compliance or may fail to comply in the future with applicable laws or regulations.

1.6 REGULATED AREAS

All asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated to minimize the number of persons within the area and to protect persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they shall demarcate the regulated area. Access to regulated areas shall be limited to authorized persons. The Contractor shall control access to regulated areas, ensure that only authorized personnel enter, and verify that Contractor required medical surveillance, training and respiratory protection program requirements are met prior to allowing entrance.

1.7 WARNING SIGNS AND TAPE

Warning signs and tape printed in English shall be provided at the regulated boundaries and entrances to regulated areas. The Contractor shall ensure that all personnel working in areas contiguous to regulated areas comprehend the warning signs. Signs shall be so located to allow personnel to read the signs and take the necessary protective steps required before entering the area. Warning signs shall be in vertical format conforming to 29 CFR 1910 and 29 CFR 1926 Section .1101, minimum 20 by 14 inches and displaying the following legend in the lower panel:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING
ARE REQUIRED IN THIS AREA

Spacing between lines shall be at least equal to the height of the upper of any two lines. Warning tape shall be provided.

1.8 WARNING LABELS:

Warning labels shall be affixed to all asbestos disposal containers used to contain asbestos materials, scrap, waste debris, and other products contaminated with asbestos. Containers with preprinted warning labels conforming to requirements are acceptable. Warning labels shall conform to 29 CFR 1926 Section .1101 and shall be of sufficient size to be clearly legible displaying the following legend:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

1.9 LOCAL EXHAUST VENTILATION:

Local exhaust ventilation units shall conform to ANSI Z9.2 and 29 CFR 1926 Section .1101. Filters on local exhaust system equipment shall conform to ANSI Z9.2 and UL 586. Filter shall be UL labeled.

1.10 TOOLS:

Vacuums shall be leak proof to the filter, equipped with HEPA filters, of sufficient capacity and necessary capture velocity at the nozzle or nozzle attachment to efficiently collect, transport and retain the ACM waste material. Power tools shall not be used to remove ACM unless the tool is equipped with effective, integral HEPA filtered exhaust ventilation capture and collection system or has otherwise been approved for use by the Engineer. All residual asbestos shall be removed from reusable tools prior to storage and reuse. Reusable tools shall be thoroughly decontaminated prior to being removed from regulated areas.

1.11 RENTAL EQUIPMENT:

If rental equipment is to be used, written notification shall be provided to the rental agency, concerning the intended use of the equipment, the possibility of asbestos contamination of the equipment and the steps that will be taken to decontaminate such equipment. A written acceptance of the terms of the Contractor's notification shall be obtained from the rental agency.

1.12 AIR MONITORING EQUIPMENT:

The Contractor's Designated IH shall select and approve air monitoring equipment to be used to collect samples. The equipment shall include, but not be limited to:

- a. High-volume sampling pumps that can be calibrated and operated at a constant airflow up to 16 liters per minute when equipped with a sampling train of tubing and filter cassette.

- b. Low-volume, battery powered, body-attachable, portable personal pumps that can be calibrated to a constant airflow up to approximately 3.5 liters per minute when equipped with a sampling train of tubing and filter cassette, and a self-contained rechargeable power pack capable of sustaining the calibrated flow rate for a minimum of 10 hours. The pumps shall also be equipped with an automatic flow control unit which shall maintain a constant flow even as filter resistance increases due to accumulation of fiber and debris on the filter surface.
- c. Single use standard 25 mm diameter cassette, open face, 0.8 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive extension cowl, and shrink bands, to be used with low flow pumps in accordance with 29 CFR 1926 Section .1101 for personal air sampling.
- d. Single use standard 25 mm diameter cassette, open face, 0.45 micron pore size, mixed cellulose ester membrane filters and cassettes with 50 mm electrically conductive cowl, and shrink bands, to be used with high flow pumps when conducting environmental area sampling using NIOSH Pub No. 84-100 Methods 7400 and 7402.
- e. Appropriate plastic tubing to connect the air sampling pump to the selected filter cassette.
- f. A flow calibrator capable of calibration to within plus or minus 2 percent of reading over a temperature range of minus 4 to plus 140 degrees F and traceable to a NIST primary standard.

PART 2 – PRODUCTS: (NOT USED)

PART 3 – EXECUTION:

3.1 GENERAL:

The Contractor shall use the engineering controls and work practices required in 29 CFR 1926 Section .1101(g) in all operations regardless of the levels of exposure. Personnel shall wear and utilize protective clothing and equipment as specified. Eating, smoking, drinking, chewing or applying cosmetics shall not be permitted in the regulated area. All hot work (burning, cutting, welding, etc.) shall be conducted under strictly controlled conditions in conformance with 29 CFR 1926 Section .352, Fire Prevention. Personnel of other trades, not engaged in asbestos abatement activities, shall not be exposed at any time to airborne concentrations of asbestos unless all the administrative and personal protective provisions of the Contractor's Accident Prevention Plan are complied with. Power to the regulated area shall be locked-out and tagged in accordance with 29 CFR 1910 and temporary electrical service with ground fault circuit interrupters shall be provided as needed. Temporary electrical service shall be disconnected when necessary for wet removal. The Contractor shall stop abatement work in the regulated area immediately when the airborne total fiber concentration: (1) equals or exceeds 0.01 f/cc or the pre-abatement concentration, whichever is greater, outside the regulated area, or (2) equals or exceeds 1.0 f/cc inside the regulated area. The Contractor shall correct the condition to the satisfaction of the Engineer, including visual inspection and air sampling. Work will resume only upon notification by the Engineer. Corrective actions shall be documented.

3.2 PROTECTION OF ADJACENT WORK OR AREAS TO REMAIN:

Asbestos abatement shall be performed without damage to or contamination of adjacent work or area. Where such work or area is damaged or contaminated, as verified by the Engineer using visual inspection or sample analysis, it shall be restored to its original condition or decontaminated by the Contractor at no expense to the Government as deemed appropriate by the Engineer. This includes inadvertent spill of dirt, dust or debris in

which it is reasonable to conclude that asbestos may exist. When these spills occur, work shall stop in all effected areas immediately and the spill shall be cleaned. When satisfactory visual inspection and air sampling analysis results are obtained and have been evaluated by the Contractor's Designated IH and the Engineer, work may proceed.

3.3 METHODS OF COMPLIANCE:

3.3.1 Mandated Practices

The Contractor shall employ proper handling procedures in accordance with 29 CFR 1926 and 40 CFR 61 Subpart M, and the specification requirements herein. The specific abatement techniques and items identified shall be detailed in the Contractor's Asbestos Hazard Abatement Plan including, but not limited to, details of construction materials, equipment, and handling procedures. The Contractor shall use the following engineering controls and work practices in all operations, regardless of the levels of exposure:

- a. Vacuum cleaners equipped with HEPA filters to collect debris and dust containing ACM.
- b. Wet methods or wetting agents to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup; except where it can be demonstrated that the use of wet methods is unfeasible due to, for example, the creation of electrical hazards, equipment malfunction, and in roofing.
- c. Prompt clean-up and disposal in leak-tight containers of wastes and debris contaminated with asbestos.
- d. Inspection and repair of polyethylene in work and high traffic areas.
- e. Cleaning of equipment and surfaces of containers filled with ACM prior to removing them from the equipment room or area.

3.3.2 Control Methods

The Contractor shall use the following control methods to comply with the PELs:

- a. Local exhaust ventilation equipped with HEPA filter dust collection systems;
- b. Enclosure or isolation of processes producing asbestos dust;
- c. Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;
- d. Use of other work practices and engineering controls;
- e. Where the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the PELs, the Contractor shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with paragraph, RESPIRATORY PROTECTION PROGRAM.

3.3.3 Unacceptable Practices

The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

- a. High-speed abrasive disc saws that are not equipped with point of cut ventilator or enclosures with HEPA filtered exhaust air.
- b. Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air.
- c. Dry sweeping, shoveling, or other dry clean-up of dust and debris containing ACM.
- d. Employee rotation as a means of reducing employee exposure to asbestos.

3.3.4 Class II Work

In addition to the requirements of paragraphs Mandated Practices and Control Methods, the following engineering controls and work practices shall be used:

- a. A Competent Person shall supervise the work.
- b. For indoor work, critical barriers shall be placed over all openings to the regulated area.
- c. Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

3.3.5 Specific Control Methods for Class II Work

In addition to requirements of paragraph Class II Work, Class II work shall be performed using the following methods:

A. Vinyl and Asphalt Flooring Materials

When removing vinyl and asphalt flooring materials which contain ACM, the Contractor shall use the practices as shown on Contract Drawings D-1. Resilient sheeting shall be removed by adequately wet methods. Tiles shall be removed intact (if possible); wetting is not required when tiles are heated and removed intact. Flooring or its backing shall not be sanded. Scraping of residual adhesive and/or backing shall be performed using wet methods. Mechanical chipping is prohibited unless performed in a negative pressure enclosure. Dry sweeping is prohibited. The Contractor shall use vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) to clean floors.

3.4 FINAL CLEANING AND VISUAL INSPECTION:

Upon completion of abatement, the regulated area shall be cleaned by collecting, packing, and storing all gross contamination. A final cleaning shall be performed using HEPA vacuum and wet cleaning of all exposed surfaces and objects in the regulated area. Upon completion of the cleaning, the Contractor shall conduct a visual pre-inspection of the cleaned area in preparation for a final inspection before final air clearance monitoring and recleaning, as necessary. Upon completion of the final cleaning, the Contractor and the Engineer shall conduct a final visual inspection of the cleaned regulated area in accordance with ASTM E 1368 and document the results on the Final Cleaning and Visual Inspection. If the Engineer rejects the clean regulated area as not meeting final cleaning requirements, the Contractor shall reclean as necessary and have a follow-on inspection conducted with the Engineer. Recleaning and follow-up reinspection shall be at the Contractor's expense.

3.5 LOCKDOWN:

Prior to removal of plastic barriers and after clean-up of gross contamination and final visual inspection, a post removal (lockdown) encapsulant shall then be spray applied to ceiling, walls, floors, and other surfaces in the regulated area.

3.6 CLEARANCE CERTIFICATION:

When asbestos abatement is complete and all ACM waste is removed from the regulated areas, and final clean-up is completed, the Engineer will certify the areas as safe before the warning signs and boundary warning tape can be removed. After final clean-up and acceptable airborne concentrations are attained, but before the HEPA unit is turned off and the containment removed, the Contractor shall remove all pre-filters on the building HVAC system and provide new pre-filters. The Contractor shall dispose of such filters as asbestos contaminated materials. HVAC mechanical, and electrical systems shall be re-established in proper working order. The Contractor and the Engineer will visually inspect all surfaces within the containment for residual material or accumulated debris. The Contractor shall reclean all areas showing dust or residual materials. The Engineer will certify in writing that the area is safe before unrestricted entry is permitted. The Government will have the option to perform monitoring to certify the areas are safe before entry is permitted.

3.7 CLEANUP AND DISPOSAL:

3.7.1 Title to ACM Materials

ACM material resulting from abatement work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified and in accordance with applicable federal, state and local regulations.

3.7.2 Collection and Disposal of Asbestos

All ACM waste including contaminated wastewater filters, scrap, debris, bags, containers, equipment, and asbestos contaminated clothing, shall be collected and placed in leak-tight containers such as double plastic bags; sealed double wrapped polyethylene sheet; sealed fiberboard boxes; or other approved containers. Waste within the containers shall be wetted in case the container is breeched. Asbestos-containing waste shall be disposed of at an EPA, state and local approved asbestos landfill approved by the Owner and Engineer. For temporary storage, sealed impermeable containers shall be stored in an asbestos waste load-out unit or in a storage/transportation conveyance (i.e., dumpster, roll-off waste boxes, etc.) in a manner acceptable to and in an area assigned by the Engineer. Procedure for hauling and disposal shall comply with 40 CFR 61 Subpart M, state, regional, and local standards.

3.7.3 Weigh Bill and Delivery Tickets

Copies of weigh bills and delivery tickets shall be submitted to the Engineer during the progress of the work. The Contractor shall furnish the Engineer scale tickets for each load of ACM weighed and certified. These tickets shall include tare weight, identification mark for each vehicle weighed, date, time and location of loading and unloading. Tickets shall be furnished at the point and time individual trucks arrive at the worksite. A master log of all vehicle loading shall be furnished for each day of loading operations. Before the final statement is allowed, the Contractor shall file with the Engineer certified weigh bills and/or certified tickets and manifests of all ACM actually disposed by the Contractor for this contract.

3.7.4 Asbestos Waste Shipment Record

The Contractor shall complete and provide the Engineer final completed copies of the Waste Shipment Record for all shipments of waste material as specified in 40 CFR 61 Subpart M and other required state waste manifest shipment records within 3 days of delivery to the landfill. Each Waste Shipment Record shall be signed and dated by the generator, the waste transporter and disposal facility operator.

SECTION 02100
CONTROLLED AND UNCONTROLLED FILLS OR BACKFILLS

PART 1 - GENERAL:

1.1 SCOPE:

- A. This Section specifies the all areas of the Project that require filling and backfilling under controlled or uncontrolled conditions. In this Section, the term fill or filling shall be understood to mean placement of any soil, stone or fractured rock material for wither new fills or for backfills which replace materials previously removed during construction activities.
- B. Controlled Conditions refer to fills which are placed to support permanent structures, pavement, slabs, walkways, fills which are placed within 5 feet of building walls, fills which placed in utility trenches or as indicated on Contract Drawings.
- C. Uncontrolled conditions refer to any fill which (a) does not provide support to any permanent structure, underground tank, pavement, slab, or walkway, (b) is not used as a railroad subballast, (c) is not placed within 5 feet of a building wall, (d) is not used on embankments, and (e) is not placed in a utility trench.

1.2 APPLICABLE STANDARDS:

- A. Work shall be performed in compliance with applicable provisions of the Occupational Safety and Health Standard of the U.S. Department of Labor (OSHA) and other Federal, State, and municipal codes and regulations concerning excavation work.
- B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Society of Testing and Materials (ASTM) Publications:

- D 422 Particle Size Analysis in Soils
(R 1972)
- D 698 Standard Test Methods for Moisture - Density Relations of Soil and Soil-Aggregate Mixtures using 5.5lb (2.49-kg) Rammer and 12-in (305-mm) Drop.
- D 1556 Density of Soil In Place by the Sand-Cone Method
- D 1557 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in. (457-mm) Drop.
- D 2487-85 Classification of Soils for Engineering Purposes.
- D 2922-81 Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
- D 3017-78 Moisture Content of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
- D 4318 Standard Test Method of Liquid Limit, Plastic Limit and Plasticity Index in Soils

2. American Concrete Institute

ACI 301 Specifications for Structural Concrete for Buildings

1.3 SUBMITTALS:

Submittals shall comply with the provisions of Division 1. The Contractor shall submit the following to the Engineer for approval:

- A. Description of earthmoving and compaction equipment to be used in performing the Work, and the proposed method of compaction.
- B. Results of field density tests, together with their locations, depth and computations of Relative Compaction (RC).
- C. Results of grain size analysis and their comparison with similar analysis of soils used for the Proctor test series to obtain the maximum dry density.

1.4 JOB CONDITIONS:

The Contractor shall comply with the following requirements:

- A. Open excavations shall be barricaded and posted with warning lights. Warning lights shall be operated during the hours from dusk to dawn each day, as required.
- B. Protect structures, utilities, sidewalks, pavements, buildings, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation and backfill operations.
- C. Other restrictions specified in this Section and these Specifications.

1.5 ENVIRONMENTAL CONDITIONS:

- A. The Contractor shall examine the Site, the Contract Drawings, survey of existing utilities and construction, and the record of test borings. The records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.
- B. The survey of the Site, existing utilities and existing construction represent all conditions known to the Engineer. Other construction, of which no records are available, may be encountered. The Contractor shall formulate his own conclusions as to the extent of such construction and shall remove all material of any nature to the design subgrades indicated or hereinafter specified.

PART 2 - PRODUCTS:

2.1 QUALITY OF MATERIAL FOR CONTROLLED FILLS:

- A. Material used for controlled fills shall consist of any suitable soil including mixtures of clays, sands, gravels, crushed stone or crushed gravel, and must be free from any perishable organic or other extraneous matter of any kind.
- B. Any solid materials, such as stones, boulders, cobbles, rock fragments or broken masonry, which are of a size and type which, in the opinion of the Engineer, will interfere with the proper installation of, or

have an adverse impact upon any surface or subsurface structures and/or appurtenances, or will prevent the proper compaction of the fill or backfill, will not be allowed.

- C. Any previously excavated material may be used as a fill material for backfilling or filling purposes, providing that the material is shown to satisfy all the criteria of this Specification. In addition, it must be shown that these properties do not change with time in the fill. In particular, if the Engineer so directs, it must be shown that any of the material does not become impervious by rehydration in the fill and prevent natural water drainage through the fill.
- D. If the quantities of excavated materials are insufficient for all fill and backfill activities, or if excavated materials are not suitable for use as fill material, additional fill material may be brought on-site from a commercial source of fill material. Prior to the transportation of any fill material to the site, the source of the fill shall be tested at an analytical laboratory approved by the Engineer using the following test methods:
- Polychlorinated Biphenyls (PCBs) by USEPA Method 8080; and
 - Total Petroleum Hydrocarbons (TPH) by USEPA Method 8015.

Analytical results, along with the name, address and owner of the backfill source shall be submitted to the Engineer for approval prior to the transport of any fill materials to the site.

- E. In no case shall any solid materials be allowed to collect and remain in layers or clusters, but shall be distributed and separated by finer materia, as directed by the Engineer.
- F. Where fill is to be replaced against sewer lines, utility lines or other pipe that is coated or wrapped for protection against corrosion, the fill material up to an elevation two (2) feet above the line shall be free of any stones larger than one inch in any dimension.

All gradation requirements specified below shall be determined in accordance with applicable procedures specified by ASTM.

1. For fills specified as "crushed stone" on the Contract Drawings, no particles exceeding 4 inches in largest dimension shall be allowed. No more than 30% by weight shall be retained on a ¾ inch sieve. For the material passing the ¾ inch sieve, no more than 45% by weight shall pass the No. 100 sieve and no more than 10% by weight shall pass the No. 200 sieve.
2. For fills specified in the Contract Documents as having to be placed in lifts, 100% must pass the ¾ inch sieve. These fills and/or backfills must satisfy the following gradation requirements:

¾" Sieve	No less than	100%		passing
No. 4 Sieve	No less than	40%	to a maximum of 100%	passing
No. 10 Sieve	No less than	20%	to a maximum of 100%	passing
No. 40 Sieve	No less than	5%	to a maximum of 60%	passing
No. 100 Sieve			no more than 40%	passing
No. 200 Sieve			no more than 15%	passing

3. The portion of material passing the number 40 sieve shall have a liquid limit less than 35 and a plasticity index less than 12.

2.2 STRUCTURAL FILL CONCRETE:

Structural fill concrete shall conform to the requirements specified in ACI 301. The minimum ultimate compressive strength shall be 1,500 psi at 28 days, unless otherwise specified. Structural fill concrete shall be placed as indicated on the Contract Drawings.

2.3 PEA GRAVEL:

Pea gravel shall be rounded pea gravel, clean and free from objectionable material, graded from 1/4-inch to 3/8-inch in size in accordance with ASTM Standard Specifications for Concrete Aggregate, Designation C-33. Pea Gravel shall not contain more than 10-percent of organic matter or other deleterious substances by volume as determined by decantation.

2.4 FROZEN EARTH:

No filling and/or backfilling procedures will be allowed if (a) the air temperature is below freezing, (b) the fill and/or backfill material is frozen, or (c) the soil below the fill and/or backfill material is frozen.

2.5 POROUS FILTER FABRIC (DRAINAGE FABRIC):

Prior to the placing of crushed stone fill for floor slab, drainage fabric shall be installed as indicated on the Contract Drawings and in accordance with the manufacturer's recommendations. Drainage fabric shall be Mirafi 140 as manufactured by Celanese Fibers Marketing Company, or approved equal.

PART 3 - EXECUTION:

3.1 COMPACTION METHOD:

- A. No backfill shall be placed in any excavation until the construction therein has been inspected and approved by the Engineer.
- B. The specific compaction requirements specified herein for controlled fills can be waived at the discretion of the Engineer for those cases where (a) no subsurface or surface structures, pavements, slabs and/or walkways are either supported on or in the fill, (b) in the judgements of the Engineer, the compaction procedures may adversely impact nearby structures and/or pipe, or (c) the volume of fill to be placed is less than 3 feet thick and covers an area of less than 50 square feet. For such situations, the fill can be flushed or puddled, at the discretion of the Engineer, to achieve adequate spreading and filling of void spaces in the fill. If such puddling is allowed by the Engineer, the fill or backfill shall be flushed with water in such a manner so as to thoroughly saturate the soil, to wash it into place, and to fill any such voids. Over a 2 week period, the flushing shall be conducted at least three times.
- C. For all other cases of fills or backfills, the Contractor is to ensure that the material is suitably compacted to at least the density stated specifically below. Any method of compaction which leads to the satisfactory state of compaction, as specified below, and at the same time does not deleteriously influence other aspects of the Project can be used. The specific method of compaction proposed by the Contractor must be approved prior to use by the Engineer. The specific method of compaction can be achieved by vibratory rolling equipment, rubber tired roller equipment, light vibratory tampers, hand held tampers, or hand tamping, with the following exceptions:
 - 1. When close to any retaining structure, either rigid or flexible, no heavy compacting equipment can come closer to the structure wall than 2/3 the unbalanced soil height at the time.

2. In and around any buried pipe or conduits, the soil must be compacted by either hand tamping or light vibratory tampers so as to provide complete and proper support all around the pipes and conduits. The hand procedures must be continued until at least 1 foot of cover above the pipes or conduits is achieved. The specific thickness of cover above the pipes or conduits required before heavy compaction equipment is again allowed is to be determined so that the compacting equipment will not damage the pipes or conduits.
3. The use of any compacting equipment, either heavy or light, vibratory or static, must not cause damage to any other part of the Project, or to any adjacent facilities or structures.

3.2 COMPACTION REQUIREMENTS - CONTROLLED FILLS:

Except for "crushed stone" fills or backfill or for those cases where flooding methods are allowed, all fills and backfills are to be placed to satisfy the following criteria. The fill or backfill is to be placed in uniform lifts no greater than 1 foot thick in its uncompacted state. Each lift must be uniformly compacted to the density state as specified below and accepted by the Engineer before the next lift is placed. If any soft spots are found to exist in the lift, they must be recompacted to achieve the required density state before the next lift is introduced onto the fill or backfill. Each lift must be compacted to the following dry densities:

- A. For those fills or backfills which will provide direct support under any load bearing element of a structure, the minimum acceptable dry density is 95% of the maximum dry density as determined by ASTM 1557 (Modified Proctor Method).
- B. For those fills or backfills which will provide direct support to floating slabs, placed around

END OF SECTION

**SECTION 02140
DEWATERING**

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the dewatering requirements to be performed as part of the excavation work.

1.2 APPLICABLE STANDARDS:

- A. Equipment and operation of the dewatering system shall comply with all ANSI, ASTM, AWWA, AFI, ASME, OSHA and all other applicable Federal, State and Municipal Codes, including revisions to the date of Contract.

1.3 GENERAL REQUIREMENTS:

- A. The Contractor shall furnish all labor, material, and equipment necessary to perform dewatering of all excavations. Dewatering consists of lowering and controlling the groundwater level and hydrostatic pressure to permit excavation and construction to be performed in near-dry conditions.
- B. This Section is a general section and, although set forth in only one place within the body of the Contract Documents, relates to any and all subsurface excavation and construction work specified under other Sections.
- C. Verification of Dimensions: The Contractor shall become familiar with all details of the Work, verify all dimensions in the field and shall advise the Engineer of any discrepancies before performing the Work.

1.4 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Additional Specification Sections:

SECTION 01030	HEALTH AND SAFETY.
SECTION 02050	EXCAVATION
SECTION 02221	EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES
SECTION 02070	TANK REMOVAL AND CLOSURE
SECTION 02100	CONTROLLED AND UNCONTROLLED FILLS AND BACKFILLS
SECTION 03300	CAST-IN-PLACE CONCRETE

1.5 SUBMITTALS:

- A. Shop Drawings: Shop drawings to be submitted shall consist of a complete list of all equipment and materials. Shop drawings shall show all principal dimensions, equipment and other information necessary to clearly identify the equipment relationship to other parts of the Work.

1.6 QUALITY ASSURANCE:

- A. Operator Qualifications: Perform dewatering operations with supervisory personnel having at least 5 years experience in field of dewatering.
- B. Maintain adequate supervision and control to ensure that stability of excavated and constructed slopes are not adversely affected by water, erosion is controlled, and flooding of excavation or damage to structures does not occur.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 DEWATERING

- A. The Contractor shall provide an adequate system to lower and control groundwater in order to permit excavation, construction of structures, and placement of fill materials under dry conditions. The Contractor shall install sufficient dewatering equipment to drain water-bearing strata above and below bottom of structure foundations, drains, sewers, and other excavations.
- B. The dewatering shall reduce hydrostatic head in water-bearing strata below structure foundations, drains, sewers and other excavations to extent that water level in construction areas are below prevailing excavation surface.
- C. Prior to excavation below groundwater level, the Contractor shall place system into operation to lower water levels as required and then operate it continuously 24 hours a day, 7 days a week until all drains, sewers and structures have been constructed, including placement of fill materials, and until dewatering is no longer required.
- D. The water removed from excavations shall be stored on-site in temporary storage tanks at the location shown on the Contract Drawings in a manner to avoid endangering public health, property, and portions of work under construction or completed. The water collected during construction activities will be managed in the groundwater treatment system, when construction is completed. No sampling or analysis of the collected groundwater is required by the Contractor. It is anticipated that start-up of the groundwater treatment system will occur in September 1997. Therefore, water storage tanks must be left in place until this time.
- E. Provide standby equipment on site, installed and available, for immediate operation if required to maintain dewatering on a continuous basis in event any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, perform such work as may be required to restore damaged structures and foundation soils at no additional expense.

END OF SECTION

SECTION 02221
EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the excavation, trenching, backfilling, and related work as required for underground utility lines and utility structures. The term "utility" as used herein shall be deemed to mean all drainage, sewer, water, fire protection, gas, and other lines, and shall include underground ducts and conduits, both concrete encased and direct buried.

1.2 APPLICABLE STANDARDS:

- A. Work shall be in compliance with applicable provisions for the Occupational Safety and Health Standard of the U.S. Department of Labor (OSHA) and Federal, State and municipal regulations concerning excavation work.
- B. Except as modified herein, materials and procedures shall be in accordance with the New York State Department of Transportation (NYDOT) Standard Specifications for Road and Bridge Construction.
- C. Applicable Publications: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Society of Testing and Materials (ASTM) Publications:

D 422-63 (R 1972)	Particle-Sized Analysis of Soils
D 1556-82	Density of Soil In Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54-kg Rammer and 18-in. (457-mm) Drop
D 2167-84	Density and Unit Weight of Soil In Place by the Rubber Balloon Method
D 2487-85	Classification of Soils for Engineering Purposes
D 2922-81	Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth)
D 3017-78	Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

- D. Trenching and backfilling for underground electrical systems shall be in accordance with the New York State Electric and Gas Company (NYSEG) Specification for Underground Work, which forms a part of these Specifications.

1.3 SUBMITTALS:

Submittals shall comply with the provisions of Division 1. The submittal shall consist of a detailed outline of intended excavation and dewatering procedures for the Engineer's information. This submittal will not relieve the Contractor of complete responsibility for the successful performance of intended excavation methods.

1.4 JOB CONDITIONS:

The Contractor shall comply with the following requirements:

- A. Open excavations shall be barricaded and posted with warning lights. Warning lights shall be operated during hours from dusk to dawn each day as required.
- B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation and backfill operations.
- C. Other restrictions specified in this Section.

1.5 ENVIRONMENTAL CONDITIONS:

- A. The Contractor shall examine the Site, the Contract Drawings, survey of existing utilities and construction, and the record of test borings. The records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.
- B. The survey of the Site, existing utilities and existing construction (including underground construction) represent all conditions known to the Engineer. Other construction, of which no records are available, may be encountered. The Contractor shall formulate his own conclusions as to the extent of such construction and shall remove all material of any nature to the design subgrades indicated or hereinafter specified.

PART 2 - PRODUCTS:

2.1 BACKFILL MATERIAL:

Backfill material shall be acceptable material as approved by the Engineer, free from organic matter, frozen material, products of demolition or other deleterious substances and containing no rocks or lumps over 4 inches in greatest dimension and no more than 15 percent, by weight, of the material passing the No. 200 sieve, except where otherwise approved in writing by the Engineer.

2.2 SELECT MATERIAL:

Imported select material or on-site excavated material meeting the following requirements shall be provided for backfill where specified. The material shall consist of sound, durable particles of a maximum 4-inch size. No more than 70% by weight shall pass a No. 40 sieve and no more than 15% by weight shall pass a No. 200 sieve. The material shall be granular and free of bricks, blocks, pavement materials, wood, organics or other deleterious material. Select backfill material will be subject to testing by the Engineer.

Select backfill may contain excess moisture in its natural state or may take on excess moisture during handling or stockpiling. Manipulation to dry the material to proper moisture content prior to compaction may be necessary. Earth excavation will not be considered as unacceptable backfill material by virtue of its moisture content only.

2.3 BEDDING:

- A. Bedding where specified shall be crushed stone conforming to NYSDOT 703-02, #1 & #2.
- B. Sand bedding shall conform to concrete sand of NYSDOT 703-06.

2.4 PLASTIC MARKING TAPE:

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 6 inches wide with a minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1,750 psi lengthwise and 1,500 psi crosswise. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specified utility.

**TABLE 1
TAPE COLOR**

Color	Description
Red	Electric
Yellow	Gas, Oil, Dangerous Material
Orange	Telephone, Telegraph, Television, Police, and Fire Communications
Blue	Water Systems
Green	Sewer Systems

PART 3 - EXECUTION:

3.1 EXCAVATION:

- A. General: Except as modified herein, construction shall conform to the requirements of NYSDOT for Subsurface Structure Excavation.
- B. The maximum length of trench that shall be open at any one time when using open trench and/or sheeting method shall be 75 feet unless otherwise approved in writing by the Engineer. When utilizing shield, pipe shall be backfilled immediately upon withdrawal of the shield. Care shall be exercised to prevent movement of the pipe when withdrawing the shield.
- C. Excavations shall be dewatered when necessary and kept free from water, snow and ice in accordance with the applicable provisions of SECTION 02140: DEWATERING.
- D. Special care shall be taken not to disturb the bottom of the excavation and not to remove material at final grade just before the utility is installed. Excavations for bell ends of pipe shall be carefully made by hand so that the pipe will uniformly rest on the trench bottom or bedding material.
- E. Sloping the sides of excavation will be allowed only where approved by the Engineer. The angle of slopes shall be approved by the Engineer and shall not be steeper than allowed by Title 29 of the Code of Federal Regulation, Part 1926, Safety and Health Regulations for Construction.
- F. Excavations for appurtenances shall be made to a vertical line 2'-0" from the horizontal limits of the appurtenances.

- G. The Contractor shall immediately notify the Engineer and appropriate utility owner if an uncharted utility line is uncovered by the excavation work. The Contractor shall allow ample time for the Engineer to investigate the possible conflict and direct the appropriate solution. The Contractor shall not interrupt existing services unless so directed by the Engineer.
- H. Whenever the material encountered during trenching is in the Contractor's opinion unstable and incapable of providing adequate support, he shall immediately notify the Engineer, and in each such instance the Engineer will determine if the soil is suitable for support. All such notification shall be verified in writing by the Contractor.
- I. Unstable material shall be removed to the extent and depths directed by the Engineer and the excavation refilled and compacted as required to the proper grade with approved "select material", or if so ordered by the Engineer, concrete cradles or encasement shall be provided.
- J. Trench excavation performed in or under proposed roadway subgrade shall be as follows: excavation for piping or conduit with a minimum of 2 feet between top of pipe and subgrade shall be performed before placing roadway pavement.
- K. Where trenches must be excavated lower than and within 2 feet from adjacent structures or wall foundations, special precautions shall be taken as follows: In earth, sheeting shall be used where the trench excavation falls below the 45° plane extending from the toe of the adjacent foundation.
- L. When a water force main parallels a gravity storm sewer, the Contractor may, where feasible, utilize a common trench. If a common trench is utilized, the water shall be founded on a shelf of undisturbed soil.

3.2 SHEETING AND BRACING:

- A. The Contractor shall provide sheeting, shoring, bracing and other temporary protective work as may be necessary. Sheeting shall be designed by a Professional Engineer, licensed to practice and concurrently registered in the State of New York.
- B. Design calculations shall be available for inspection, if so ordered. Sheeting design, sealed by the Professional Engineer, shall be submitted for record.
- C. Where required for safety or by governing laws, and when so ordered in writing by the Engineer, leave sheeting in place. In such instances remove original braces and rebrace sheeting against the structure in a manner approved by the Engineer. Cut off sheeting at elevations directed by the Engineer.
- D. Where wooden sheeting is utilized and it extends below the top of pipe within 2.5 O.D.'s of the pipe, in an area where the Engineer has not ordered the sheeting left in place, the sheeting shall be cut off 18 inches over the top pipe and the lower portion left in place.

3.3 BEDDING:

Bedding material, shall be installed in 6-inch maximum loose lifts and compacted to the satisfaction of Engineer. After compaction the bedding shall be carefully shaped to conform to the utility to be installed.

3.4 BACKFILL:

- A. Backfill of trenching shall not begin, until all required pressure, leakage, or other testing has been performed, and until the approvals of the Engineer and appropriate utility owners been obtained.
- B. Should any of the Work be covered prior to meeting the requirements of the above paragraph, it shall be uncovered and subsequently rebackfilled when directed by the Engineer, all at no additional cost to the Owner.
- C. During the backfilling operation, care shall be taken not to damage pipe coatings, wrappings or other protective layers.
- D. Unless otherwise directed, trenches and excavations shall be backfilled as soon as possible after permission to backfill has been given by the Engineer.
- E. Backfill shall not be done in freezing weather nor with frozen materials, nor when materials already placed are frozen.
 - 1. Where clearance is less than 15 inches between utilities or ducts and structures, the utility or duct shall be backfilled with concrete for a minimum width of 3 feet to the satisfaction of the Engineer.
 - 2. All utility pipe crossing under tracks, 4-inch or larger shall be encased in concrete to a distance of 10 feet beyond the center line of the outer track, as detailed in the Contract Drawings.
 - 3. Select material for backfill shall be brought up evenly on both sides of utility line in 6 inch loose layers and thoroughly and carefully compacted until there is a cover of not less than 1 foot over the top of the utility line.
- F. When 1 foot of cover has been satisfactorily provided, the remainder of the trench shall be backfilled with embankment material in 6 inch maximum level loose layers and compacted to required density.
- G. Backfill shall not be placed against manhole and structures until the approval of Engineer has been obtained. Concrete shall have been in place for at least 72 hours. Mortar joints and exterior plaster coating of masonry structures shall be thoroughly set and shall have been in place at least 3 days and damp-proofed surface properly cured. Backfilled shall be deposited in horizontal layers, not over 6 inches in compacted thickness, uniformly spread and compacted to the specified density. Special precautions shall be taken to prevent wedging action against the walls of structure.
- H. Excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction and shall then be refilled and compacted to require density with the surface restored to required grade at no additional cost to the Owner.

3.5 COMPACTING:

- A. Backfill material shall be compacted to not less than 95% off maximum dry density for that material when tested in accordance with AASHTO T-180 Method D.
- B. In place density tests shall be the responsibility of the Contractor.

3.6 RESTORATION:

Areas where trenching work has been performed shall be restored to at least the condition existing prior to the work. In streets, pavement shall be restored as shown on the Contract Drawings. Damage caused to existing streets or private property as a result of the Contractor's operation shall be restored by the Contractor at no cost to the Owner.

END OF SECTION

**SECTION 02713
WATER LINES**

PART 1 - GENERAL:

1.1 SCOPE:

This Section shall consist of furnishing and installing water lines, valves, and appurtenances.

1.2 APPLICABLE STANDARDS:

A. Work shall be performed in compliance with applicable provisions of the Occupational Safety and Health Standard of the U.S. Department of Labor (OSHA) and other Federal, State, and Municipal codes and regulations concerning excavation work.

B. Applicable Publications: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Society of Testing and Materials (ASTM) Publications:

D 1599-86	Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing and Fittings
D 1784-81	Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds
D 1785-86	Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
D 2241-84	Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
D 2466-78	Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
D 2467-76a	Socket-Type Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
F 477-76 (R 1981)	Elastomeric Seals (Gaskets) for Joining Plastic Pipe

2. American Water Works Association (AWWA) Standards:

B 300-80	Hypochlorites
B 301-81	Liquid Chlorine
C 509-94	Resilient-Seated Gate Valves for Water and Sewerage Systems
C 502-85	Dry Barrel Fire Hydrants
C 601-81	Disinfecting Water Mains
C 606-81 & C606a-83	Grooved and Shouldered Type Joints

- C 800-84 Underground Service Line Valves and Fittings
- C 900-89 PVC Pipe, 4-inch Through 12-inch, for Water Distribution
- M23-80 PVC Pipe - Design and Installation

3. American National Standards Institute (ANSI):

- ANSI B16.1-1975 Cast Iron Pipe Flanges and Flanged Fittings, Classes 25, 125, 250 and 800.

4. Manufacturer's Standardization Society of Valve and Fittings Industry (MSS) Standard:

- SP-80 Bronze Gate, Globe Angle and Check Valves (1979)

1.3 SUBMITTALS:

- A. Shop Drawings: Shop drawings shall consist of a complete list of all piping systems and their component parts and installation instructions. Shop drawings shall contain any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout of piping and appurtenances, and relationship to other parts of the Work.
- B. Recommendations of the Manufacturer: The Contractor shall, as a part of the shop drawings, submit to the Engineer the manufacturer's recommendations for each material or procedure to be utilized which is required to be in accordance with such recommendations. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless otherwise directed by the Engineer.

1.4 EXCAVATION, TRENCHING AND BACKFILLING FOR WATER LINES:

Excavation, trenching and backfilling shall be in accordance with the applicable provisions of SECTION 02221: EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

PART 2 - PRODUCTS:

2.1 PIPE:

- A. Pipe for Water Lines shall be polyvinyl chloride (PVC) plastic pipe unless otherwise shown or specified. PVC plastic pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454

2.2 JOINTS:

Joints for pipe, fittings and couplings for pipe shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations as approved by the Engineer.

2.3 VALVES:

- A. Check valves shall be designed for a minimum working pressure of 150 psi or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when the inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when the discharge pressure exceeds the inlet pressure. The size of the valve, working pressure, manufacturer's name, initials or trademark shall be cast on the body of each valve. Valves shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the 125-pound type conforming to ANSI B16.1.
- B. Gate valves shall be designed for a working pressure of not less than 150 psi. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast into the metal, indicating the direction of opening. Valves shall be iron body, bronze mounted, and shall conform to AWWA C509. Flanges shall not be buried. An approved pit shall be provided for all flanged connections

2.4 DISINFECTION:

Chlorinating materials shall conform to one of the following:

- A. Chlorine, Liquid: AWWA B 301.
- B. Hypochlorite, Calcium and Sodium: AWWA B 300.

PART 3 - EXECUTION:

3.1 HANDLING:

Pipe and accessories shall be handled so as to ensure delivery to the trench in sound undamaged condition. Pipe shall be carried into the position; not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of the pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place. PVC pipe and fittings shall be handled and stored in accordance with manufacturer's recommendations.

3.2 CUTTING PIPE:

Cutting of pipe shall be performed in a neat and workman-like manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Engineer, cutting shall be performed with an approved mechanical-type cutter. Wheel cutters shall be used when practicable.

3.3 ADJACENT FACILITIES:

- A. Sewer Lines: Where the location of the water pipe is not clearly defined in dimensions of the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity flow sewer lines, the sewer pipe, for a distance of 10 feet each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall, in all cases, cross above sewage force mains or inverted siphons and

shall not be less than 2 feet above the sewer main. Joints in the sewer main closer horizontally than 3 feet from the crossing shall be encased in concrete.

- B. Water Lines: Water lines shall not be laid within the same trench with sewer lines, gas lines, fuel lines or electric wiring.
- C. Roads: Water pipe shall be encased in a sleeve of rigid conduit for all installations under paved areas. A minimum clearance of at least 2 inches between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding shall be provided for the water pipe through the sleeve. Sleeves of ferrous metal shall be provided with corrosion protection as required for the conditions encountered at the site of installation.
- D. Structures: Where water pipe is required to be installed within three feet of existing structures the water pipe shall be sleeved as required for roads. Care shall be exercised and proper precautions taken during installation of the water pipe and sleeve to assure that there will be no damage to the structures and no settlement or movement of foundations or footings. Any damage occurring as a result of the Contractor's operation shall be corrected and all costs connected therewith shall be borne by the Contractor.

3.4 JOINT DEFLECTION:

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Engineer, but in no case shall it exceed 5 degrees.

3.5 PLACING AND LAYING:

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other approved equipment. Under no circumstances shall any of the water-line materials be dropped or dumped into the trench. Except where necessary in making connections with other lines or as approved by the Engineer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings and joints. Pipe that had the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when the trench conditions are unsuitable for the work. Water shall be kept out of the trench until joining is completed. When work is not in progress, open ends of pipe fittings and valves shall be securely closed so that no trench water, earth or other substance will enter the pipe or fittings. Pipe ends left for future connections shall be valved, plugged or capped and anchored.

- A. PVC pipe shall be installed in accordance with AWWA M23.
 - 1. Training: The manufacturer shall assist the Contractor by training and instructing the Contractor's personnel in proper installation procedures and techniques. Certification will be required in writing from the manufacturer's listing the names of those persons so qualified. The manufacturer's representative shall be a person regularly engaged in such service and shall be certified in writing by the manufacturer to be technically qualified and experienced to supervise this training.
 - 2. Deficiencies include improper diameter of pipe ends, damaged interior, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contour, leaving pipe ends open in trench overnight, not properly drying joints after rain, exceed effective adhesive life, sharp objects in the trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction, or any other conditions which could have an adverse

impact on the satisfactory completion and operation of the piping system. Prompt action shall be taken to correct all deficiencies. In addition, the Contractor shall take prompt action to return to the factory all damaged and defective pipe and fittings and shall order prompt replacement of such materials. The Contractor shall maintain a chronological record throughout the course of the Contract of all deficiency items and dates of correction.

3. Final Certification: Upon completion of the piping and before final acceptance the Contractor shall deliver to the Engineer a statement signed by the Principal Officer of the Contracting Firm stating that the installation is satisfactory and in complete accordance with the contract plans and specifications and manufacturer's prescribed procedures and techniques.

- B. Pipe passing through walls of valve pits and structures shall be provided with ductile-iron of Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with a rich cement mortar. Annular space between pipes and sleeves shall be filled with mastic.

3.6 JOINTING:

Connections between different types of pipe and accessories shall be made with transition fittings recommended by the manufacturers of the different materials.

3.7 SERVICE LINES:

Service lines shall include the pipeline connecting with the building service at a point approximately 5 feet outside the building where such a service exists. Where building services are not installed, the Contractor shall terminate the service line approximately 5 feet from the site of the proposed building service at a point specified by the Engineer. Such service lines shall be closed with plug or caps. All service stops and valves shall be provided with extension service boxes of the lengths required. Service lines shall be connected to the main by a tapped saddle, tapping sleeve and valve, or service clamp or reducing tee, depending on the main diameter and the service line diameter and shall have a gate valve.

3.8 THRUST BLOCKS:

Plugs, caps, tees and bends deflecting 22-1/2 degrees or more, either vertically or horizontally, on waterlines shall be provided with thrust blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust blocking shall be concrete of a mix not leaner than one (1) part cement, 2-1/2 parts sand, five (5) parts gravel, and having a compressive strength of not less than 4,000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust blocks shall be poured directly against undisturbed earth. The sides of the thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.

3.9 HYDROSTATIC TESTING:

- A. Where any section of a water line is provided with concrete thrust blocking for fitting, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved. The method proposed for disposal of wastewater generated from the hydrostatic tests and disinfection shall be submitted to the Engineer for approval prior to performing the hydrostatic tests.
- B. Pressure Test: After the pipe is laid, the joints completed and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall be subjected

for 1 hour to a hydrostatic pressure test of 150 psi. Each valve shall be opened and closed several items during the test. Exposed pipe, joints, fittings and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the results are satisfactory to the Engineer. The requirement for the joints to remain exposed for the hydrostatic test may be waived by the Engineer when one or more of the following conditions is encountered:

1. Wet or unstable soil conditions;
2. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions;
3. Maintaining the trench in an open condition would delay completion of the Contract; or
4. An unforeseeable cause which would results in extreme costs.

The Contractor may request the waiver, setting forth in writing the reasons for the request, and stating the alternative procedure proposed to comply with the required hydrostatic test. Backfill placed in prior to the test shall be placed in accordance with the requirements of SECTION 02221:

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

- B. Leakage test shall be conducted after the pressure test have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to 200 psi pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section thereof, necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. No piping installation will be accepted until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = 0.0001351ND(P^{1/2})$$

Where

L equals the allowable leakage, in gallons per hour;
N is the number of joints in the length of pipeline tested;
D is the nominal diameter of the pipe, in inches; and
P is the average test pressure during the leakage test, in psig.

Should any test of pipe disclose leakage of greater than that specified, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Owner.

- C. Time for Making Tests: Except for joint material setting or where concrete reaction backing necessitates a 5-day delay, pipelines may be subjected to hydrostatic pressure, inspected and tested for leakage at any time after partial completion of backfill.
- D. Concurrent Hydrostatic Tests: The Contractor may elect to conduct hydrostatic test using either or both of the following procedures. Regardless of the sequence of tests employed, the results of the pressure test, leakage tests and disinfection shall be satisfactory as specified. All replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Owner.
1. Pressure test and leakage test may be conducted concurrently;

2. Hydrostatic tests and disinfection may be conducted concurrently, using water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, the disinfection shall be re-accomplished.

3.10 DISINFECTION:

Before acceptance of potable water operation, each unit of complete water line shall be disinfected as prescribed by AWWA C601. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introduction of the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite or sodium hypochlorite, conforming to PART 2 - PRODUCTS. The chlorinating material shall provide a dosage of not less than 50 parts per million (ppm) and shall be introduced into the water lines in an approved manner. PVC pipe lines shall be chlorinated using only the above specified chlorinating material in solution. In no case shall the agent be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore-forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24-hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. All valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. From several points in the unit, the Engineer will take samples of water in proper sterilized containers for bacterial examination. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. A laboratory acceptable to the Engineer shall conduct all bacterial examination required in this specification section at the Contractors expense.

3.11 CLEAN-UP:

Upon completion of the installation of the water lines and appurtenances, all debris and surplus materials resulting from the Work shall be removed. The surficial areas of work shall be restored to at least the state in which they were before Work commenced.

END OF SECTION

**SECTION 02750
WASTE MANAGEMENT**

PART 1-GENERAL:

1.1 SCOPE:

This Section covers the management of wastes generated by the Site Preparation activities, including on-site accumulation, on-site and off-site transportation, and on-site and off-site disposal. Wastes included in the scope of this specification consist of soils, non-hazardous solid wastes, and hazardous wastes as defined in this Section. The disposal of asbestos-containing materials is covered under SECTION 02080: ASBESTOS ABATEMENT. Except as specified below, the Contractor shall furnish labor, tools, containers, and equipment and perform the necessary operations to manage solid and hazardous wastes as required by the Contract Documents.

1.2 DEFINITIONS:

- A. Non-hazardous solid wastes are those materials, including soils, construction/demolition wastes, and other solid wastes, which are defined as non-hazardous under Federal, State, and local regulation and guidance. To the extent possible, waste characterization analysis shall be conducted as described in this Specification prior to construction.
- B. Hazardous wastes are solid wastes which meet the definition of hazardous waste as specified in Federal, State, and local hazardous and solid waste regulations and guidance. For the purposes of this Specification, concrete from the Waste Solvent Tank shall be considered hazardous.
- C. Contaminated water means water from Waste Solvent Tank removal, excavation dewatering, or any other activities resulting in fluids which have been in contact with contaminated materials at the site.
- D. Soils are defined as hazardous or non-hazardous natural earth materials or existing earth fill materials consisting of clay, silt, sand, gravel, or any mixture thereof, excluding construction materials such as concrete, brick, wood, pipe, metal, reinforcing rods, and wire.
- E. Construction/demolition materials which have been in direct contact with overburden soil materials or contaminated groundwater within the fenced area of the facility shall be assumed to be hazardous wastes unless waste characterization demonstrates that these materials are non-hazardous. These materials include, but are not limited to, concrete building floors, concrete dike wall foundations, the Waste Solvent Tank, asphalt paving, and other materials used in subsurface structures.
- F. Overburden soil materials from within the fenced area of the facility shall be considered hazardous unless waste characterization demonstrates that these materials are non-hazardous.

1.3 APPLICABLE REGULATIONS:

- A. The Contractor shall comply with applicable laws and regulations pertaining to the management of solid and hazardous waste, including but not limited to:

40 CFR Parts 260-299 (Federal RCRA Regulations)

29 CFR Part 1910.120 (Federal OSHA Hazardous Waste Operations and Emergency Response)

6 NYCRR Part 360 (New York State Solid Waste Regulations)

6 NYCRR Parts 370-376 (New York State Hazardous Waste Regulations)

NYSDEC Technical and Administrative Guidance Memoranda

Where required and not waived by the Order on Consent, permits for solid and hazardous waste management shall be obtained by the Contractor at the Contractor's expense.

1.4 GENERAL PROCEDURES AND CONDITIONS:

- A. Waste management operations shall not commence without the prior authorization of the Engineer.
- B. The Contractor shall develop and submit a Site Preparation Waste Management Plan describing the proposed methods and procedures for managing wastes generated by the Project. The procedures shall provide for safe conduct of the Work, characterization, removal and disposal of materials in accordance with applicable regulations, and shall provide descriptions of the mode and sequence of waste management operations.
- C. Except for hazardous wastes, and/or as limited by the Engineer, waste materials generated by the Site Preparation activities shall become the property of the Contractor. The Contractor shall be responsible for management and disposal of non-hazardous solid wastes in accordance with the applicable regulations.
- D. If hazardous waste is managed by the Contractor during the Project, after identification of the hazardous waste material, the Contractor shall prepare and stage such wastes for transportation, treatment, and/or disposal, and shall act as the Owner's agent on-site for the purposes of manifesting and labeling the waste, chain-of-custody documentation, and certification of treatment/disposal in accordance with the applicable regulations. The Owner will retain ownership of the hazardous wastes and will provide the Contractor with pre-approved, signed manifest forms and labels.
- E. Existing structures and facilities within the area of operations shall be protected from damage. This includes monitoring wells, extraction wells, and piezometers. Damage and disturbance resulting directly or indirectly from the Contractor's operations, excepting soil stockpile and management areas designated on the Contract Drawings, shall be properly restored, repaired, or replaced at the Contractor's cost to the satisfaction of the Engineer.

PART 2 - PRODUCTS: (NOT USED)

PART 3 - EXECUTION:

3.1 MANAGEMENT OF SOILS:

- A. To the extent possible, excess soils should be backfilled in the excavation created by removal of the Waste Solvent Tank.
- B. Soils shall be screened in the field using an organic vapor monitor to determine apparent level of contamination and segregated based on the screening results. Soils with screening results greater than 5 ppm shall be considered hazardous and excess soils (not used for construction backfill) shall be used to backfill the Waste Solvent Tank excavation or managed at the excess

soils management area shown on the Contract Drawings. Soils with screening results less than 5 ppm shall be considered non-hazardous and excess soils shall be spread on the ground surface in the general vicinity of the location from which the soils were excavated or at an on-site location approved by the Engineer.

- C. A temporary stockpile shall be constructed, if necessary, at the location indicated on the Contract Drawings for the purposes of temporary storage of hazardous and non-hazardous soil materials excavated during Site Preparation activities. This stockpile shall be lined with an appropriate impermeable liner material and shall be a maximum of 10 feet high with side slopes no steeper than 2 feet horizontal to 1 foot vertical. The Contractor shall also manage the stockpile in a manner that prevents surface water and sediment runoff from impacting surface water drainage at the site, including storm drains, ditches, and streams, through the use of silt fencing, stockpile cover materials, temporary containments berms, etc.
- D. Excess hazardous soil remaining when Site Preparation is completed shall be managed at the on-site soil management area shown on the Contract Drawings. This includes soil remaining in the temporary stockpile. The on-site soil management area shall be a maximum of 3 feet high with side slopes no steeper than 3 feet horizontal to 1 foot vertical and shall be managed in a manner that prevents surface water and sediment runoff from impacting surface water drainage at the site, including seeding and cover materials.
- E. During utility installation activities, soils excavated from utility trenches shall be used to the extent possible to backfill the trench. Excess soil from utility installation shall be spread on the ground surface or placed in the Waste Solvent Tank excavation, based on field screening results.
- F. Soil from excavation activities not related to the Waste Solvent Tank removal (i.e., foundation excavations, wet-well installation, etc.) shall be used to backfill the excavations after construction activities are completed. Excess soil from these excavations shall be spread on the ground surface or placed in the Waste Solvent Tank excavation, based on field screening results.
- G. During Waste Solvent Tank removal activities, soil excavated from around the tank shall be placed in the temporary stockpile.
- H. Soil from the temporary stockpile (i.e., soil from Waste Solvent Tank removal, other excavations, and utility installation) shall be placed in the Waste Solvent Tank excavation to the extent possible. Remaining soil shall be managed on-site at the excess soil management area shown on the Contract Drawings.

3.2 MANAGEMENT OF CONTAMINATED WATERS:

- A. Contaminated waters shall be stored on-site in temporary storage tanks located as shown on the Contract Drawings. Water shall be stored in closed container(s) in accordance with applicable Federal, State, and local regulations. Contaminated waters will be managed by the Owner.

3.3 CHARACTERIZATION OF CONSTRUCTION/DEMOLITION WASTE:

- A. Prior to construction, construction material and subsurface soil samples shall be collected to characterize the construction/demolition waste as hazardous or non-hazardous.

- B. Concrete from the Waste Solvent Tank shall be assumed to be hazardous.
- C. Within the interior of the Primary Treatment Room, four borings shall be conducted to collect concrete core samples and shallow subsurface soil samples for characterization. The borings shall be conducted at the following locations: the existing loading dock, proposed wet-well location, proposed subsurface piping trench, and proposed inlet separator area. Shallow borings shall extend to a depth of 6 inches below the base of the concrete. Borings shall be conducted with a concrete coring device and hand auger.
- D. Two shallow subsurface soil borings shall be conducted adjacent to the concrete dike walls and former tank supports to a depth of 3 feet or the approximate foundation depth of the structure. Soil samples for waste characterization shall be collected from the bottom of the boring.
- E. For concrete samples, chip samples shall be collected from the bottom of the concrete core, placed in the appropriate containers, and submitted to a laboratory for the waste characterization analysis specified below.
- F. Soil samples shall be collected by hand auger, placed in the appropriate containers, and submitted to a laboratory for the waste characterization analysis specified below.
- G. Samples shall be collected with dedicated equipment, or equipment that has been decontaminated according to the following procedure:
 - 1. Potable water rinse;
 - 2. Alconox detergent wash;
 - 3. Potable water rinse; and
 - 4. Distilled/deionized water rinse.
- H. Waste characterization samples shall be submitted to an analytical laboratory approved by the Owner for the following analyses:
 - TCLP (except pesticides and herbicides) -- Method 1311
 - Volatile Organic Compounds -- Method 8240
 - Ignitability - SW-846
 - Corrosivity - SW-846
 - Reactivity - SW-846
- I. Determination of whether or not construction debris is hazardous shall be made based on evaluation of the analytical results.

3.4 MANAGEMENT OF NON-HAZARDOUS WASTE:

- A. Non-hazardous wastes from Site Preparation activities, excluding soils and contaminated waters, shall be placed in roll-off containers and transported off-site for disposal at a permitted construction/demolition debris disposal facility.
- B. Contractor shall limit the amount and volume of waste placed in roll-off containers to comply with Department of Transportation regulations, including weight restrictions. Contractor shall provide documentation of proper transport and disposal.

3.5 MANAGEMENT OF HAZARDOUS WASTE:

- A. Hazardous wastes from Site Preparation activities, excluding soils and contaminated waters, shall be placed in sealed, lined roll-off containers and transported off-site for disposal at the permitted hazardous waste facility approved by the Owner.
- B. Wastes placed in roll-off containers shall consist of dry, solid materials only. No free liquids shall be present.
- C. Contractor shall limit the amount and volume of waste placed in roll-off containers to comply with Department of Transportation regulations, including weight restrictions.
- D. Contractor shall act as Owner's agent on-site for completion of manifests and labeling of waste containers. Owner will provide pre-approved manifests and labels for this purpose.

3.6 MANAGEMENT OF PERSONAL PROTECTIVE EQUIPMENT:

- A. Personal protective equipment, including Tyvek coveralls, gloves, boots, decontamination supplies, etc., shall be placed in DOT 17H drums and staged in the garage on-site. Drums shall be clearly marked to indicate contents and the date filled in accordance with the Owner's labeling requirements. Wastes shall be analyzed and disposed of as defined in Paragraph MANAGEMENT OF HAZARDOUS WASTE.

3.7 MANAGEMENT OF MISCELLANEOUS SOLID WASTES:

- A. Miscellaneous non-construction/demolition wastes which has been in contact with contaminated materials (i.e. plastic sheeting, etc.) shall be managed along placed in DOT 17H drums and staged in the garage on-site. Drums shall be clearly marked to indicate contents and the date filled in accordance with the Owner's labeling requirements. Wastes shall be analyzed and disposed of as defined in Paragraph MANAGEMENT OF HAZARDOUS WASTE.
- B. Miscellaneous non-construction/demolition solid wastes which have not been in contact with contaminated materials (i.e. paper, cardboard, etc.) shall be disposed of offsite by the Contractor as ordinary solid waste.

END OF SECTION

**SECTION 02800
ASPHALTIC CONCRETE PAVEMENT**

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the asphaltic concrete pavement and surface restoration to be performed as part of the Site Preparation Work.

1.2 RELATED WORK:

A. The Contractor shall coordinate with other subcontractors to assure the proper incorporation of and provision for all piping, conduit, curbs and frames and other metal and iron items which will be furnished or installed by them.

B. Additional Specification Sections:

SECTION 02100 CONTROLLED AND UNCONTROLLED FILLS AND BACKFILLS
SECTION 02221 EXCAVATION, TRENCHING AND BACKFILLING FOR UTILITIES

1.3 SUBMITTALS:

The following information, shall be submitted.

A. Asphalt concrete mix proportions.

B. Results of density tests, as specified upon completion of tests.

C. Tests in conformance with ASTM D3515, as specified upon completion of tests.

1.4 APPLICABLE STANDARDS:

The publications listed below form a part of these Specifications to extent referenced. The publications are referred to in the text by the basic designation only.

A. American society for Testing and Materials (ASTM)

D977	Standard Specifications for Emulsified Asphalt
D1188	Standard Method of Test for Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-coated Specimens
D2027	Standard Specifications for Liquid Asphalt (Medium-Curing Type)

PART 2 - PRODUCTS:

2.1 ASPHALTIC CONCRETE PAVEMENT:

- A. Asphaltic concrete pavement shall consist of a foundation course and a wearing course.
 - (1) The foundation course for the new restored permanent pavement shall consist of crushed stone and shall be a minimum of 8 inches in thickness, except as otherwise specifically provided. The foundation course for the new temporary pavement shall be 6 inches in thickness.
 - (2) The 3-inch asphaltic concrete wearing course shall consist of a binder mixture and a surface mixture, each 1-1/2 inches in thickness after compaction. Additional binder mixture shall be placed for leveling when required.
- B. Temporary Pavement: Bituminous concrete layer shall consist of one wearing course and it shall be 2 inches thick.
- C. Overlaid Area of Pavement: Bituminous concrete layer shall be 1-1/2 inches thick.
- D. Asphalt concrete paving shall be hot-laid plant mix ("Hot-Mix").

2.2 FOUNDATION COURSE:

New crushed stone shall be either limestone, traprock or other approved stone and shall not contain any pieces that will pass through a hole one inch square and shall not contain any pieces that will not pass through a hole 3 inches square.

2.3 PAVEMENT BINDING COURSE:

- A. Binding course mixture on which a surface course is to be installed shall be composed of coarse and fine aggregate, with or without mineral filler, bonded together by asphalt cement, as specified herein.
- B. Asphalt Cement: Asphalt cement, for binding course, shall conform to ASTM D946, Penetration Grade 60-70, unless otherwise specified.
- C. Aggregate and Mineral Filler: Coarse and fine aggregate and mineral filler, for binding course shall conform to the requirements specified in ASTM D3515 as modified or supplemented herein.
- D. Combined Aggregate: Combined aggregate, after drying, shall have a sand equivalent value of not less than 35, determined in accordance with ASTM D2419.

2.4 PAVEMENT SURFACE COURSE:

- A. Surface course mixture shall be composed of coarse and fine aggregate, with or without mineral filler, bonded together by asphalt cement, as specified herein.
- B. Asphalt Cement: Asphalt cement, for surface course, shall conform to ASTM D946, Penetration Grade 85-100, unless otherwise specified.
- C. Aggregate and Mineral Filler: Coarse and fine aggregate and mineral filler, for surface course, shall conform to the requirements specified in ASTM D3515, as modified or supplemented herein;

graduation shall conform to the requirements of TABLE 1. Combined aggregate, after drying, shall have a sand equivalent value of not less than 45, determined in accordance with ASTM D2419.

2.5 SIDEWALKS:

- A. Asphalt concrete sidewalks shall be a single course of a mixture composed of coarse and fine aggregate, bonded together by asphalt cement, as specified herein.
- B. Asphalt Cement: Asphalt cement, for sidewalks, shall conform to ASTM D945, Penetration Grade 60-70.

2.6 PROTECTIVE SURFACE COAT:

Protective surface coats for permanent pavement and overlay shall be of coal tar emulsion. The material for protective coat shall meet the Federal Specifications RP-355d ASTM-D 3320. Monsey Product No. 90-03 shall meet the above requirements.

PART 3.0 - EXECUTION:

3.1 MIXING PLANT:

Asphalt concrete mixing plant shall conform to ASTM D995 and the requirements specified herein.

3.2 HEATING AND STORING INGREDIENTS:

- A. The asphaltic cement shall be heated in approved receptacles to a temperature between 275°F and 235°F. It shall be kept uniform in composition and consistency by thorough mixing and agitation, and, if required, it shall be agitated both before and during use. Approved methods of agitation, which will not injure the cement, shall be used.
- B. The crushed stone and sand shall be heated in approved revolving dryers and delivered to separate storage bins. If the crushed stone and sand are heated together in the same drum, they shall be screened and delivered to separate storage bins. The broken stone shall be delivered to the proportioning box at a temperature not exceeding 350°F. The sand shall be delivered to the proportioning box at a temperature not exceeding 400°F.
- C. The mineral dust, as used, shall be thoroughly dry. It may be heated in an approved manner to a temperature not exceeding 325°F.

3.3 PROPORTIONING INGREDIENTS:

The materials comprising the charge for each batch shall be proportioned accurately by weight or by volume. The proportioning apparatus shall be of approved design, kept in good working order and accurate to 0.5 percent. Fluid materials may be measured by approved fluidometers.

3.4 MIXING INGREDIENTS:

After proportioning, the ingredients shall be incorporated in an approved mixer. When mixed in a batch mixers prior to the addition of the asphaltic cement, the aggregate shall be deposited in the mixer and thoroughly mixed for a period of not less than 10 seconds for binder mixture and 15 seconds for asphaltic concrete mixture. The asphaltic cement shall then be added and the mixing continued for a period of not less than 30 seconds. When mixed

in a batch or continuous mixer, the mixing shall be continued until a homogeneous mixture is produced in which all particles of the mineral aggregate are completely coated with asphaltic cement.

The size of the batch shall not exceed the rated capacity of the mixer.

3.5 TEMPERATURE OF MIXTURE:

The temperature of the mixture and rolling time available for placement of bituminous paving mixtures shall be regulated according to the temperature of the surface on which the mat is placed (called base temperature) and the mat thickness to be placed. The maximum temperature of any batch immediately after mixing shall in no case exceed 350°F at the plant, and the minimum laydown temperature and rolling time available for placement of bituminous paving mixture be as given in the following table:

Base Temp. (F)	1/2"	3/4"	1"	1-1/2"	2"	3" and Greater
20-32	-	-	-	-	-	285
+32-40	-	-	-	305	295	280
+40-50	-	-	310	300	285	275
+50-60	-	310	300	295	280	270
+60-70	310	300	290	285	275	265
+70-80	300	290	285	280	270	265
+80-90	290	280	275	270	265	260
90+	280	275	270	265	260	255
Rolling Time Available (Minutes)	4	6	8	12	15	15

The above temperature limits are based on the use of residual petroleum asphalt. If the Contractor uses asphalt derived from other sources, the Contractor shall submit for approval of the Engineer appropriate temperature limits to which the mixture must be confined.

3.6 TRANSPORTATION:

The asphalt mixtures shall be transported from mixing plants to the Site in tight vehicles having clean and smooth metal beds. Each load shall be covered with canvas or other suitable material of such size as to protect the mixture from the weather. When necessary, so that the mixture will be delivered on the road at the specified temperatures, truck bodies shall be properly insulated.

The inside surface of the vehicles used for the transportation of plant mixes shall be lightly coated, just before the vehicles are loaded, with either a whitewash or lime and water, soap solutions or detergents, or fuel oil applied by a high pressure fog system.

If fuel oil is used, it shall be applied as fog spray. The fog spray shall form a flat or solid cone spray with an angle not greater than 45 degrees and shall give a uniform coating at a distance of 6 feet measured from the nozzle tip. The maximum discharge shall be 0.5 gallon per minute. The application platform, high pressure hose, and spray handle must be sufficient length to allow the inside of the entire truck body to be coated. The platform shall be convenient, safe and permit complete coating without the applicator having to center the body. An on-off switch or valve for engaging the system shall be located within easy reach of the applicator. The nozzle tip shall be attached to the spray handle as to prevent easy removal. The supply of fuel oil shall be adequate and properly protected against contamination. Each fuel oil fog spray system shall be approved by the Engineer prior to use as a truck release agent. The use of any other asphalt or tar solvents for coating the inside of the vehicles will not be permitted.

After application, the truck bodies shall be raised for a sufficient time to allow the excess fluid to drain.

3.7 SITE PREPARATION:

The Contractor shall perform all operations in connection with demolition and removal of sidewalks, curbs and asphalt pavement where required to a depth of 12 inches below finished grade. All artificial fill, rubbish, organic and other loose types of soil encountered shall be removed to its full depth and disposed of as directed.

3.8 ROUGH GRADING:

Rough grades shall be established, in general, 12 inches below and parallel to the finished grade as shown by the finished grade elevations and finished contours on the drawings and as otherwise directed. Where existing surface levels are lower than the subgrade levels, the subgrade shall be prepared to lines, grades and elevations required by the drawings, and compacted to maximum density after subsurface structures have been placed and the backfill therefore has been placed and properly consolidated as specified herein.

3.9 INSTALLATION OF ASPHALT CONCRETE:

Asphalt concrete pavements shall be constructed to the lines, grades and details indicated on the Contract Drawings or restored to meet existing grades.

3.10 PREPARATION OF FOUNDATION COURSE:

After the required broken stone has been placed, it shall be rolled to a true and even surface with a 10 to 12 roller or hand tamper and clean sand shall be spread in uniform thin layers over the broken stone, so that the voids are filled without an excess of sand above the surface of the broken stone.

3.11 PREPARATION OF SURFACE:

Before any asphaltic mixture is laid, the surface shall be thoroughly swept and cleaned of all dirt, loose and foreign matter, and be free from standing water. No mixture shall be deposited unless the surface on which it is to be laid is in a condition acceptable to the Engineer.

Unless otherwise specified, shown on the plans, surfaces on which asphaltic mixtures are to be laid shall be given a tack coat of emulsified asphalt. The tack coat shall be uniformly distributed, without atomization, over the entire surface of the base for pavement at a rate of 1 gallon per 10 square yards of surface by means of a pressure distributor of approved type in such a manner as not to defile or discolor curbs or other structures. A tack coat shall be applied to each layer of the binding course, and between the binding and surface course.

3.12 MECHANICAL SPREADERS:

The maximum length of asphaltic mixture which can be placed by an approved mechanical spreader in a continuous strip shall not exceed 800 feet, unless permitted, in writing, by the Engineer. Adjacent strips shall be laid, subject to the above limitations, immediately after each previous strip is placed until the full width of roadway surface has been covered in the said maximum or permitted length.

3.13 LAYING BINDER MIXTURE:

Binder mixture shall be furnished and laid by means of a mechanical spreader of approved design to depth which, after final compaction shall be equal to the specified depth. In areas where the use of a mechanical spreader is impractical, other approved means of spreading and compaction may be permitted.

Where permitted by the Engineer, hand laying of the mixture shall comply with the following requirements: Binder mixture, on reaching the street, shall be dumped outside the area on which it is to be spread, and shall be deposited over the area to be covered by means of hot shovels. It shall be uniformly spread by means of hot iron rakes, with tines not less than ½-inch longer than loose depth mixture, or by means of a mechanical spreader of approved design, to a depth which, after final compression, shall be 1-½ inches. Binder shall be thoroughly compacted by approved tamping irons adjacent to curbs, manholes, rails, etc., and with approved rollers to a thickness of 1-½ inches below the finished grade and crown of the street. If the binder mixture breaks up, shows lack of bond or other defects before the surface mixture is laid, it shall be taken up, removed and replaced with suitable material, properly laid in accordance with these Specifications.

3.14 BINDER SURFACE:

The surface of the binder course shall be kept as free from traffic as is possible under working conditions, be clean free from water, and if necessary, swept off immediately before the surface mixture is laid. Binder shall be covered with surface mixture as soon as practicable and in all cases not later than the same day, unless otherwise directed by the Engineer.

3.15 PAINTING CONTACT SURFACES:

All contact surfaces of curbs, gutters, headers, manholes, etc. shall, before the surface mixture is laid, be well painted with a thin uniform coating of approved hot asphaltic cement or liquid asphalt or emulsified asphalt.

3.16 LAYING SURFACE MIXTURE:

Surface mixture shall be furnished and laid by means of a mechanical spreader of approved design to a depth which, after final compaction, shall be equal to the specified depth. In areas where the use of a mechanical spreader is impractical, other approved means of spreading and compaction may be permitted.

Where permitted by the Engineer, hand laying of the mixture shall comply with the following requirements: The surface mixture, on reaching the street, shall be dumped on approved dumping boards or steel plates, and shall be deposited immediately by means of hot shovels over the area to be covered. It shall be uniformly spread by means of hot iron rakes with tines not less than ½-inch longer than the loose depth of the mixture, or be deposited and spread by means of a mechanical spreader of approved design, to a depth which, after final compression, shall be of the thickness required. No walking will be permitted on the surface mixture during the laying operations. If laid by hand, the surface mixture, after spreading and raking, shall be carefully luted from the sides before compaction. The width of the lute shall be approximately 6 feet and the handle shall be sufficiently long to reach from edge to midway of the width under construction.

3.17 LAYING LEVELING COURSE MIXTURE:

Leveling course mixture, on reaching the street, shall be dumped on approved dumping boards of steel plates and shall be immediately deposited by means of hot shovels over the area to be leveled, built up, or adjusted.

Prior to the placement of the leveling course, the existing pavement shall be straight-edged or string-lined and marked accordingly. After the leveling course is placed, it shall be straight-edged or string-lined again to determine its effectiveness. Only after satisfactory results have been obtained, should the mechanical spreader (paver) place the final course.

3.18 ROLLERS:

Tandem type power driven rollers shall weight not less than 10 tons and not less than 225 pounds per inch width of main roll. They shall be in first class mechanical condition and adjustment so that they run smoothly without jerking or pounding, and have smooth, true rolls without flat spots or other imperfections. The rollers shall be kept clean at all times and the amount of water used to prevent adhesion of asphaltic materials shall be kept to a minimum.

Pneumatic rubber-tired rollers shall be self-propelled and shall have wheels so mounted, grouped and spaced as to provide essentially uniform coverage with each pass. Rear group wheels shall not follow in the tracks of forward group wheels. Maximum wheels load shall be 5,600 pounds, tire compression on pavement, where the area of contact is measured on a hard, unyielding surface, shall be 80 psi, $\pm$ 5 psi, for each wheel; and the total maximum load per axle, whether single axle or a group of axles in the same alignment, shall be 22,400 pounds. Axles shall be mounted in a rigid frame provided with a platform or body suitable for ballast loading. Wheels shall be mounted to oscillate individually or in pairs. Tires shall be smooth, show no tread pattern, of equal size and diameter, and inflated so the air pressure in the several tires shall not vary more than 5 psi. Wheel loads and tire pressures shall be controlled to produce the required degree of compaction without rutting of the surface to be rolled. Tire roll surfaces shall be kept clean at all times and the amount of water used to prevent adhesion of asphaltic materials shall be kept to a minimum.

3.19 ROLLING:

- A. Rolling shall proceed continuously within the time limit requirements of Paragraph 2L3.5 and at the following rates:
 - 1. For binder mixtures, when spread by hand, not in excess of 400 square yards per hour per roller;
 - 2. For binder mixtures, when spread by machine, not in excess of 600 square yards per hour per roller;
 - 3. For surface courses, when spread by hand, not in excess of 300 square yards per hour per roller; and
 - 4. For surface courses, when spread by machine, not in excess of 400 square yards per hour per roller.
- B. All mixtures, immediately after spreading or as soon thereafter as is practicable without causing undue displacement, shall be thoroughly compacted by approved tamping irons adjacent to curbs, manholes, rails, etc., and by rolling with approved rollers continuously from commencement to final completion of compression at a speed not exceeding 3 miles per hour. Initial rolling, using steel-wheeled, power-driven, tandem type rollers, shall be made parallel to the centerline of the street beginning at the curbs or edges of the roadway and working toward the center, overlapping on successive trips by one half the rear wheel of the roller. Immediately following the initial rolling, further compaction shall be obtained by the use of pneumatic rubber-tired rollers. A minimum of 8 passes of the rubber-tired rollers will be required over the entire surface. Shallow ruts and ridges, developing in the rubber-tired rolling stage shall be smoothed with a tandem roller. Final rolling shall proceed, first, longitudinally with the street, and secondly, diagonally or at right angles to the street. It shall continue until no further compression results, the mixture has cooled, no marks show under the roller and until the surface is smooth and free from all depressions, waves, bunches and unevenness. After the mixture has been rolled, the surface shall be tested with an approved straight edge 10 feet long or an approved surface testing machine laid parallel with the center line of the roadway, and any irregularity exceeding 1/4-inch shall be immediately corrected.
- C. The Engineer may permit the Contractor to omit rolling with pneumatic rubber-tired rollers. In that case, the procedures for initial and rubber-tired rolling, outlined above, shall not apply.

3.20 LAYING IN DAYLIGHT, WET WEATHER, COLD WEATHER:

- A. Mixtures shall be spread and compacted during daylight, unless otherwise permitted by the Engineer and then only when satisfactory artificial light is provided.
- B. Placement of bituminous paving materials shall not be scheduled when the precipitation probability, obtained by the Contractor from the U.S. Weather Bureau within 3 hours prior to the start of such operations, equals or exceeds 50 percent. The Contractor shall notify the Engineer of the exact time at which the above information was obtained.
- C. Generally, the laying of mixtures will not be permitted in wet weather. However, the Engineer may permit work of this character to continue when overtaken by sudden rain, up to the amount which may be in transit from the plant at the time. The plant shall, however, shut down on his orders under these conditions and no additional material will be permitted to be laid.

No mixture shall be laid when the air temperature in the shade is below 32 degrees F.

3.21 JOINTS:

The surface mixture shall be laid in as nearly a continuous operation as possible and the roller shall pass over the unprotected end of the freshly laid mixture only when the laying of the course is to be discontinued for such length of time as to permit the mixture to become chilled. In all cases, including the formation of joints, as herein required, provision shall be made for proper bond with the new mixture by cutting or trimming back the joints so as to expose an unsealed or granular surface for the full specified depth of the course. At the end of each day's work on the mixture, joints shall be formed by laying and rolling against boards of the thickness of the compacted mixture, placed across the entire width of the pavement or by such other method as may be approved by the Engineer. When the laying of the mixture is resumed, the exposed edge of the joint shall be painted with a thin coat of approved hot asphaltic cement or liquid asphalt fresh mixture shall be raked against the joint and thoroughly tamped with hot tampers and rolled. Hot smoothing irons may be used for sealing joints.

Edge coat shall be emulsified asphalt conforming to ASTM D977, Grade RS-1 or RS-2, unless otherwise specified.

3.22 TRAFFIC:

No traffic of any kind will be allowed on the pavement until permitted by the Engineer.

3.23 DEFECTIVE WEARING COURSE:

Such portions of the complete wearing course as are defective in finish, compression composition, density, or do not comply with the requirements of these specifications, shall be taken up, removed and replaced with suitable material properly laid in accordance with these specifications.

3.24 OVERLAY PREPARATION:

Prior to receiving overlays of bituminous concrete, the Contractor shall prepare the defective pavement area as follows:

- A. 1-1/2-inch deep saw cut the perimeter of defective area.
- B. Remove unsound material and fill with crushed stone.

3.26 BITUMINOUS CONCRETE OVERLAY AREA:

After preparation of the patch, the Contractor shall place leveling course 1-½ inch thick bituminous concrete and tamp it adequately. Then a top course of 1-½ inch thickness shall be placed and compressed with a roller.

3.27 PROTECTIVE COAT:

Two coats of coal tar emulsion shall be applied over the permanent and overlaid surfaces. The rate of application shall be 1.5 to 2.0 gallons per square foot. The drying time, application temperature, preparation of surfaces and application methods shall be in accordance with the manufacturer's recommendation.

3.28 TESTING:

A. Acceptance Tests:

1. General: Unless otherwise specified, Contractor shall perform acceptance tests as specified herein.

(a) Density Tests:

- (1) Sampling: Sampling of asphalt concrete shall be in accordance with ASTM D979.
- (2) Laboratory-Prepared Specimens: Required density shall be determined, for each lot, from the average density of six laboratory-prepared specimens representing two subsamples chosen on a random basis, from trucks delivering mixture to the job site. By quartering, each subsample shall be reduced to obtain three sample units (specimens), each of sufficient weight (approximately 2-½ pounds) to prepare a specimen two and one-half inches in height. Specimens shall be compacted in accordance with ASTM D1559, except that the temperature of the mixture immediately prior to compaction of the specimens shall be within the range of 250 degrees F to 325 degrees F for Penetration Grade 85-100 asphalt cement, and 265 degree F to 335 degree F for Penetration Grade 60-70 asphalt cement. The sample of mixture may be placed in an oven for not more than 30 minutes to maintain heat, but it shall not be reheated if it cools before use.
- (3) Field-Prepared Specimens: Acceptance of the compacted pavement with respect to density will be based on the average of five density determinations, performed by Contractor, for each lot (one day's production) of asphalt mixture place. Cores drilled from the binding course and surface course shall be used to test the density of the pavement in accordance with ASTM D1188. Each lot of compacted base and surface course shall have an average of five density determinations equal to or greater than 97 percent of the required density determined in accordance with this Section. No individual determination shall be lower than 95 percent of the average density of the six laboratory-prepared specimens specified in this Section.
- (4) Contractor shall fill all holes resulting from the sampling. Core holes shall be patched with the same asphalt concrete mixture removed and thoroughly compacted flush with the top of the pavement.

- (b) Measurement of Pavement Thickness: The cores used to test density, as specified in Paragraph 2L5.1.2.3, shall be used to measure the thickness of pavement. The compacted base and surface courses shall have average thicknesses of not less than those indicated on the Contract Drawings. Any deficiency in base thickness shall be corrected with surface course mixture.

B. Material Tests:

Contractor shall perform tests on materials, and mixtures, as specified in ASTM D3515, and as modified herein.

C. Additional Tests:

Additional tests, if required, shall be as specified by the Engineer.

END OF SECTION

TABLE 1
COMPOSITION OF BINDER AND ASPHALTIC CONCRETE MIXES
Sieve Analysis of Mineral Aggregate (Square Sieve Openings)

Sieve Size	Percent Passing By Weight			
	Binder		Asphaltic Concrete	
	Fine	Job Mix Tolerance (%)	Fine	Job Mix Tolerance (%)
1-1/2 inch	100	-		-
1 inch	95-100	-	100	
1/2 inch	70-90	±6	90-100	
3/8 inch		±7		
1/4 inch	48-74		65-85	±7
1/8 inch	32-62		36-65	±7
No. 4				
No. 8				
No. 20	15-39	±7	15-39	±7
No. 40	8-27	±7	8-27	±7
No. 50				
No. 80	4-16	±4	4-16	±4
No. 200	2-8	±2	2-6	±2
Percent by Weight Soluble In Chloroform	4.5 - 6.5	±0.4	5.8-7.0	±0.4

**SECTION 03200
CONCRETE REINFORCEMENT**

PART 1 - GENERAL:

1.1 SCOPE:

The Contractor shall furnish all labor, materials, equipment, and incidentals required and install all concrete reinforcement as shown on the Contract Drawings and specified herein.

1.2 RELATED SECTIONS:

SECTION 03300: CAST-IN-PLACE CONCRETE

1.3 SUBMITTALS:

A. The following shall be submitted for review prior to the fabrication of reinforcement:

1. Placing drawings for steel reinforcement.
2. Bar bending details.

B. The following shall be submitted at the time of shipment of reinforcing steel:

1. Manufacturer's certification of product.

1.4 REFERENCES

A. All work shall comply with the applicable requirements of the American Concrete Institute, the Concrete Reinforcing Steel Institute, the American Society for Testing Materials and all other applicable Federal, State and Municipal Codes, including revisions to the date of Contract.

B. Applicable Publications: the publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. ASTM A-185 - Specification for Wire Fabric, Plain, Welded Steel, for Concrete Reinforcement.
2. ASTM A-615 - Specification for Bars, Deformed and Plain, Billet-Steel, for Concrete Reinforcement.
3. ASTM A-616 - Specification for Bars, Deformed and Plain, Rail-Steel, for Concrete Reinforcement.
4. ASTM A-617 - Specification for Bars, Deformed and Plain, Axle-Steel, for Concrete Reinforcement.

1.5 PRODUCT DELIVERY AND HANDLING:

- A. Reinforcing shall be substantially free from millscale, rust, dirt, grease, or other foreign matter.
- B. Reinforcement shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same designations as shown on the submitted placing drawings.
- C. Reinforcing steel shall be stored off the ground and shall be protected from moisture and kept free from dirt, oil, or injurious contaminants.

PART 2 - PRODUCTS:

2.1 MATERIALS:

- A. Materials shall be new, be of domestic manufacturer, and shall conform to the following material specifications:
 - 1. Concrete reinforcing bars: ASTM A-615, Grade 40.
 - 2. Welded steel wire fabric: ASTM A-185.
 - 3. Plastic protected bar supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.
 - 4. Precast concrete block bar supports: CRSI Bar Support Specifications, Precast Blocks with Wires.
 - 5. Tie wires for reinforcement: 16-/12-gauge or heavier, black annealed wire.
- B. The following alternate materials are allowed:
 - 1. ASTM A-616 (rail-steel), Grade 60 deformed bars for ASTM A-615 (Billet-Steel) deformed bars.
 - 2. ASTM A-617 (Axle-steel) Grade 60 deformed bars (Billet-steel), Grade 60.

2.2 FABRICATION OF REINFORCEMENT:

- A. Fabrication tolerances shall be in accordance with the CRSI, Code of Standard Practice-Fabrication.
- B. Bars shall be cold bent.
- C. Bars shall be bent around a revolving collar having a diameter of not less than that recommended by the CRSI, Code of Standard Practice-Detailing. Hooks shall conform to the same code.
- D. Steel reinforcement in concrete shall conform to ACI 350 and ACI 318 unless otherwise specified.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. Surface condition, bending, spacing, tolerances of placement of reinforcement shall conform to the CRSI, Code of Standard Practice-Field Erection.
- B. Except as otherwise indicated on the Contract Drawings, the minimum concrete cover of reinforcement shall be as follows:
 - 1. Concrete cast against and permanently exposed to earth: 3-inch.
 - 2. Concrete surfaces in contact with soil, water, sewage, sludge, or exposed to the weather: 2-inch.
 - 3. Concrete surfaces not in contact with soil, water, sewage, sludge or exposed to the weather.
 - a. Beams, girders, columns: principal reinforcement; ties; stirrups or spirals: 1-1/2 inch.
 - b. Walls and bottom steel of slabs: 1 inch.
 - c. Shells and top steel of slabs: 3/4 inch.
- C. Reinforcement which is to be exposed for a considerable length of time after being placed shall be painted with a heavy coat of neat cement slurry, if required by the Engineer.
- D. No reinforcing bars shall be welded either during the fabrication or erection unless specifically called for on the Contract Drawings, specified herein, or with prior written approval of the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved, it shall conform to the AWS Structural Welding Code-Reinforcing Steel, AWS D1.4.

3.2 REINFORCEMENT AROUND OPENINGS:

- A. Place an equivalent area of steel to that interrupted by an opening, pipe penetration, or duct penetration around the opening or penetration. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

3.3 SPLICING:

- A. Except as otherwise indicated on the Contract Drawings, compression embedment and lap splices shall be 30 diameters, but not less than 12 inches. The lap splice length for column vertical bars shall be based on the bar size in the column above.
- B. Except as otherwise indicated on the Contract Drawings, tension lap splices shall be in accordance with the applicable tables on the ACT 315 Detailing Manual. Class B splices shall be used when 50 percent or less of the bars are spliced within the required lap length, otherwise Class C splices shall be used.
- C. Except as otherwise indicated on the Contract Drawings, splices in circumferential reinforcement in circular walls shall be Class C splices. Adjacent bars shall not be spliced within the required lap length.

- D. Splices in reinforcement for tension tie members and hangers shall be welded to develop in tension at least 125 percent of the specified yield strength of a bar. Splices adjacent bars shall be offset the distance of a Class C splice. Splicing of bars in tension tie members and hangers shall be avoided whenever possible.
- E. Splices in welded wire fabric shall be lapped not less than 1-½ courses or 12-inch. Fabric splices shall be tied together with wire ties spaced no more than 24-inches on center.

3.4 ACCESSORIES:

- A. The Contractor is solely responsible for determining, providing, and installing accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the steel and the placement of concrete.
- B. Precast concrete blocks with wires shall be used where the reinforcing steel is to be supported over soil.
- C. Stainless steel protected bar supports shall be used to firmly hold vertical reinforcement in position.
- D. Precast concrete blocks with wires or plastic protected bar supports shall be used to support reinforcing steel on formwork. If the bottom of the precast blocks will be exposed to offer removal of forms, the color and appearance of the block shall match that of the adjacent concrete.
- E. Alternate method of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

3.5 INSPECTION:

- A. In no case shall any reinforcing steel be covered with concrete until the amount and position of the reinforcement has been checked and approved by the Engineer. The Engineer shall be given ample prior notice of the availability of set reinforcement for checking.

END OF SECTION

**SECTION 03300
CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL:

1.1 SCOPE:

This Section describes the cast-in-place concrete work to be performed as part of the Site Preparation activities.

1.2 RELATED WORK:

- A. Coordinate with subcontractors to assure the proper incorporation of and provision for all piping, conduit, curb angles, frames, metal door frames, and other iron and metal items, which will be furnished or installed by them. Work requiring coordination includes mechanical and electrical work, vapor barrier and base, expansion joints and perimeter insulation.
- B. Also under this Section of the Specifications, unless otherwise stipulated, the following items:
 - 1. Foundations and footings for machinery, or other mechanical or electrical equipment which will be furnished and installed by separate sub-contractors, unless otherwise stipulated hereinafter.
 - 2. Fills under ground floor slabs or sidewalks, etc., of slag, gravel, broken stone, or sand all of which will be furnished and installed under this Contract.

1.3 APPLICABLE REGULATIONS:

- A. All work shall comply with the applicable requirements of the American Concrete Institute, the Concrete Reinforcing Steel Institute, and The American Society for Testing Materials and all other applicable Federal, State and Municipal Codes, including revisions to date of Contract.

1.4 GENERAL REQUIREMENTS:

- A. Standard Products: Materials and equipment shall be the standard products of a manufacturer regularly engaged in, and with a successful history of the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is reasonably convenient to the site, as determined by the Engineer.
- B. Verification of Dimensions: The Contractor shall become familiar with all details of the Work, verify all dimensions in the field, and shall advise the Engineer of any discrepancies before performing the Work.

1.5 DELIVERY AND STORAGE:

- A. The Contractor shall deliver cement only in approved bags or barrels with the brand type and name of the manufacturer clearly marked thereon or deliver in bulk in a manner approved by the Engineer. A bag of cement must contain 94 pounds net and be considered to equal 1 cubic foot. A barrel of cement must contain 376 pounds net. Information as to brand, type and manufacture must be provided in the shipping invoices accompanying bulk cement.
- B. The Contractor shall store cement in a suitable weather-tight building which will protect the cement from dampness, and in such a manner as to permit easy access for suitable inspection and identification of each

carload or equivalent. Do not store the cement in excess of eight (8) bags high. When permission is given by the Engineer to store temporarily in the open, provide a platform and adequate waterproof covering.

- C. Store the fine and coarse aggregate separately off the ground in such a manner as to prevent segregation of size, and avoid the inclusion of dirt and other foreign materials in the concrete.

PART 2 - PRODUCTS:

2.1 MATERIALS:

A. CEMENT:

1. Portland cement, ASTM C-150, Type I.
2. Air-Entraining Portland Cement, ASTM C-175.

B. ADMIXTURES:

1. Air-entraining agent, Neutralized Vinsol Resin, ASTM C-260.
2. Water reducing, set controlling agent Pozzolith as manufactured by Master Builders, Cleveland, Ohio, or approved equal.
3. The admixture shall produce concrete with the following specific qualities as required in this division:
 - (a) Workability
 - (b) Entrained Air Content
 - (c) Controlled Rate of Hardening
 - (d) Compressive and/or Flexural Strength

Only products with an established field record will be approved. The admixture manufacturer shall provide a certified test result showing the admixture exceeds the minimum requirement of ASTM C-494. Field service shall be available by a full-time, qualified concrete technician of the admixture manufacturer to assist in the preparation of design mixes at the testing laboratory, and during the batching and placing of concrete.

C. WATER:

Water shall be clean and free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious materials.

D. AGGREGATES:

1. Fine: ASTM C-33
2. Coarse: ASTM A-33
3. Under slab Base: 3/4" to 1-1/2" crushed stone, gravel or slag.

E. METAL REINFORCEMENT:

1. Bars: ASTM A-615
2. Wire: ASTM A-82
3. Fabricated Material: ASTM A-185
4. Accessories: CRSI Standards and for ACI-315.

F. MISCELLANEOUS:

1. Asphalt impregnated fiberboard expansion joints: ASTM D-1751 for interior and ASTM D-1752 for exterior.
2. Neoprene water stops: CRD D-572.
3. Perimeter insulation: ASTM D-1692 and C-355.
4. Waterproof paper curing material: ASTM C-156, D-829, and E-97.
5. Premoulded membrane vapor barrier: ASTM E-96.
6. Metallic floor hardener: Master plate pre-mixed natural gray as manufactured by Master Builders, or approved equal.

2.2 MIXES:

A. PROPORTIONING:

1. Composition: Compose mixture of Portland cement, fine aggregate, coarse aggregate, water, admixture, and, as required, air-entraining agent.
2. Proportioning of Mixture: Make concrete mix homogeneous, readily placeable, and uniformly workable and proportioned in accordance with ACI-211 to attain properties of strength, slump, entrained air content, and rate of hardening in conformance with the following requirements:
 - (a) Maximum Size of Coarse Aggregates:
 - (1) Maximum size of coarse aggregates must be not larger than one-fifth of the narrowest dimension between the sides of the forms of the member for which the concrete is to be used, nor larger than three-fourths the minimum clear spacing between reinforcing bars.
 - (2) The unit weight of this concrete must be within the limits of 144 to 150 pcf depending on strength required, air content and aggregate approved by the Engineer.
 - (3) Unit weight, slump and air content specified and approved by the Engineer must be maintained, variation in the unit fresh weight exceeding 2 pcf will not be permitted.
 - (b) Strengths and Slumps: The following are the minimum compressive strengths and maximum slumps, unless noted otherwise on the Contract Drawings:

Compressive Strength

Type of Construction	28 days, psi	Slump, Inches
Reinforced Concrete:		
Caissons and Grade Beams	4000	3
Footings and Slabs on Grade	4000	3
Suspended Slabs	3500	4
Walls and Columns	4000	4
Non-Reinforced Lean Concrete	4500	3
Pavements		
Moderate Exposure	3500	3
Severe Exposure	5000	3

- (c) Air-Entrainment: The air content in all concrete exposed to weathering must be maintained in accordance with Table #3 ACI-211 (i.e.: For 3/4 inch aggregate concrete 6% plus or minus 1-1/2%; 1-1/2 inch aggregate concrete 4.5% plus or minus 1-1/2%).
- (d) Rate of Hardening of Concrete: For climatic conditions and types of construction indicated, the concrete mix must be adjusted to produce the required rate of hardening:

Rate of Hardening

Type of Construction	Climatic Conditions	Required Rate of Hardening
Structural Concrete	Over 90 degrees F	
Structural Concrete	Under 50 degrees F	3
Pavements	Over 90 degrees F	3
Pavements	Under 50 degrees F	4
Mass Concrete	Over 40 degrees F	4

All other concrete shall have normal rate of hardening. Should the Contractor find it advantageous to use concrete with modified rates of hardening to facilitate his work and improve workmanship, consideration for approval will be given by the Engineer upon submission of laboratory test data.

- (e) Limits: All concrete must have water-cement ratios and corresponding cement factors sufficient to meet strength, workability and durability requirements in accordance with ACI-301, ACI-318.

B. MIXING AND PLACING:

1. Equipment: Machine mix all concrete. Provide adequate equipment and facilities for accurate measurement and control of all materials for readily changing the proportions to conform with varying conditions of work.
2. Method of Mixing: Preference shall be given to:
 - (a) Ready-mix concrete must be used throughout (ASTM C-94 58.4 alternate No. 2).
 - (b) Site Mix: Site concrete may be used only if method of storing material, mixing material and type of mixing equipment is approved by the Engineer. The approval of site mixing does not relieve the Contractor from the responsibilities of adhering to every item in this Section.
3. Ready-Mixed Concrete: Use in reference to concrete mixed at the job, and conform to the "Specifications for Ready-Mixed Concrete", ASTM C-94, except as modified herein. The plant must have sufficient capacity and transportation equipment to deliver at the rate required.
 - (a) Central Mixing: Provide an initial mixing at the plant of not less than 1 minute after all materials, including water, are in the mixer and transport in clean watertight receptacles equipped with an agitator device operated until the concrete is discharged.

- (b) Transit Mixing: When the concrete is transported in a revolving drum, initial mixing at the plant may be omitted, providing the drum has revolved the number of revolutions required by the manufacturer after all materials, including water, are in the mixer.
 - (c) Mixing Time: Minimum time for mixing each batch after raw materials are in the mixer must be 1 minute for batches 1-1/2 cubic yards or smaller and 1-1/2 minutes for batches larger than 1-1/2 cubic yards. The speed or the volume capacity of the mixer must not exceed those recommended by the manufacturer of the mixer. Excessive over-mixing requiring additions of water to preserve the required consistency, will not be permitted.
4. Batching:
- (a) Cold Weather Batching: When the temperature is below 40 degrees F, or is likely to fall below 40 degrees F during the 24 hour period after placing, provide equipment for heating the concrete materials meeting the approval of the Engineer. Use no frozen materials or material containing ice in cold weather. Do not exceed temperatures of 100 degrees F for the separate materials, including the mixing water, when placed in the mixer. Maintain concrete temperatures between 50 degrees and 90 degrees when placed in forms.
 - (b) Hot Weather Batching (ACI-305): During hot weather, maintain temperatures of the cement, aggregates and mixing water at the time delivered to job site at less than 90 degrees F.
5. Retempering:
- (a) Mix concrete in such quantities as are required for immediate use, and place while fresh, before loss of slump occurs. Retempering (adding water to restore slump lost during excessive mixing or due to too long an elapse of time since initial mixing) will not be permitted.
6. Conveying: Convey concrete rapidly from mixer to forms by methods that will prevent segregation.

PART 3 - EXECUTION:

3.1 ENVIRONMENTAL CONDITIONS:

- A. Perform hot weather concrete work in conformance with ACI-305.
- B. Perform winter concrete work in conformance with ACI-306.

3.2 PREPARATION:

A. INSTALLATION:

Make forms conforming with the working drawings to shape, line and dimensions of members and substantially free from surface defects and sufficiently tight to prevent leakage. Properly brace and tie to maintain position and shape.

- 1. For inspection of forms and reinforcing prior to depositing concrete provide access openings.
- 2. Do not use form coatings that discolor or injure concrete.

3. When excavation can be accurate to required size, omit side forms for footings.
4. Follow ACI-347.

B. PLACING REINFORCEMENT:

1. **Cleaning and Bending:** Use reinforcement free from heavy scale or rust, or coatings that will reduce bond. Bend bars when cold. Make bends for stirrups and ties around pins having at least twice the thickness of the bars. Make bends for all other bars around pins having a minimum thickness of six times the thickness of bars 1-inch and smaller, and eight times the thickness of bars larger than 1 inch.
2. **Placing:** Place reinforcement accurately and secure chairs and spacers in position. In no case make the clear distance between bars be less than 1 inch, nor less than 1-1/3 times the maximum size of the coarse aggregate. Where reinforcement in beams or girders is placed in two or more layers, make the clear distance between layers not less than 1 inch and then place bars in the upper layers directly above those in the bottom layer.
3. **Splices:** Lap necessary splices not shown on drawings sufficiently to develop the strength of the bars by bond, and securely wire. Stagger splices in adjacent bars. Lap adjacent sheets of wire mesh at least 6 inches and securely tie. The clear distance between bars also apply to the clear distance between contact splices and adjacent contact splices or bars.
4. **Concrete Foundation:** Place the reinforcement of footings and other principal structural members in which concrete is deposited against the ground with not less than 3 inches of concrete between it and the ground surface. If concrete surfaces after removal of forms are to be exposed to the weather or be in contact with the ground, protect the reinforcement with not less than 1-1/2 inches of concrete.
 - (a) Make the concrete protective covering for reinforcement at surfaces not exposed directly to the ground or weather not less than 3/4 inch for slabs and walls; and not less than 1-1/2 inches for beams, girders and columns.
 - (b) Make concrete protection for reinforcement in all cases at least equal to the diameter of round bars, and 1-1/2 times the side dimension of square bars.

C. FASTENING DEVICE AND INSERTS:

1. Provide installation of inserts, pipe sleeves, drains, hangers, metal ties, reglets, anchor slots, nailing strips, blocking and other required devices for attaching other work.
2. Cooperate with other trades to properly locate and secure prior to placing of concrete.

D. CONSTRUCTION JOINTS:

1. Make and locate monolithic construction joints subject to prior approval of the Engineer, in general in accordance with this Section.
2. **Preparation of Joints:** Roughen the surface of the concrete, thoroughly clean, and remove all laitance. In addition to the foregoing, thoroughly wet joints and slush with a coat of neat cement grout immediately before placing of new concrete.

3. Joints between horizontal members and walls or columns: At least 2 hours must elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supporting thereon. Consider beams, girders, brackets, column capitals and haunches as part of the floor system and place monolithically unless otherwise specifically indicated on the plans.
4. Joints in Horizontal Members: Locate construction joints in floors near the middle of the spans of slabs, beams or girders, unless a beam intersects a girder at this point, in which case offset the joints in the girders a distance equal to twice the width of the beam. Provide for shear by use of inclined reinforcement.

E. UNDERSLAB BASE INSTALLATION:

Distribute evenly to depths as detailed, compact thoroughly, eliminate all voids, and grade uniformly to established elevations.

3.3 INSTALLATION:

- A. Placing: In preparation for the placing of concrete, remove all construction debris and extraneous matter from within the forms. Remove struts, stays, bracing and blocks, serving temporarily to hold the forms in correct shape and alignment, when the concrete placing has reached an elevation rendering their services unnecessary. Unless otherwise specified, place all concrete on clean damp surfaces free from any water, or upon properly consolidated fills, but never upon soft mud or dry porous earth. Deposit along the forms. Deposit in horizontal layers not to exceed 18 inches in thickness, unless specifically permitted by the Engineer and carry on placement at such a rate that all concrete surfaces not yet to grade have not reached their initial set before additional concrete is placed thereon.
- B. Consolidate concrete by means of mechanical vibrating equipment. Insert and remove vibrators vertically (do not drag horizontally) at such regular intervals as to insure uniform consolidation throughout the entire section of concrete being placed. In no case use vibrators to transport concrete inside the forms. Internal vibrators must maintain a speed of not less than 7,000 impulses per minute when in operation submerged in concrete. Use a sufficient number of vibrators to consolidate the concrete properly. Concrete having a slump in excess of that specified at the point of placement will be rejected.
- C. Bleeding: The Engineer will determine prior to placing of concrete the allowable bleeding. Maximum allowable bleeding must be in accordance with ASTM C-494.
- D. New Concrete on Set Concrete: Before depositing new concrete on or against concrete which has set, reset the forms, roughen the surface of the set concrete thoroughly, and clean all foreign matter and laitance. Saturate with water, slush with a coat of mortar grout, and place concrete while the grout is still soft.
- E. Cure all concrete for a period of not less than 7 days by the approved method listed below with the approval of the Engineer. During this curing period permit no part of the concrete to become dry. Apply the curing medium so as to prevent the checking and cracking of the surface of the concrete immediately after placing, and so as to prevent loss of water from the concrete for the duration of the entire curing period.
- F. Protect fresh concrete from heavy rains, flowing water and mechanical injury, and from injurious action of the sun.
- G. Curing Material: Use curing paper conforming to ASTM C-156, D-829, and E-97.

- H. Removal: Remove forms in a manner and at such times to insure complete safety of the structure. In no case remove supporting forms or shoring until sufficient strength has been obtained to support weight and load. Use results of job cured cylinders (ACI-C-31) as evidence that concrete has obtained required strength. Reshoring, as required by the Engineer, is the responsibility of the Contractor.
- I. Rubbed Finish: Remove all projections, repair damage and level all offsets. Rub with cement or abrasive brick. Remove blemishes and form marks. Finish to uniform, smooth and clean surface.
- J. Finish all floors and slabs as indicated on the Contract Drawings or otherwise specified, or as is obviously suitable for the specific slab or floor. Hereinafter listed are descriptions of the common types of finish:
 - 1. Integral finishes as herein specified are finishes of the structural concrete slabs obtained without applying a separate topping coat, must be not less than Class C in quality and in no case with the cement factor less than six (6) bags (94-pound bag) per cubic yard, and, for the purpose of these specifications, consist of three (3) types as follows:
 - (a) Obtain the Screeded Type of integral finish by placing continuous screeds at frequent intervals and striking off to the surface elevation desired. Unless otherwise stipulated, use this type of finish on base slabs upon which tile, or similar type wearing surfaces are to be applied.
 - (b) Obtain the Woodfloated Type of integral finish by working a previously screeded surface with a wood float until the desired texture is reached. Unless otherwise stipulated, use this type finish for exterior paved areas, sidewalks, ramps, floors of unfinished spaces, and similar locations.
 - (c) Obtain the Steel Troweled Type of integral floor finish where indicated on the drawings or otherwise specified, by first screeding and removing all excess laitance and then giving a preliminary wood float finish, which shall be true and even and free from depressions. After this operation, compact the surfaces with motor driven floats of the disc type and then smooth the surface with not less than two (2) thorough and complete steel trowelling operations.
 - (d) Provide at all exposed concrete floors integral metallic floor hardener, Master Plate Pre-Mixed Natural Gray as manufactured by Master Builders, applied at rate of 1.5 lbs. per sq. ft. Preparation, application procedures and precautions must be in strict compliance with the manufacturer's recommendations.
- K. Sub-divide all exterior concrete slab pads at exits and entrances expansion strips into areas not to exceed 100 sq. ft. and further sub-divide by scoring into areas not to exceed 30 sq. ft. Exact spacing of expansion strips and scoring to be determined by the Engineer to suit the various job conditions.
- L. Concrete work which is not properly formed, true, plumb, or level, or which fails to meet specified minimum compressive strength shows poor workmanship or carelessness, or contains foreign substances of materials will be deemed to be defective. Remove this work from site as directed by the Engineer, replacing same with new materials complying with the contract specifications and meeting the approval of the Engineer.

3.4 PROTECTION:

- A. Place all concrete and protect so that the temperature at the surface will not fall below 50° F., or that there will be no loss of moisture from the surface for a period of 7 days after placing. During hot weather, take precautions to avoid high temperature in the fresh concrete and to avoid rapid drying.
- B. Submit for approval the methods proposed for protecting the concrete against low temperatures.
- C. The requirement above concerning the temperature at the surface is intended to apply to the placing of concrete in those seasons of the year or in such places where the possibility of freezing or continued low temperatures is to be expected. Concrete must be protected from freezing temperatures at any time during the first 72 hours. Control cooling of the concrete at the end of the protection period. Cooling at the rate of twenty 20°F for 24 hours is recommended.
- D. Accomplish protection against loss of moisture from the surface of the concrete by keeping the surface continuously wet. Use one of the following methods:
 - 1. Surface remaining in contact with the forms in dry hot weather kept moist by continuous sprinkling.
 - 2. Covering with burlap or cotton mats kept continuously wet.
 - 3. Covering with paper of suitable type.
 - 4. Continuous sprinkling of the exposed surfaces.
 - 5. Use of an impervious membrane consisting of approved liquid sealing compound applied in an atomized form after surface water has entirely disappeared but surfaces are still moist. Compounds must form an effective seal which will prevent evaporation of moisture from concrete for the full curing period.
 - 6. The surface of slabs protected by ponding.
 - 7. Covering with a 1-inch layer of thoroughly wet sand, earth, or sawdust over suitable paper covering.
 - 8. Covering with a 6-inch layer (loose) of thoroughly wet straw, hay or similar materials, as approved by the Engineer (materials will not be permitted which will have an injurious effect on conduits or pipes concealed in concrete).

END OF SECTION

SECTION 03410
STRUCTURAL PRE-CAST CONCRETE

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the structural pre-cast concrete units to be installed as part of the Site Preparation activities.

1.2 RELATED WORK:

- A. Coordinate with subcontractors to assure the proper incorporation of and provision for all piping, conduit, curb angles, frames and other metal and iron items which will be furnished or installed by them. Work requiring coordination includes mechanical and electrical work, vapor barrier and base, expansion joints and perimeter insulation.

1.3 APPLICABLE REGULATIONS:

- A. All work shall comply with the applicable requirements of the American Concrete Institute, the Concrete Reinforcing Steel Institute, and The American Society for Testing Materials and all other applicable Federal, State and Municipal Codes, including revisions to date of Contract.

1.4 GENERAL REQUIREMENTS:

- A. **Standard Products:** Materials and equipment shall be the standard products of a manufacturer regularly engaged in, and with a successful history of the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is reasonably convenient to the site, as determined by the Engineer.
- B. **Verification of Dimensions:** The Contractor shall become familiar with all details of the Work, verify all dimensions in the field, and shall advise the Engineer of any discrepancies before performing the Work.

1.5 SUBMITTALS:

- A. **General:** Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. **Product data and instructions for manufactured materials and products, including:**
 - 1. Certification by paint and curing compound manufacturers that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
- C. **Shop drawings** prepared by or under the supervision of a qualified professional engineer detailing fabrication and installation of pre-cast concrete units. Indicate: member dimensions and cross-sections; locations, sizes, and types of reinforcement, including special reinforcement; and lifting devices necessary for handling and erection.

1. Indicate layout and dimensions, and identify each pre-cast concrete unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS standard symbols. Detail loose, cast-in, and field hardware, inserts, connections, and joints, including accessories and construction at openings in pre-cast units.
 2. Indicate locations and details of anchorage devices that are to be embedded in other construction. Furnish templates, if required, for accurate placement.
 3. For pre-cast concrete units indicated to comply with design loadings or calculated fire-resistance requirements, include structural analysis data sealed and signed by the qualified professional engineer responsible for their preparation.
- D. Samples, approximately 12 by 12 by 2 inches (300 by 300 by 50 mm), to illustrate quality of finishes, colors, and textures of exposed pre-cast concrete units.
- E. Samples of bearing pads.
- F. Design mixes for each concrete mix. Submit revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
1. Concrete materials.
 2. Reinforcing materials.
 3. Pre-stressing strands.
 4. Admixtures.
 5. Bearing pads.

1.6 DELIVERY AND STORAGE:

- A. All equipment delivered and placed in storage at the site shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants.
- B. Deliver pre-cast concrete units to the Site in such quantities and at such times to ensure continuity of installation. Store units at the Site so as to prevent cracking, distorting, warping, staining, or other physical damage, and so that markings are visible.
- C. Lift and support units only at designated lifting or supporting points as shown on final shop drawings.
- D. Deliver anchorage items that are to be embedded in other construction before starting such work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS:

2.1 REINFORCING MATERIALS:

- A. Reinforcing Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, Grade 60 (ASTM A 706M, Grade 400).
- C. Galvanized Reinforcing Bars: ASTM A 767 (ASTM A 767M), Class II, 2 oz./sq. ft. (610 g/sq. m) zinc, hot-dip galvanized.
- D. Epoxy-Coated Reinforcing Bars: ASTM A 775 (ASTM A 775M).

STRUCTURAL PRE-CAST CONCRETE

03410

Page 2

- E. Steel Wire: ASTM A 82, plain, cold drawn.
- F. Steel-Welded Wire Fabric: ASTM A 185, plain, cold drawn.
- G. Deformed-Steel-Welded Wire Fabric: ASTM A 497, cold drawn.
- H. Epoxy-Coated, Steel-Welded Wire Fabric: ASTM A 884, Class A, deformed.
- I. Supports for Reinforcement: Provide supports for reinforcement, including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs that are protected with plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.2 PRESTRESSING TENDONS:

- A. Pre-stressing Strand: ASTM A 416, Grade 250 or 270, uncoated, 7-wire, low-relaxation strand.

2.3 CONCRETE MATERIALS:

- A. Portland Cement: ASTM C 150, Type I or Type III.
 - 1. Use only one brand and type of cement throughout Project, unless otherwise acceptable to the Engineer.
- B. Fly Ash: ASTM C 618, Class C or F.
- C. Silica Fume: ASTM C 1240, amorphous silica.
- D. Normal-Weight Aggregates: ASTM C 33, Class 5S. Provide aggregates from a single source.
- E. Lightweight Aggregates: ASTM C 330.
- F. Water: Potable.
- G. Admixtures, General: Provide admixtures for concrete that contain not more than 0.1 percent chloride ions by mass of portland cement or cementitious material.
- H. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- I. Water-Reducing Admixture: ASTM C 494, Type A.
- J. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
- K. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
- L. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

2.4 CONNECTION MATERIALS AND FINISHES:

- A. Steel Shapes and Plates: ASTM A 36 (ASTM A 36M).
- B. Malleable Iron Castings: ASTM A 47 (ASTM A 47M).
- C. Plate Stainless Steel: ASTM A 666, Type 304, of grade suitable for application.
- D. Bolts and Studs: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts and studs; carbon-steel nuts; and flat, unhardened steel washers.
- F. Welded Headed Studs: AWS D1.1, Type B headed studs, cold-finished carbon-steel bars.
- G. Deformed-Steel Wire Bar Anchors: ASTM A 496.
- H. Accessories: Provide clips, hangers, shims, and other accessories required to install pre-cast concrete units.
- I. Hot-Dip Galvanized Finish: For exterior steel items and items indicated for galvanizing, apply zinc coating by the hot-dip process, complying with the following requirements:
 - 1. ASTM A 123 for galvanizing rolled, pressed, and forged shapes, plates, bars, and strips.
 - 2. ASTM A 153 for galvanizing iron and steel hardware.
- J. Galvanizing Repair Paint: High-zinc-dust-content paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.
- K. Shop-Primed Finish: Prepare surfaces of interior steel items, except those with galvanized finish or those surfaces to be embedded in concrete, according to requirements of SSPC-SP 3 and shop-apply primer according to SSPC-PA 1.
 - 1. Primer: Fast-curing, lead- and chromate-free, VOC-conforming, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

2.5 BEARING PADS:

- A. Provide bearing pads for pre-cast concrete units as follows:
 - 1. Elastomeric Pads: AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 shore A durometer, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D 412.
 - 2. Random, Fiber-Reinforced Elastomeric Pads: Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 shore A durometer.
 - 3. Cotton-Duck-Fabric-Reinforced Elastomeric Pads: Preformed, horizontally layered cotton-duck fabric, bonded in elastomer. Surface hardness of 80 to 100 shore A durometer.
 - 4. Frictionless Pads: Tetrafluoroethylene (TFE), glass-fiber-reinforced, bonded to mild-steel plate, of type required in-service stress.

5. Hardboard: AHA A135.4, Class 1, tempered hardboard strips, smooth on both sides.
6. High-Density Plastic: Multimonomer, non-leaching, plastic strip.

2.6 GROUT MATERIALS:

- A. Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Metallic, Non-shrink Grout: Premixed, factory-packaged ferrous aggregate grout, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.
- C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, non-corrosive, non-staining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and a 30-minute working time.
- D. Epoxy Grout: ASTM C 881, 2-component epoxy resin, of type, grade, and class to suit requirements.

2.7 CURING MATERIALS:

- A. Clear, Solvent-Borne, Liquid, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class A or B, wax free.
- B. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.
 1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2.8 CONCRETE MIXES:

- A. Prepare design mixes for each type of concrete required.
 1. Limit use of fly ash and silica fume to not exceed, in aggregate, 25 percent of the Portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified pre-cast manufacturing plant personnel at pre-cast fabricator's option.
- C. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.1 and ACI 301, using materials to be used on the Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28-Day): 6000 psi (41.4 MPa).
 2. Compressive Strength (28-Day): 5000 psi (34.5 MPa).
 3. Compressive Strength (28-Day): 4000 psi (27.6 MPa).
 4. Maximum Water-Cement Ratio at Point of Placement: 0.40.
 5. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.40.
- D. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows, with a tolerance of plus or minus 1-1/2 percent:

1. Air Content: 6 percent for 1-inch (25-mm) maximum aggregate.
 2. Air Content: 6 percent for 3/4-inch (19-mm) maximum aggregate.
 3. Air Content: 7 percent for 1/2-inch (13-mm) maximum aggregate.
 4. Air Content: 2.5 to 4.5 percent.
- E. Lightweight Concrete: Proportion mixes by either laboratory trial batch or field test data methods according to ACI 211.2 and ACI 301, using materials to be used on the Project, to provide lightweight concrete with the following properties:
1. Compressive Strength (28-Day): 6000 psi (41.4 MPa).
 2. Compressive Strength (28-Day): 5000 psi (34.5 MPa).
 3. Compressive Strength (28-Day): 4000 psi (27.6 MPa).
 4. Unit Weight: Calculated equilibrium unit weight of 115 lb/cu. ft. (1842 kg/cu. m), plus or minus 3 lb/cu. ft. (48 kg/cu. m), according to ASTM C 567.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in lightweight concrete at point of placement having an air content as follows:
1. Air Content: 4 to 6 percent for 3/4-inch (19-mm) maximum aggregate.
 2. Air Content: 4.5 to 7.5 percent for 3/8-inch (10-mm) maximum aggregate.
 3. Air Content: 4 percent, minimum.
- G. Other Admixtures: Use water-reducing, high-range water-reducing, water-reducing and accelerating, or water-reducing and retarding admixtures according to manufacturer's directions.
- H. Concrete-Mix Adjustments: Concrete-mix design adjustments may be proposed when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.

2.9 FABRICATION:

- A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and for pre-tensioning and de-tensioning operations. Maintain formwork to provide completed pre-cast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL-116.
1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.
 2. Unless forms for pre-cast, pre-stressed concrete units are stripped prior to de-tensioning, design forms so that stresses are not induced in pre-cast units due to deformation of concrete under pre-stress or movement during de-tensioning.
- B. Built-In Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect the position of the main reinforcement or placing of concrete. Do not relocate bearing plates in units, unless acceptable to Engineer.
- C. Cast-in openings larger than 10 inches (250 mm) in diameter or 10 inches (250 mm) square according to final shop drawings. Other smaller holes may be field cut by trades requiring them, as acceptable to Engineer.

- D. Reinforcement: Comply with the recommendations of CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers and hangers, as required.
 3. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Pre-tensioning: Pretension tendons for pre-cast, pre-stressed concrete either by single-strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.
- F. Concrete Mixing: Comply with requirements and with ASTM C 94. Following concrete batching, no additional water may be added.
- G. Concrete Placement: Place concrete in a continuous operation to prevent seams or planes of weakness from forming in pre-cast units. Comply with requirements of ACI 304R for measuring, mixing, transporting, and placing concrete.
1. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with ACI 309R.
 2. Comply with ACI 306R procedures for cold-weather concrete placement.
 3. Comply with ACI 305R procedures for hot-weather concrete placement.
- H. Identify pickup points of pre-cast concrete units and orientation in structure with permanent markings, complying with markings indicated on final shop drawings. Imprint casting date on each pre-cast unit on a surface that will not show in the finished structure.
- I. Cure concrete according to the requirements of PCI MNL-116 by moisture retention without heat or by accelerated heat curing, using low-pressure live steam or radiant heat and moisture.
- J. Delay de-tensioning pre-stressed concrete units until concrete has attained at least 70 percent of its compressive strength as established by test cylinders cured under the same conditions as the concrete.
1. If concrete has been heat cured, de-tension while concrete is still warm and moist to avoid dimensional changes that may cause cracking or undesirable stresses.
 2. De-tension pre-tensioned tendons either by gradually releasing tensioning jacks or by heat-cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.
- K. Finish formed surfaces of pre-cast concrete as indicated for each type of unit, and as follows:
1. Standard Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, and form joint

- marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
2. Commercial Finish: Remove fins and large protrusions and fill large holes. Rub or grind ragged edges. Faces are to be true, well-defined surfaces.
 3. Grade B Finish: Fill air pockets and holes greater than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of adjacent surfaces. Grind smooth form offsets or fins greater than 1/8 inch (3 mm).
 4. Grade A Finish: Fill air pockets and holes greater than 1/4 inch (6 mm) in diameter with sand-cement paste matching color of pre-cast concrete. Grind smooth form offsets or fins greater than 1/8 inch (3 mm). Float-apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles.
- L. Finish unformed surfaces by trowel, unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
1. Apply scratch finish to pre-cast concrete units that will receive concrete topping after installation. Following initial strike-off, transversely scarify surface to provide ridges approximately 1/4 inch (6 mm) deep.

PART 3 - EXECUTION:

3.1 EXAMINATION:

- A. Examine substrates and conditions for compliance with requirements, including installation tolerances, true and level bearing surfaces, and other conditions affecting performance of pre-cast concrete units. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. Bearing Pads: Install bearing pads as pre-cast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until pre-cast units are placed.
- B. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
1. Protect pre-cast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
 2. Repair damaged metal surfaces by cleaning and applying a coat of galvanizing repair paint to galvanized surfaces.
 3. Repair damaged metal surfaces by cleaning and re-priming damaged painted surfaces.
- C. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to pre-cast, pre-stressed units, unless otherwise acceptable to Engineer.
- D. Erection Tolerances: Install pre-cast units level, plumb, square, and true, without exceeding the recommended erection tolerances of PCI MNL-127 "Recommended Practice for Erection of Pre-cast Concrete."
- E. Shore and brace pre-cast concrete units to maintain location, stability, and alignment until permanent connections are installed.
- F. Grouting Connections and Joints: After pre-cast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:

1. Grout Type: Cement grout.
2. Grout Type: Metallic, non-shrink grout.
3. Grout Type: Nonmetallic, non-shrink grout.
4. Grout Type: Epoxy grout.
5. Provide forms or other acceptable method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

3.3 CLEANING:

- A. Clean exposed surfaces of pre-cast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 1. Wash and rinse according to pre-cast concrete fabricator's recommendations. Protect other work from staining or damage due to cleaning operations.
 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes.

END OF SECTION

**SECTION 04100
MASONRY MORTAR**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. The Contractor shall coordinate with other sub-contractors so as to assure proper incorporation of and provision for all items furnished or installed by them.
- B. Work to be coordinated includes unit masonry.

1.2 SUBMITTALS:

- A. The Contractor shall provide samples of each type of mortar material.

1.3 PRODUCT HANDLING:

- A. The Contractor shall deliver cementitious materials to job site in original unopened packages with manufacturer's name and brand thereon.
- B. The Contractor shall handle, store and protect all materials so as to prevent deterioration or intrusion of foreign matter.
- C. Do not use material which has deteriorated or which has been mixed with foreign matter.
- D. Bagged cement stored for more than 6 months will be rejected.

1.4 ENVIRONMENTAL CONDITIONS:

- A. Use mortar as soon as practicable after mixing, at air temperatures in excess of 80 degrees, use within 2-1/2 hours after introduction of water to mix. At lower temperatures this time may be increased to 3-1/2 hours.
- B. Discard all mortar that has stiffened due to chemical reaction (Hydration). Mortars which have stiffened within the time limits noted due to evaporation may be retempered to restore workability by adding water as frequently as needed, providing workability of mortar is not impaired by addition of too much water.
- C. When cements used in mortar have been tested, and observed time of initial set as described under ASTM-C-266 has been determined, the following optional methods of selecting time limits may be used:

Time Limit for Use of Mortar

Air Temperature
in Degrees (F).

80 degrees or higher
Less than 80 degrees

Time Limit for
Use After Mixing

Time of initial set of cement minus one hour
Time of initial set of cement minus 1/4 hour

- D. Determine as above the time limit for use of mortar containing both Portland and masonry cements by the cement with the shortest observed time of initial set.
- E. Perform no mortar work in freezing temperatures unless suitable means are used to heat materials and protect the work.

PART 2 - PRODUCTS

2.1 MORTAR MATERIALS:

- A. Portland cement shall meet the requirements of ASTM Designation C-150 Type I.
- B. High early strength Portland cement shall meet the requirements of ASTM Designation C-150, Type III.
- C. Masonry cement shall meet the requirements of ASTM Designation C-91, Type II.
- D. Hydrated lime shall meet the requirements of ASTM Designation C-207, Type S. Quick lime shall meet the requirements of ASTM Designation C-5.
- E. Sand shall meet the requirements of ASTM Designation C-144, except that for grout and pointing mortar, which shall meet the following specification: 100 percent shall pass No. 30 sieve, not more than 15 percent shall pass No. 100 sieve, and uniformly graded. White sand shall be used where specified.
- F. Water clean enough to drink and free from injurious amounts of oil, soluble salts, alkali, acids, organic impurities, and other deleterious materials shall be used in all applications.
- G. Waterproofing admixture shall be of a brand approved by the engineer. In lieu of waterproofing admixture. Contractor has option of using an approved brand of cement which has been waterproofed at mill.
- H. Do not use admixture without the approval of the Engineer.
- I. Do not use anti-freeze compounds.

2.2 MIXES:

- A. Type N. mortar mix for all other masonry work, unless otherwise specified, shall consist of one part Portland cement, 1-1/4 parts of hydrated lime and 6-3/4 parts of sand (or one part masonry cement and 2-3/4 parts of sand), with a minimum compressive strength of 750 pounds per sq. in.
- B. Quantities of materials listed above are by volume. If materials are measured by weight use the following table to determine quantities:

Weights Per Cu. Ft.

<u>Material</u>	<u>Pounds per Cu. Ft.</u>
Portland Cement	94
Masonry Cement	Weight printed on bag
Hydrated Lime	40
Sand, Damp	85

- C. Pointing mortar shall consist of 1 cubic foot non-staining cement and 2 cubic feet damp loose sand with only sufficient hydrated lime to make as stiff a mixture as can be worked.
- D. Mortar grout shall consist of equal parts of Portland cement and sand with addition of sufficient water to produce proper consistency.
- E. Neat grout consisting of Portland cement and water and of pouring consistency.
- F. Measuring and mixing of mortar meeting requirements of ASTM Designation C-270, except as otherwise specified herein. Measure all materials accurately. Use automatic measuring devices that will consistently maintain specified proportions within a plus or minus tolerance of not more than five (5) percent.
- G. Except as otherwise approved for small batches, mix mortar in mechanically operated drum-type batch mixers in which water can be accurately and uniformly controlled. Mix all dry ingredients for at least two (2) minutes, then add water and mix for at least three (3) additional minutes. Do not permit volume of mixed material per batch to exceed manufacturer's rated capacity of mixer. Empty mixer completely after each batch. Keep mixer and all other equipment clean.
- H. Mortar having flow after suction (water retention) of at least 75 percent of that immediately after mixing.
- I. Add water to hydrated lime at least 24 hours before mixing with other materials.
- J. Waterproofing and other admixtures shall be added only when so specified.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Provide full mortar bed for all masonry materials, trowelled smooth.
- B. Fill all vertical joints completely.

END OF SECTION

SECTION 04200
UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED WORK:

- A. The Contractor shall coordinate with other sub-contractors to assure proper incorporation of and provision for items to be furnished or installed by them.
- B. Work requiring coordination includes structural steel, intake louvers, exhaust louvers, hose bibbs and wall hydrants, wall mounted exterior light fixtures, exterior electrical outlets and similar items.

1.2 SUBMITTALS:

- A. The Contractor shall provide samples of each type of concrete block.
- B. Provide samples or catalog data for wall ties, anchors, reinforcing, and accessories.

1.3 PRODUCT HANDLING:

- A. Upon delivery to the site, the Contractor shall pile all masonry units free of the ground and protect it from weather by tarpaulins or other suitable and approved means.
- B. The Contractor shall handle all masonry units at all times in a manner to prevent spalling, chipping and other damage. Protect all unit masonry with straw during transportation and storage on the job site.

1.4 ENVIRONMENTAL CONDITIONS:

- A. Do not erect masonry when sun, heat, wind, or limitations of Contractor's facilities prevent proper setting and curing, or obtaining of proper bond.
- B. Do not lay units having a surface film of water or frost.
- C. Do not erect masonry during freezing weather or when it appears probable that freezing weather will be encountered before the mortar has set, unless, subject to written approval, suitable precautionary measures are taken. When the Engineer during cold temperatures authorizes masonry work, special protective provisions as follows must be provided.
- D. When the outside air temperature is between 35 degrees F and 32 degrees F, keep all masonry units completely covered and free from ice and snow at all times. The mixing water or sand shall be heated not to exceed 160 degrees F or under 70 degrees F. Maintain the air temperature on both sides of the masonry above 40 degrees F for a period of at least seventy-two (72) hours. Submit for approval, the methods proposed for use in protecting the masonry against low temperatures. Building upon frozen work is prohibited.
- E. When the outside air temperature is between 32 degrees F and 25 degrees F, in addition to requirements noted above, heat the mixing water and sand not to exceed 160 degrees F or be less than 70 degrees F.

- F. When the outside temperature is between 25 degrees F and 18 degrees F, in addition to all the requirements above, add calcium chloride to the mixing water at a rate not to exceed 1-1/2 to 2 pounds per sack of Portland cement. Do not add calcium chloride to masonry cement mortars unless specifically recommended by the manufacturer of the masonry cement. When the outside temperature is between 18 degrees F and 0 degrees F, in addition to all the provisions above, heat all hollow masonry units, when laid, to at least 40 degrees F.
- G. When the outside air temperature is 0 degrees F and below, perform masonry work only in an emergency. In addition to all of the provisions above, heat all solid masonry units to a temperature above 40 degrees F immediately before laying. Provide complete temporary enclosures for masonry construction during sustained sub-zero weather.

1.5 PROTECTION:

- A. The Contractor shall protect surfaces of masonry not being worked on at all times during the construction period. At such time when rain or snow is imminent and work is discontinued, cover tops of exposed masonry with strong waterproof membranes well-secured in place.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Concrete block shall be load bearing block of modular dimensions and shall include all closer, jamb units, solid headers, caps and special shapes and sizes required to complete the work. Units shall be of same manufacture, composition, size and appearance and shall be cured by the same process throughout the job. Units shall be sound and free from cracks, chipped edges and other defects. Units shall be free of any deleterious matter that will stain plaster or corrode metal and shall be adequately cured before shipment. Units shall be Grade N-1, complying with ASTM C-90, with crushing strength not less than 1,000 lbs. per sq. in., on the gross area, maximum water absorption of 15 lbs per cu. ft., and maximum moisture content of 40%. Block aggregate shall conform to ASTM C-33 or C-331.
- B. Use anchors, ties and joint reinforcement of approved design and except as otherwise specified herein, of zinc-coated metal of types noted below. Zinc coating anchors and ties conforming to ASTM Designation A-153, Class B-1, B-2 or B-3, as required. Zinc-coating of wire for joint reinforcing conforming to ASTM Designation A-116, Class 2.
- C. Use joint reinforcement fabricated from steel wire, conforming to ASTM Designation A-82, zinc-coated before fabrication as noted above. Longitudinal wires may be smooth or deformed and not lighter than 0.1620 inch nominal diameter (8 gauge). Cross wires not lighter than 0.1055 inch (12 gauge). Distance between contacts of cross wires with longitudinal wires measured between contacts on each longitudinal wire not to exceed 6 inches for smooth longitudinal wires and 16 inches for deformed longitudinal wires. Spacing of longitudinal wires in joint reinforcement, used with load bearing and non-load-bearing units respectively, shall be 2 inches less than the nominal width of the deformed longitudinal wires, but shall intersect above or below plain longitudinal wires and shall extend not more than 1/8 inch beyond outer sides of longitudinal wires. Use joint reinforcement furnished in flat sections, ranging from 10 to 20 feet or more in length. Reinforcement in roll will not be permitted. Provide special shapes for corners and wall intersections.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Lay walls uniformly, in layers one scaffold high, around entire building. Lay all work accurately to dimensions, carried up plumb, with horizontal joints level and laid to a line. Accurately space courses with each course breaking joints with course below unless otherwise indicated. Keep horizontal and vertical joints uniform, approximately 3/8".
- B. Install wall reinforcing as specified in the Masonry Reinforcement Schedule to reinforce all masonry walls throughout the structure, making laps and corners in accordance with manufacturer's printed directions.
- C. Keep bond pattern for all masonry work plumb throughout. Keep corners and reveals plumb and true. Keep all corners, both internal and external, square. At door and window jambs, and at other built-in items, grout voids solid with mortar mixed to pouring consistency.
- D. Lay all units in full mortar bed, including shell and webbing, and fill all vertical joints completely.
- E. Form smooth concave compacted joints in all exposed areas. Control joints shall be raked out 3/4" and left ready for caulking.
- F. Build in, as work progresses, all inserts, collars, sleeves, anchors, plates, flashings, lintels, frames, conduits, pipes, and other accessories required to be built in. These items will be furnished under other sections, or separate contracts, and the appropriate trades will designate correct locations and direct their installation.

3.2 CLEANING:

- A. At completion of work, fill all holes in joints of exposed exterior masonry surfaces with mortar, and tool suitably. Immediately after cleaning, rinse thoroughly with clean water. Leave clean, free of mortar daubs, and with tight mortar joints throughout. When cleaning masonry, protect all other work against damage or disfigurement.

END OF SECTION

**SECTION 05250
STEEL GRATING**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

- A. This section includes welded steel grating and associated angle steel for grate bearing surfaces.

1.2 RELATED WORK:

- A. SECTION 03300: CAST IN PLACE CONCRETE

1.3 DELIVERY, STORAGE, AND HANDLING:

- A. Store all materials in accordance with manufacturers recommendations, under cover, above grade, and protected from physical damage and effects of weather until required for use or installation.

PART 2 - PRODUCTS

2.1 STEEL GRATING:

- A. Provide welded steel grating as manufactured by McNichols Co. Model: GW-100 galvanized with the following:
 - 1. Size: 1" x 3/16" Steel Bars
 - 2. Spacing: 1-3/16"
 - 3. Cross Spacing: 4"
 - 4. Wt./Sq. Ft: 7.4 lbs
 - 5. Finish: Hot Dip Galvanized
- B. Provide bearing steel angles as detailed on the contract drawings at all bearing points of steel grating.
- C. McNichols Co.
PO Box 30300
Tampa, Fl 33630-3300
1-800-237-3820

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION:

- A. Examine all grating upon delivery to site. Verify sizes and condition prior to installation.
- B. Prepare work surfaces prior to installation of steel grating.

3.2 INSTALLATION:

- A. Install steel grating in accordance with manufacturers recommendations.
- B. Order all steel grate sections factory cut to length. Field cut openings for pipe penetrations with metal cutting disks or metal blades. Torches are not permitted for cutting steel grating.
- C. Coat all field cuts with two coats of cold galvanizing compound. Compound to produce a dry film containing a minimum of 90% zinc.
- D. Provide minimum recommended bearing lengths.

END OF SECTION

**SECTION 05400
LIGHT GAUGE FRAMING**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. The Contractor shall coordinate with other sub-contractors to assure proper incorporation of and provisions for items to be furnished or installed by them.
- B. Work requiring coordination includes structural steel, steel joists and steel deck, insulation, hollow metal work and aluminum windows, mechanical work and electrical work.

1.2 QUALIFICATION:

- A. Conform to AISI Specification for Design of Cold Formed Steel Structural Members for all structural components.
- B. Use material as manufactured by Dale Industries, Inryco/Milcor, USG, Wheeling-Pittsburgh Steel Corp., or approved equal.

1.3 REGULATORY REQUIREMENTS:

- A. Design exterior non-load bearing walls for wind load of 25 psf and L/600.
- B. Comply with all current BOCA, NFPA and National Building Code requirements applicable to this project.
- C. Comply with UL Design U-420 for one hour fire rating of all corridor walls and for all two hour rating of all stair and elevator walls.

1.4 SUBMITTALS:

- A. Submit for approval, samples of all components to be used in the framing system.
- B. Submit for approval, complete and detailed fabrication and erection drawings.

1.5 PRODUCT HANDLING:

- A. Protect materials from damage in shipping and handling.
- B. Store on site in such a manner to protect from damage until installed.

PART 2 - PRODUCTS

2.1 MATERIAL:

- A. All painted studs conforming to ASTM A-570 with minimum yield of 50,000 psi.
- B. All galvanized studs conforming to ASTM A-446, Grade D with minimum yield of 50,000 psi.

- C. All painted track, bridging, end closures and accessories conforming to ASTM A-611, Grade C, with minimum yield of 33,000 psi.
- D. All galvanized track, bridging, end closures and accessories conforming to ASTM A-446, Grade A, with minimum yield of 33,000 psi.
- E. All studs and accessories primed with rust inhibitive paint meeting Fed. Spec. TT-P-636 C or formed from steel with G-60 galvanized coating conforming to Fed. Spec. QQ-S-775, Type I, Class D, and ASTM A-525, 1.25 oz. coating class.

2.2 COMPONENTS:

- A. For exterior non-load bearing walls. Use 4" galvanized 16 ga. studs, as indicated on the drawings.
- B. For interior non-load bearing wall use 4", 18 ga. studs.
- C. All studs shall be punched for mechanical or electrical chaseways at minimum spacing of 24".

2.3 ACCESSORIES:

- A. Minimum gauge of bridging, bracing and tracks shall be 20 gauge.
- B. All material for exterior walls shall be galvanized.
- C. Provide self-drilling, self tapping screws for steel connections.
- D. Provide welding materials as necessary.
- E. Provide power driven anchors for securing track.
- F. Provide self drilling, self tapping screws for attaching sheathing and dry wall.

PART 3 – EXECUTION

3.1 FABRICATION:

- A. Pre-assemble into panels, prior to erection. Make panels square and attach components in manner to prevent racking.
- B. Cut framing components squarely for attachment to perpendicular members, or as required for angular fit against abutting members, and hold positively in place until properly fastened.
- C. Install axially loaded studs in manner to assure stud ends are positioned against inside track web, prior to stud and track attachment.
- D. Provide double studs at jambs of all framed door, window, and other major openings. Provide double studs, properly spaced for finish attachment at all corners and intersections.
- E. Provide all framed openings up to 8' wide with flat runners at head and sill of openings and jack studs between.

LIGHT GAUGE FRAMING

05400

Page 2

- F. Insulate between all double studs and headers in exterior walls which will not be accessible after fabrication.
- G. Fabricate all panels with continuous single runners top and bottom with runners specifically made to accept studs, and no splices within the panel.
- H. Use 16" on center maximum stud spacing for exterior non-load bearing walls.
- I. Use 16" on center maximum stud spacing for all interior non-load bearing walls. (4" studs).
- J. Install horizontal bridging to provide resistance to both minor axis bending and rotation, at maximum spacing of 4'-0" on center.
- K. Fabricate all fascia and soffit framing as detailed.
- L. Do all cutting with radial arm saw or an abrasive cut-off (chop saw) with reinforced abrasive blade, or a band saw. For small quantities, use a Skil Saw with reinforced abrasive cut-off blade, a band saw, or a power hack saw. For welding, use a wire feed type welder or 3/32" or 1/8" AWS type 6013 or 7014 rods with welding heat of 60-110 amperes to suit gauge of material and fit of parts.
- M. Fasten components with self-drilling screws or welding of sufficient size to assure strength of connections. No wire tying will be permitted.

3.2 ERECTION:

- A. Handle and lift prefabricated panels in such manner to avoid distortion of any member. Provide uniform and level bearing support for all panels.
- B. Securely anchor tracks to foundation walls or slabs, using power driven fasteners at maximum spacing of 24".
- C. At track butt joints, securely anchor abutting pieces to common element, or butt weld and splice together.
- D. Plumb all studs and jack studs and securely attach to flanges or webs of top and bottom tracks.
- E. Frame openings, provide insulation at doublers, provide bridging and diagonal bracing and erect fascia and soffit framing, all as specified under "Fabrication" above.
- F. Provide temporary bracing as required until erection is complete.
- G. Provide additional horizontal framing, bracing, blocking or other accessories as needed for pipe racks, toilet accessories and railings.

LIGHT GAUGE FRAMING

05400

Page 3

- H. Any interior walls or partitions supporting equipment and exceeding 10'-0" in length between corners or intersecting walls shall be braced by additional framing members of proper size and in a horizontal plane, welded to the top tracks, and set at diagonal or perpendicular to walls being braced; as an alternate, bracing may be additional vertical members extended and welded to steel framing above, spaced at every third stud, lapping studs a minimum of 6" and welded in place. Bracing methods must be coordinated so as not to interfere with ductwork, piping, conduit, or equipment of other trades.
- I. Entire installation must be in strict accordance with manufacturer's printed instructions.

END OF SECTION

**SECTION 05521
HANDRAILS AND RAILINGS**

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Furnish and install aluminum pipe railings and components.

1.2 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS:

- A. Furnish anchors to be cast in concrete to SECTION 03300: CAST-IN-PLACE CONCRETE.
- B. Furnish anchors for embedding in masonry to SECTION 04300: MASONRY UNIT.

1.3 SUBMITTALS:

- A. Submit shop drawings and product data under provisions of Division 1.
- B. Indicate component details, materials, finishes, connection and joining methods, and the relationship to adjoining work.
- C. Submit manufacturer's installation instructions under provisions of Division 1.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces.
- B. Storage on Site:
 - 1. Store material in a location and in a manner to avoid damage. Stacking shall be done in a way which will prevent bending.
 - 2. Store material in a clean, dry location away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin, or polyethylene sheeting in a manner that will permit circulation of air inside the covering.
- C. Keep handling on site to a minimum. Exercise particular care to avoid damage to finishes of material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER:

- A. Railing pipe and components shall be as manufactured by JULIUS BLUM & CO., INC., of Carlstadt, New Jersey for its CONNECTORAIL® System.

2.2 MATERIALS AND FINISHES:

A. Aluminum

1. Extruded Seamless Pipe: Alloy 6063-T52
2. Drawn Seamless Pipe: Alloy 6063-T832
3. Reinforcing Bars: Alloy 6061-T6
4. Extruded Bars & Shapes: Alloy 6063-T52
5. Castings: Almag 35
6. Finish: refer to NAAMM Metal Finishes Manual.

2.3 RAILING SYSTEM:

A. Material shall conform to 2.2.6 and be finished in accordance with 2.2.6.

B. Railing system shall be permanently anchored.

C. Rails and Posts

1. Fabricate rails and posts from anodized aluminum, 6063-T52 with nominal size of 1-1/2 inches 1.900 inches outside diameter Schedule 40, .140 inch wall.

D. Fittings

1. Fittings shall be of wrought material of aluminum. Tee-fittings and elbows which are fabricated from more than one piece shall be of welded construction with no weld marks visible when the fitting is installed.

E. Connector Sleeves

1. Internal connector sleeves shall be of extruded aluminum.

F. Mounting Flanges

1. Floor flanges shall be of cast aluminum.
2. Heavy duty floor flange shall be of cast aluminum with a solid aluminum reinforcing bar.

G. Toe Board

2.4 FASTENERS:

A. Mechanical Fasteners:

1. RHMS 1/4" - 20 x 1" SEMS with lock washer, stainless steel.
2. 1/4" - 20 x 2-1/2" RHMS with lock nut, stainless steel.
3. A25-140 internally threaded tubular rivets, aluminum.
4. 3/8" x 3" sleeve anchor bolt, cadmium plated steel.
5. Machine screws used to mount fascia flanges to stringers shall be of stainless steel, 3/8 inch diameter.

B. Adhesive: Scotch-Weld epoxy adhesive, Catalog No. 3M EC-2216 B/A Clear Amber.

C. Cement: Hydraulic, ASTM C 595, factory prepared with accelerant.

HANDRAILS AND RAILINGS

05521

Page 2

2.5 FABRICATION:

- A. Form rail-to-end post connections and all changes in rail direction by mitre elbows.
- B. Cut material square and remove burrs from all exposed edges, with no chamfer.
- C. Make exposed joints butt tight and flush.
- D. Close exposed ends of pipe by use of appropriate end cap.
- E. For posts set in concrete, furnish matching sleeves or inserts not less than 5 inches long.
- F. Locate intermediate rails midway between top rail and finished floor or center line of tread.
- G. Verify dimensions on site prior to shop fabrication.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Supply items to be cast in concrete.

3.2 DISSIMILAR METALS:

- A. When aluminum components come into contact with dissimilar metals, surfaces shall be kept from direct contact by painting the dissimilar metal with asphalt paint.
- B. When aluminum components come into contact with cement or lime mortar, exposed aluminum surfaces shall be painted with water-white methacrylate lacquer.

3.3 INSTALLATION:

- A. Install in accordance with shop drawings and manufacturer's instructions.
- B. Erect work square and level, free from distortion or defects detrimental to appearance or performance.

3.4 CLEANING:

- A. As installation is completed, wash thoroughly using clean water and soap; rinse with clean water.
- B. Do not use acid solution, steel wool or other harsh abrasives.
- C. If stain remains after washing, remove finish and restore in accordance with NAAMM Metal Finishes Manual. Finish must not be removed from anodized aluminum. Reanodizing can only be done by removing railing and returning it to the anodizer.

3.5 REPAIR OF DEFECTIVE WORK:

Remove stained or otherwise defective work and replace with material that meets specification requirements.

END OF SECTION

HANDRAILS AND RAILINGS

05521

Page 4

**SECTION 06100
ROUGH CARPENTRY**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. The Contractor shall coordinate with other contractors to assure proper incorporation of and provisions for items to be furnished or installed by them.
- B. Work requiring coordination includes temporary enclosures, barricades, project sign, concrete form work, roofing work and painting.

1.2 PRODUCT HANDLING:

- A. Deliver lumber to the site, store carefully off the ground in such manner as to insure proper drainage, ventilation, and protection from the weather as approved by the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Furnish all rough hardware including shoes, dogs, spikes, bolts, stirrups, joist hangers, nails, lag screws, lagging bolts and anchors required for proper execution of the work. Bolts shall be minimum of 1/4" diameter.
- B. Pressure treat all framing lumber, grounds, furring strips, blocking, plates, and all lumber in contact with ground, or masonry in accordance with Federal Specification TT-W-571.
- C. Use kiln dried or air dried lumber with moisture content not in excess of 19%.
- D. Conform to the applicable current published standards of the following associations or agencies:
 - 1. ASTM D-245
 - 2. Western Wood Products Association
 - 3. California Redwood Association
 - 4. American Plywood Association
 - 5. U.S. Commercial Standards CS-45 or CS-122
- E. For framing lumber use Douglas Fir or Larch, Select Structural Grade.
- F. For plates, blocking, grounds, and furring use Douglas Fir or Larch, Select Structural Grade.
- G. For roof sheathing use 5/8" Species Group 1, Exposure 1-APA.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Prime paint all rough framing, blocking, grounds, and furring before installation.
- B. Back and edge prime plywood before installation.

3.2 INSTALLATION:

- A. Install all rough hardware required for proper execution of the work in accordance with the function to be performed.
- B. Attach plates, sills, blocking and other framing to masonry, concrete or steel with bolts spaced not over 4'-0" on centers.
- C. Closely fit all framing lumber and rough work setting accurately to required lines and level, and securing rigidly in place. Do nailing and spiking in thorough manner, using nails and spikes of proper size as per the recommended nailing schedule of the NLMA.
- D. Install all plywood roof sheathing in accordance with American Plywood Association recommendations.

END OF SECTION

**SECTION 07200
FIBERGLAS BATT INSULATION**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provisions for items to be furnished or installed by them.
- B. Work requiring coordination includes light gauge framing, mechanical and electrical work.

1.2 SUBMITTALS:

- A. Submit samples of batt insulation for approval.
- B. Deliver no material until samples have been approved.

1.3 PRODUCT HANDLING:

- A. Properly store all materials and protect from moisture and damage until installed.
- B. Remove all damaged material from site, do not use damaged materials.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. For exterior wall insulation use 3-1/2" thick X 16" X 96" rolled batts FS-25 Fiberglas insulation having R value of 11 as manufactured by Owens-Corning or approved equal.
- B. For sound insulation in walls use 3-1/2" X 16" X 96" unfaced rolled batts R-11 Noise Barrier, Fiberglas insulation.
- C. For office ceiling insulation use 6-1/4" X 16" X 96" Kraft faced Fiberglas batt insulation with an R value of 19, complying with ASTM C665, Type II, Class C, as manufactured by Owens-Corning or approved equal.

PART 3 - EXECUTION:

3.1 PREPARATION:

- A. Coordinate installation of batt insulation with light gauge framing.

3.2 INSTALLATION:

- A. Install batt insulation to full wall height in all exterior wall stud spaces, in strict accordance with manufacturer's printed instructions. Wire in place where no dry wall finish is called for directly over insulation on interior stud face.

- B. Install sound insulation to full wall height in all toilet room walls throughout the structure.

3.3 CLEANING:

- A. Remove all trash and surplus material from the site.

END OF SECTION

FIBERGLASS BATT INSULATION

07200

Page 2

**SECTION 07210
SPRAYED-ON INSULATION**

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. Work under this section consists of the furnishing of all labor, materials and equipment necessary for and incidental to the complete and proper installation of all sprayed insulation as shown on the drawings or specified herein, and in accordance with the Contract Documents.
- B. The material and installation shall conform to the applicable building code requirements, and the requirements of authorities having jurisdiction.

1.2 RELATED WORK:

- A. Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.
- B. All roof penetrations shall be made prior to insulation installation. Vertical piping for roof penetrations shall be installed and protected.
- C. Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.

1.3 QUALITY ASSURANCE:

- A. Sprayed insulation work shall be performed by a firm having experience in the installation of materials similar to those specified herein on projects comparable to this project.
- B. Before proceeding with insulation work, approvals of the proposed materials and installation methods shall be obtained from the Engineer and other necessary authorities.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Materials shall be delivered to the project site in the manufacturer's unopened packages.
- B. Damaged packages found unsuitable for use shall be rejected and removed from the job site.

1.5 ENVIRONMENTAL CONDITIONS:

- A. CAFCO® HEAT - SHIELD products should not be installed when ambient or surface temperatures may fall below 40°F (40° C) or rise above 155° F (68° C) during the application or drying processes.
- B. If necessary for job progress, provide enclosures with heat to maintain temperatures.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. The sprayed insulation shall be asbestos-free HEAT SHIELD (System B) products as supplied by ISOLATEK INTERNATIONAL.
- B. Insulation materials shall be free of vermiculite and certified asbestos-free.

2.2 PRODUCT REQUIREMENTS:

- A. The material shall meet the requirements of Federal Specification SS-S-111 C, Type II.
- B. The sprayed insulation shall have a fire hazard classification in accordance with ASTM E84, exhibiting the following characteristics:

Flame Spread.....0
Smoke Developed.....10

- C. The material shall be rated noncombustible as tested per ASTM E 136-82.
- D. Insulating material shall yield a "k" factor of .26 at 75°F (0.037W/mK at 24°C).

PART 3 - EXECUTION

3.1 SURFACE PREPARATION:

- A. All surfaces to receive sprayed insulation shall be thoroughly cleaned so that they are free of mill scale, dirt, grime, oil, grease, paints/primers, loose rust or other materials which would impair proper bonding.
- B. Any required cleaning shall be accomplished just prior to the application of sprayed insulation.
- C. Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of sprayed thermal insulation.
- D. The installation of ducts, piping, (except roof penetrations) conduits or other suspended equipment shall not take place until the application of sprayed thermal insulation is complete in an area.
- E. CAFCO BOND-SEAL must be applied as an adhesive, to all substrates, prior to application of HEAT-SHIELD AF®

3.2 AREA PREPARATION:

- A. Provide all necessary measures for protection of the general public and for prevention of air pollution. Enclose exterior opening at areas where spray application is in progress.
- B. Provide masking, drop cloths or other satisfactory coverings for all materials which are not to receive insulation so as to prevent damage from overspray.

SPRAYED-ON INSULATION

07210

Page 2

3.3 APPLICATION:

- A. The insulation contractor shall apply a minimum 2" thickness Heat Shield (System B) over the entire primary treatment room ceiling. This application shall include 24" of coverage at the top of all treatment room exterior walls.
- B. Equipment, mixing and application shall be in accordance with the written application instructions.
- C. Insulation shall not be applied to floor decks until concrete work on that deck is completed.
- D. Insulation shall not be applied to roof decks until roofing work is complete and the roof is tight.

3.4 CLEANING:

- A. After completion of insulation work in an area, equipment shall be removed and walls, floors, ceilings and other surfaces not to be sprayed shall be cleaned of all deposits of insulation materials.

END OF SECTION

SPRAYED-ON INSULATION

07210

Page 3

SECTION 07620
SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section specifies the sheet metal flashing and trim required as part of the Site Preparation Work and includes the following:
 - 1. Exposed trim, gravel stops, and fasciae.
 - 2. Copings.
 - 3. Metal flashing.

1.2 PERFORMANCE REQUIREMENTS:

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.
- B. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the following wind zone:
 - 1. Wind Zone 2: Wind pressures of 31 to 45 psf (1.48 to 2.15 kPa).

1.3 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data including material and finish data.
- C. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.5 PROJECT CONDITIONS:

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS:

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
1. Mill-Finish Alclad Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alclad 3003-H14, with a minimum thickness of 0.040 inch (1.0 mm), unless otherwise indicated.
 2. Mill-Finish Aluminum Sheet: ASTM B 209 (ASTM B 209M), 3003-H14, with a minimum thickness of 0.040 inch (1.0 mm), unless otherwise indicated.
 3. Factory-Painted Aluminum Sheet: ASTM B 209 (ASTM B 209M), 3003-H14, with a minimum thickness of 0.040 inch (1.0 mm), unless otherwise indicated.
 4. Extruded Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T52, with a minimum thickness of 0.080 inch (2.0 mm) for primary legs of extrusions that are anodized, unless otherwise indicated.
- B. Stainless-Steel Sheet: ASTM A 167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch (0.5 mm) thick, unless otherwise indicated.

2.2 CONCEALED THROUGH-WALL SHEET METAL FLASHING:

- A. Material: Fabricate from the following metal:
1. Stainless Steel: 0.0156 inch (0.4 mm) thick.
 2. Fabricate through-wall metal flashings embedded in masonry as follows:
 - a. With ribs formed in dovetail pattern at 3-inch (75-mm) intervals along length of flashing to provide a 3-way integral mortar bond and weep-hole drainage.
 - b. With ribs formed in sawtooth pattern at 3-inch (75-mm) intervals along length of flashing to provide a 3-way integral mortar bond and weep-hole drainage.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- C. Products: Subject to compliance with requirements, provide one of the following:
1. Cheney Flashing (Dovetail); Cheney Flashing Company, Inc.
 2. Cheney Flashing (Sawtooth); Cheney Flashing Company, Inc.
 3. Keystone Three-Way Interlocking Thruwall Flashing; Keystone Flashing Co.

2.3 MISCELLANEOUS MATERIALS AND ACCESSORIES:

- A. Solder for Stainless Steel: ASTM B 32, Grade Sn60, used with an acid flux of type recommended by stainless-steel sheet manufacturer; use a noncorrosive rosin flux over tinned surfaces.
- B. Stainless-Steel Welding Rods: Type recommended by stainless-steel sheet manufacturer for type of metal sheets furnished.

- C. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- D. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- E. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- F. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- G. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- H. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.

2.4 FABRICATION, GENERAL:

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- G. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with mastic or other permanent separation as recommended by manufacturer.
- H. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- I. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.

1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS:

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from the following material:
 1. Aluminum: 0.050 inch (1.2 mm) thick.
 2. Stainless Steel: 0.0187 inch (0.5 mm) thick.
- C. Copings: Fabricate from the following material:
 1. Aluminum: 0.050 inch (1.2 mm) thick.
 2. Stainless Steel: 0.0250 inch (0.65 mm) thick.
- D. Base Flashing: Fabricate from the following material:
 1. Aluminum: 0.040 inch (1.0 mm) thick.
 2. Stainless Steel: 0.0187 inch (0.5 mm) thick.
- E. Drip Edges: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.
 2. Stainless Steel: 0.0156 inch (0.4 mm) thick.
- F. Eave Flashing: Fabricate from the following material:
 1. Aluminum: 0.0320 inch (0.8 mm) thick.
 2. Stainless Steel: 0.0156 inch (0.4 mm) thick.
- G. Equipment Support Flashing: Fabricate from the following material:
 1. Stainless Steel: 0.0187 inch (0.5 mm) thick.
- H. Roof-Penetration Flashing: Fabricate from the following material:
 1. Stainless Steel: 0.0187 inch (0.5 mm) thick.

2.6 ALUMINUM EXTRUSION FABRICATIONS:

- A. Aluminum Extrusion Units: Fabricate extruded-aluminum running units with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

2.7 ALUMINUM FINISHES:

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.

- B. High-Performance Organic Coating Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.
1. Fluoropolymer 2-Coat Coating System: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2.
- a. Color and Gloss: As indicated by manufacturer's color and gloss designations.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION:

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Roof-Edge Flashings: Secure metal flashings at roof edges according to FM Loss Prevention Data Sheet 1-49 for specified wind zone.
- D. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).
- E. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except where pretinned surface would show in finished Work.
1. Do not solder the following metals:

- a. Aluminum.
 - 2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
 - F. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
 - G. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - H. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - I. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with mastic or other permanent separation as recommended by manufacturer.
 - 1. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
 - J. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.
 - K. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
 - 1. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.
- 3.3 CLEANING AND PROTECTION:
- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
 - B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION

**SECTION 07900
CAULKING**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provisions for items to be furnished or installed by them.
- B. Provide caulking at all locations as follows:
 - 1. Outside perimeter of all window frames, door frames, louvers, grilles, and other framed openings in walls.
 - 2. Inside perimeter of all window frames, door frames, louvers, grilles, and other framed openings in masonry walls.
 - 3. At all control joints and expansion joints.
 - 4. At all joints where wood or metal abut masonry, plaster or dry wall.
 - 5. At all exterior soffit joints.
 - 6. At all sill and coping joints.
 - 7. At edges of slabs abutting building walls.

1.2 SUBMITTALS:

- A. Submit for approval samples of each type of caulking.
- B. Submit color charts for selection of colors by the Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. For all caulking at exterior, and at exterior and interior expansion joints use a polysulfide elastomer, similar to Synthacalk GC-9 manufactured by Pecora Chemical Corp., 7000 Sealant manufactured by Products Research and Chemical Corporation, or Lasto-Meric manufactured by Tremco Manufacturing Company or approved equal.
- B. For caulking at all interior use, except as specified above or otherwise noted on drawings, use a butyl type, similar to Sealant BC-158 manufactured by Pecora Chemical Corporation, or Butyl Sealant manufactured by Tremco Manufacturing Company or approved equal.
- C. Use natural gray color for all polysulfide elastomeric caulking. Match all butyl caulking to the color of materials for which it is used.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Rake out joints to receive butyl caulking compound 3/4 inch deep, and in properly manner to receive caulking before proceeding. Where spaces to be caulked are deeper than 3/4 inch, pack with picked oakum or caulking cotton to within 3/4 inch of the frame surface, and fill the remaining space with caulking compound. Thoroughly clean spaces of loose material by the use of air hose under pressure. Where masonry or other absorbent surface comes in contact with caulking compound, apply an approved colorless sealer to exposed surfaces of joint prior to applying the caulking compound.
- B. Prime and prepare joints to receive polysulfide elastomeric caulking compound in accordance with the current printed directions of the manufacturer. Fill deep joints to within 3/4 inch of the surface, using polystyrene strip. Provide masking where necessary, and remove after caulking has been installed. Complete all exterior caulking before any silicone waterproofing is applied.

3.2 APPLICATION:

- A. Force all caulking into place by means of a pneumatic pressure gun using pressure recommended by the manufacturer. Fill the entire void and finish smooth and flush with face of adjacent surface. Provide windproof, waterproof, weatherproof and dustproof application by the manufacturer or by an installation contractor authorized and approved by him; done under the direction of a mechanic with not less than five (5) years experience in responsible charge of similar work, in strict agreement with the manufacturer's latest specifications. Point all joints as directed. Remove all excess caulking from adjacent surfaces in strict accordance with the manufacturer's instruction. Hardening, cracking, crumbling, melting, shrinking, running, staining, or admitting of water will not be acceptable.

3.3 CLEANING:

- A. Remove all trash and surplus materials from the site.
- B. Clean all adjacent surfaces of all stains resulting from caulking work.

END OF SECTION

**SECTION 07905
PAVING JOINT SEALANTS**

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section specifies joint sealants for the following:
 - 1. Expansion and contraction joints within portland cement concrete paving.
 - 2. Joints between portland cement concrete paving and asphalt paving.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS:

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.
- C. Samples for verification purposes of each type and color of joint sealant required.
- D. Certificates from manufacturers of joint sealants attesting that their products comply with specification requirements and are suitable for the use indicated.

1.3 QUALITY ASSURANCE:

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Single Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS:

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer or below 40 deg F (4 deg C).
 - 3. When joint substrates are wet.

- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL:

- A. Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealants to comply with the following:
 - 1. Match colors indicated by reference to manufacturer's standard designations.

2.2 COLD-APPLIED JOINT SEALANTS:

- A. Silicone Sealant for Concrete: One-part, low-modulus, neutral-cure silicone sealant complying with ASTM C 920 for Type S, Grade as indicated below, Class 25, and as follows:
 - 1. Use Related to Exposure (As Recommended by Manufacturer): Use T.
 - 2. Uses Related to Joint Substrates: Uses M and, as applicable to joint substrates of concrete highways, O.
 - 3. Grade P for joints in horizontal paved surfaces.
 - 4. Grade NS for vertical and other joints where installation of a Grade P (self-leveling) sealant would result in sealant flowing out of joint.
- B. Silicone Sealant for Concrete and Asphalt: One-part, low-modulus, neutral-cure silicone sealant complying with ASTM C 920, Type S, Grade P, Class 25, and Uses T, M, and as applicable to joints with concrete and asphalt substrates.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Grade P Silicone Sealant for Concrete:
 - a. "Roadsaver Silicone-SL," Crafcro Inc.
 - b. "Dow Corning 888-SL," Dow Corning Corp.
 - 2. Grade NS Silicone Sealant for Concrete:
 - a. "Roadsaver Silicone," Crafcro Inc.
 - b. "Dow Corning 888," Dow Corning Corp.
 - 3. Silicone Sealant for Concrete and Asphalt:
 - a. "Dow Corning 890-SL," Dow Corning Corp.

2.3 HOT-APPLIED JOINT SEALANTS:

- A. Elastomeric Sealant for Concrete: One-part formulation complying with ASTM D 3406.
- B. Sealant for Concrete and Asphalt: One-part formulation complying with ASTM D 3405.
- C. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Elastomeric Sealant for Concrete:

- a. "Product #9012," Koch Materials Co.
- 2. Sealant for Concrete and Asphalt:
 - a. "ROADSAVER 221," Crafc0 Inc.
 - b. "Product #9005," Koch Materials Co.
 - c. "Product #9030," Koch Materials Co.
 - d. "SEALTIGHT HI-SPEC," W.R. Meadows, Inc.

2.4 JOINT SEALANT BACKING:

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Backer Rods for Cold-Applied Sealants: Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible, plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and nonoutgassing in unruptured state.
 - 2. Proprietary, reticulated, closed-cell polymeric foam, nonoutgassing, with a density of 2.5 pcf (40 kg/cu m) and tensile strength of 35 psi (240 kPa) per ASTM D 1623, and with water absorption less than 0.02 g/cc per ASTM C 1083.
 - 3. Either material indicated above.
- C. Backer Rods for Hot-Applied Sealants: Crosslinked, closed-cell polyolefin foam or polyethylene foam, nonoutgassing, nonstaining, and capable of withstanding high temperatures of hot-applied joint sealants.
 - 1. Available Products: Subject to compliance with requirements, backer rods for hot-applied sealants that may be incorporated in the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. "HBR XL," Applied Extrusion Technologies., Inc.
 - b. "SEALTIGHT CERA-ROD," W.R. Meadows, Inc.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.5 MISCELLANEOUS MATERIALS:

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. **Surface Cleaning of Joints:** Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer.
- B. **Joint Priming:** Prime joint substrates where indicated or where recommended by joint sealant manufacturer based on prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS:

- A. **General:** Comply with joint sealant manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. **Elastomeric Sealant Installation Standard:** Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. **Installation of Sealant Backings:** Install sealant backings to comply with the following requirements:
 - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - a. Do not leave gaps between ends of joint fillers.
 - b. Do not stretch, twist, puncture, or tear joint fillers.
 - c. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.
 - 2. Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.
- D. **Installation of Sealants:** Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.
- E. **Tooling of Nonsag Sealants:** Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
- F. **Provide joint configuration to comply with recommendations of sealant manufacturer unless otherwise indicated.**
- G. **Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.**

3.4 CLEANING:

- A. **Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.**

3.5 PROTECTION:

- A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

END OF SECTION

**SECTION 08100
METAL DOORS AND FRAMES**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provision for items to be furnished or installed by them.
- B. Work requiring coordination includes, hardware, glass, painting and caulking.

1.2 SUBMITTALS:

- A. Submit schedule and shop drawings for approval, showing gauge, details, profiles, connections, fastening, anchors, reinforcement, and hardware locations.
- B. Provide set of approved schedule and shop drawings to hardware supplier, who will in turn furnish approved hardware schedule and necessary templates.

1.3 PRODUCT HANDLING:

- A. Crate all material securely to guard against damage in transit and handling.
- B. Store carefully on site, as packaged, in upright position, under cover, and on wood supports in manner to prevent rust or damage. Do not use unvented plastic or canvas, as this will create a humidity chamber.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Annealed, cold rolled, stretcher leveled steel.

2.2 FABRICATION:

- A. Doors
 - 1. Top and bottom channels, 16 gauge; face sheets, 18 gauge; no visible seams on faces or edges; welds 2" on center around perimeter; pre cured, odorless, self extinguishing, vermin-fungus-bacteria-moisture-mildew-rot resistant structural foam bonded to panels with thermosetting adhesive; mortised, reinforced, drilled and tapped to receive specific mortised hardware; reinforced for specific surface hardware, drilling and tapping to be done in field; 10 gauge hinge reinforcing plates, 12 gauge closer reinforcing, all other hardware reinforcing 14 gauge.
 - 2. All exposed surfaces shall be cleaned, treated with Bonderite chemical and given one baked-on shop coat of gray synthetic primer for interior doors.

Door panels and end closures manufactured of hot dip galvanized material in the 1.25

METAL DOORS AND FRAMES

08100

Page 1

oz. coating class conforming to ASTM A-525 and A-526 and Federal Specification QQ-S-775 D, Type 1, Class D (except marking); treated in the mill to assure superior prime paint adhesion, conforming to Military Specification MIL-C-490, Amendment 1, and Federal Specification TT-C-490, Grade 1 for exterior doors.

3. Where required provide Underwriters Laboratories, Inc. label with appropriate ratings for the class of openings.
4. Factory installed louvers, insert type, vision proof, inverted V-baffles with 18 gauge blades and 18 gauge welded steel frames.
5. Formed glazing strips, snap-in type (no screws), for 1/4" glass.
6. Hardware locations conforming to National Builders Hardware Association.
7. Shop Fabricate all work to required profiles by forming and welding with corners, angles and edges, straight and sharp. Fit and fabricate accurately with corners, joint, seams, and surfaces free from warp, wave, buckle or other defects.

B. Frames

1. Frames of 16 gauge combination type with integral stop and trim.
2. Head assemblies reinforced internally at each miter joint with 18 gauge channel shaped reinforcements.
3. Frames having self-aligning tabs and slots for secure locking and mitered and continuously arc welded on the frame face, and ground smooth to form a one-piece assembly.
4. Frames having one welded in floor anchor in each jamb and provided with 3 steel snap-in anchors of proper type for wall construction.
5. Frames mortised, reinforced, drilled and tapped at the factory to receive mortise hinges and strikes as specified. Plaster guards installed where applicable. Frames reinforced for specific surface hardware as required. Strike jambs punched for 3 silencers.
6. Where required provide Underwriters Laboratories, Inc. labels for the class of opening.
7. Finish: same as specified for doors.
8. Workmanship: same as specified for doors.
9. Frames conforming to CS-242-62 or PS-4-66 and as manufactured by Amweld, or approved equal.

C. Schedule

Door	Manufacturer	Door Model	Size	Frame Model
Office/Exit	Amweld Building Products, Inc.	Series 2500-G	3'-0"x6'-8"	Series 400
Office/PTR	Amweld Building Products, Inc.	Series 2500-G	3'-0"x6'-8"	Series 2600
Office/Mech.	Amweld Building Products, Inc.	Series 2500-L1	3'-0"x6'-8"	Series 2600
Office/RR	Amweld Building Products, Inc.	Series 2500-L1	2'-8"x6'-8"	Series 2600
PTR North	Amweld Building Products, Inc.	Series 2500-F	3'-0"x6'-8"	Series 400
PTR South	Amweld Building Products, Inc.	Series 2500-F	3'-0"x6'-8"	Series 400

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Erect all the metal frames plumb, square, rigid and true. Anchor floor clips in place with expansion bolts, power-driven fasteners or other approved devices. Provide all fasteners, accessories and incidentals required for installation. Brace frames as necessary until built into permanent construction. Remove bracing when no longer required.
- B. Install all the hollow metal work plumb, level, square, true and rigid. Coordinate installation with work of others as necessary.
- C. Completely grout frame voids at masonry walls.
- D. Erect frames in place as framing work progresses. Setting of frames into completed framed openings will not be permitted.

END OF SECTION

**SECTION 08300
SPECIAL DOORS**

PART 1 - GENERAL

1.1 SUMMARY:

- A. Furnish and install the following Rolling Service Doors as manufactured by Cornell Iron Works, Inc:
 - 1. Model CFW-6F (10' wide x 10' high opening)
 - 2. Model CFW-6F (8' wide x 7' high opening)
- B. Opening preparation, miscellaneous or structural metal work, access panels, finish or field painting, electrical wiring, wire, conduit, fuses and disconnect switches are not part of this section.

PART 2 - PRODUCT

2.1 MANUFACTURER:

- A. Cornell Iron Works, Inc.
Crestwood Industrial Park
Mountaintop, PA 18707
(800) 233-8366

2.2 MATERIALS:

- A. Curtain slats shall be interlocking sections designed to meet 25 psf minimum windload. Endlocks on alternate slats. Provide windlocks as required to meet design windload minimum 25 psf. Bottom Bar to be two steel angles, 2" x 2" x 1/8" minimum.
- B. Guides shall be formed of steel angles, minimum 3/16" thick. Provide windlock bars as required to meet design windload, minimum 20 psf. Attach guides to jams with not less than 3/8" steel bolts spaced not more than 30" apart.
- C. Counterbalance Shaft Assembly shall consist of steel pipe capable of supporting curtain load with maximum deflection of 0.03" per foot of width and helical torsion spring assembly designed for proper balance of door to insure that effort to operate door will not exceed 35 pounds. Ball or roller bearing to be furnished at rotating support points. Provide wheel for applying spring torque and for future adjustment.
- D. Brackets shall be steel plate not less than 3/16" thick with ball or roller bearings at rotating support points, bolted to extension of guide wall angles, support counterbalance shaft assembly and form end closures.
- E. Hoods shall be #24 gauge prime painted galvanized steel, internally reinforced to maintain rigidity and shape for wider openings.
- F. Operation shall be hand chain, 35 pounds maximum pull.

G. Weather stripping: Equip bottom bar with vinyl weatherstrip which extends into guides. Equip WeatherGuard doors with vinyl strips on guides, to seal against flat face of door curtain on Thermiser insulated doors provide vinyl guide strips to seal against inside and outside faces of door curtain. Equip hood with neoprene/rayon air baffle to close space between top of hood and curtain.

H. Furnish and install slide bolts for locking manually operated doors.

2.3 FINISHES:

A. Galvanized steel curtains to be prefinished curtain slats with a baked-on light gray polyester enamel primer.

B. Stainless steel to have a #4 finish.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install doors in accordance with Cornell Iron Works, Inc. instructions.

B. Installation shall be by authorized Cornell Iron Works, Inc. distributor or representatives.

END OF SECTION

**SECTION 08700
FINISH HARDWARE**

PART 1 - GENERAL

1.1 WORK INCLUDED:

- A. The work shall include, but not be limited to the following: Furnishing and delivering, for installation under another Section, new finish hardware for doors, including all screws, bolts and other fastening required to install the hardware.
- B. The hardware specified herein is intended to cover all necessary material required to fully complete the hardware requirements of the building. The hardware shall be figured in sufficient quantities to fill the requirements of the contract drawings even though every item necessary to do so is not herein specified, except for those items of hardware that are specifically covered under other sections of the specifications. If the hardware for any particular location is not specified herein, it shall be furnished of similar design and finish, and of quality equal to other items specified for similar locations. It shall be of suitable type and ample size and weight to perform the service required.
- C. Should it be determined that the hardware as specified in certain locations, due to detail or size of members to which the hardware is to be applied, is unsuitable, provide in lieu thereof hardware of proper type having as nearly as practicable the same operation and quality as type specified.

1.2 REQUIREMENTS OF REGULATORY AGENCIES:

- A. All hardware must be in accordance with all code and legal requirements as applicable, including labeled requirements, notwithstanding any real or apparent conflict therewith in these specifications.

1.3 SUBMITTALS:

- A. Submit complete schedule for approval before order is placed.
 - 1. This working schedule of hardware shall be of the "vertical type". Each schedule shall include a "door index" with cross reference Doors and Hardware sets. In addition, this schedule must include a vendor listing of the various manufacturers. Each group of hardware shall be assigned a hardware set number and that set number shall be the same as for the specified hardware under (HARDWARE SETS) of this portion of the specifications. In the event, due to specific detail requirements, more than one set of a specific numbered hardware set is required, they shall be suffixed with a letter using the standard alphabetical sequence (i.e. HARDWARE SET #1, HARDWARE SET #2A, HARDWARE SET #2B). Copies of this schedule shall be submitted for approval and no hardware is to be ordered or otherwise procured until this approval is received. The Contractor shall be prepared to distribute copies of the approved hardware schedule, even though they may not be required.
 - 2. All paper templates and schedules of finishing hardware shall be furnished to all parties requiring same.

3. Contractor shall consult drawings and details, scale and full size details, and relevant shop drawings and schedules which are prepared during progress of work, to the end that hardware furnished shall conform to details and requirements of materials and units to which it is to be applied and to be suitable for purpose intended.
- B. Along with hardware schedules, submit in brochure form, two (2) sets of cuts of catalog sheets illustrating each item of hardware scheduled. Numbers, finishes, and other pertinent data to be supplied.
- C. All hardware for metal frames shall be made to template. Furnish to all interested manufacturers, templates and hardware schedules in sufficient quantities for the preparation of their work to receive hardware. Templates will be required for all hardware applied to hollow metal. Where necessary for proper installation, samples shall be furnished to the manufacturer so that he may make all provisions for attachment, clearance or other requirement.
- D. Furnish to installer, special tools (3 of each type) where required for adjusting or maintaining hardware items furnished. Upon completion of installation these tools are to be turned over to the Owner.
- E. Approvals: The General Contractor is instructed that schedules submitted for approval that are not in accordance with the above procedure, will be considered incomplete and returned marked "NOT APPROVED".

1.4 QUALIFICATIONS:

- A. The hardware supplier must have, sufficient experience and organization to properly handle, detail and service the hardware in a satisfactory manner.
- B. All material shall be of first class workmanship, free from flaws, and defects. All material is to have proper quantity, size and type of screws and/or bolts necessary to apply same in a satisfactory manner, and must conform in character and finish.
- C. Change of Materials: The types and numbers of the hardware specified herein are as nearly correct as can be determined in advance of the final detail drawings. The Contractor, however, shall check all hardware specified against the approved detail drawings previously referred to and any conflicts or inconsistencies between these specified and approved drawings shall be immediately brought to the attention of the Engineer, in writing, before the hardware in question has been manufactured or otherwise procured. The Contractor shall then furnish appropriate and suitable hardware in accordance with the directions and subject to the approval of the Engineer. All changes in materials which are not reported to the Engineer as above specified shall be made with no additional cost to the Owner.
- D. The Contractor shall provide a competent representative from his organization who shall inspect and direct the method of setting, applying and adjustment of all hardware. It is not required that he remain constantly at the site, but he shall inspect all work as it progresses in the building. When requested by the Engineer, this representative shall consult with the Engineer's representative at the project site, at least twice during construction to assist or advise the Contractor in the hardware installation.

1.5 PRODUCT HANDLING:

- A. Package each item of hardware and each lockset separately in individual container, complete with necessary screws, keys, instruction and installation template for spotting mortising tools. Provide 10% additional screws for all types of hardware. Mark each container with item number corresponding to number shown on approved Hardware Schedule. Keep knobs suitably covered during construction period.
- B. The material must be furnished in such quantities and at such times so as not to delay the progress of the building. All material must be labeled or tagged for its intended use in such a manner that application will be easily understood. A working schedule of all hardware shall be furnished.
- C. The Contractor must arrange for the assembling of material before application so that same can be checked and also to enable all parties concerned to investigate discrepancies pertaining to quantity and character of material. All materials must be kept in a room under lock and key until ready for final application.
- D. The Contractor shall see that all finishing hardware shall be adequately protected from damage during the progress of the work. At completion of the building, all hardware shall be cleaned and any damaged or broken parts replaced. All hardware shall be left in perfect working order at the completion of the building.

1.6 OPERATION INSTRUCTIONS:

- A. At completion of project, provide the Owner with the following:
 - 1. Instruction sheets for all locks, door closers, floor hinges and any other special hardware items.
 - 2. All special closer and lock wrenches.
 - 3. Bitting List indicating keying layout and key change numbers.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Catalog Numbers: Unless otherwise specified, hardware numbers are taken from the catalogs of:

Butts	<u>Hager</u>
Locksets	<u>Corbin/Russwin</u>
Exit Devices	<u>Corbin/Russwin</u>
Closers	<u>Corbin/Russwin</u>
Stops & Holders	<u>Corbin/Russwin</u>
Thresholds & Gaskets	<u>Reese</u>

FINISH HARDWARE

08700

Page 3

- B. Other manufacturers: Hardware of the same types, weight and function, approved by the Engineer and as manufactured by the following manufacturers may be bid, except NO SUBSTITUTIONS on the items listed.

Butts	<u>Stanley-McKinney</u>
Closers	<u>L.C.N.</u>
Stops	<u>Glynn-Johnson</u>
Door Trim	<u>Baldwin-Brookline</u>
Thresholds	<u>Pemko, N-G</u>
Locksets	<u>Corbin</u>
Exit Devices	<u>Von Duprin</u>

Finish: Provide all hardware with US26D - US32D as noted.

- C. All other hardware items not listed by the above manufacturers must be approved, in writing, by the Engineer ten (10) days prior to bid date.
- D. Finish: Provide all hardware with US32D or US26D. Provide knurled knobs on public side of all doors giving access to mechanical rooms, electrical closets, equipment rooms, interstitial areas and roofs.
- E. Lock Design - Finish: (US26D) NZM
- F. Exit Device - Finish: (US26D) type as listed. Devices used on label doors must have UL Rating tag attached.
- G. Butts - Finish: (US26D) All hinges to be three (3) knuckle construction with pins and plugs concealed in the barrel. Ball bearing hinges to have fully concealed bearings and self-lubricating sleeves for lateral wear. Furnish all butts with Phillips Head Screws.
- H. Kickplates - Finish: (US32D) 8" X 1 1/2" less than width of door, 18 gauge (0.050"). Pairs of doors to be 1" less than width. All to be drilled and counter sunk for flush screw installation - pan head screws are not acceptable.
- I. Closers - Finish: (Alum.) Where required, provide parallel arm closers for appearance. Size as per manufacturers recommendation. Furnish where listed on schedule and on all labeled doors.
- J. Door Stops - Finish: (US26D) Furnish wall type on all doors. Where wall bumpers are not applicable, provide O. H. Stops 1670 Series. Check at job for proper types after doors are hung and as approved by the Engineer.
- K. Push Plates and Pulls - Finish (32D) - Design and type as listed.
- L. Door Holders - Finish (26D) - Type as listed on schedule
- M. Thresholds - To be continuous length of opening.
- N. Rubber Silencers - Furnish silencers as required for hollow metal frames. Three (3) each single, two (2) each pair.

FINISH HARDWARE

08700

Page 4

- O. Keying - All locks grand master keyed in one set to the existing system and supplied with construction master key system. All keys to be PLAIN BOW type, stamped "Do Not Duplicate"

Furnish: 3 - Master Keys for each required set
3 - Construction master keys
3 - Grand master keys

Furnish "Visual Key Control:" - Stamp all keys and cylinders. Final keying shall be subject to Owner's and Engineer's approval. Doors to same rooms or sections keyed alike as directed. All locks furnished with construction master key system. Each key and cylinder to be stamped with corresponding numbers.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Hardware shall fit details as furnished. Where required, apply flush bolts to edge of doors.
- B. Furnish hardware to template and with machine screws for use with steel frames.
- C. Supply all necessary template information to the various manufacturers.

3.2 CLEANING AND ADJUSTING:

- A. At completion of work, clean all hardware and replace damaged or broken parts.
- B. Leave all hardware in perfect working order.

3.3 SCHEDULE:

A. HARDWARE SCHEDULE:

<u>DOOR</u>	<u>HARDWARE SET</u>
OFFICE/EXIT	#1
OFFICE/PTR	#1
OFFICE/MECH	#2
OFFICE/RR	#3
PTR NORTH	#1
PTR SOUTH	#1

B. **HARDWARE:**

<u>HARDWARE SET #1</u>	<u>HARDWARE SET #2</u>	<u>HARDWARE SET #3</u>
1 PANIC DEVICE	1 PASSAGE LOCKSET	1 PRIVACY LOCKSET
1 CYLINDER	3 PR HINGES	3 PR HINGES
3 PR. HINGES	1 KICKPLATE	1 KICKPLATE
1 KICKPLATE		
1 CLOSER		
1 THRESHOLD		
1 WEATHERSTRIP		

END OF SECTION

FINISH HARDWARE

08700

Page 6

**SECTION 09260
GYPSUM BOARD DRY WALL**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provision for items to be furnished or installed by them.
- B. Work requiring coordination includes light gauge framing, rough carpentry, insulation and plaster, mechanical and electrical work.

1.2 ENVIRONMENTAL CONDITIONS:

- A. Maintain a uniform room temperature between 55 degrees and 70 degrees F in cold weather, during application of gypsum board, joint treatment, finishing and until completely dry.
- B. Provide adequate ventilation.
- C. Avoid direct exposure to sources of heat and drafts and take special care to prevent too rapid drying conditions caused by high temperature, low humidity draft exposure.

1.3 RELATED SECTIONS:

- A. SECTION 05400: LIGHT GAUGE FRAMING
- B. SECTION 06100: ROUGH CARPENTRY
- C. SECTION 07200: INSULATION
- D. SECTION 09980: FIBERGLASS WALL PANELS

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Gypsum wallboard shall be 1/2" thick, moisture resistant wallboard conforming to ASTM Specification C630 in 4 foot widths and 10 ft. or greater lengths, with beveled and tapered long edges.
- B. Fasteners shall be nails, screws, or staples of type as recommended by gypsum board manufacturer.
- C. Joint tape shall be coated fiber tape as recommended by the gypsum board manufacturer.
- D. Joint compound shall be a base plaster ready mix fast hardening compound as recommended by the gypsum board manufacturer and complying with ASTM C-587 and Fed. Spec. SS-P-00402B, Type VI.

- E. Corner beads, casing beads, trim and other accessories shall be of galvanized steel and as recommended by the gypsum board manufacturer.
- F. Fasteners shall be 1-1/2" Type S dry wall screws.
- G. Complete system including all components shall be from one manufacturer, Gold Bond Building Products, or approved equal.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. New partitions, bulkheads, ceilings and soffits shall be framed with light gauge steel framing with studs spaced at 16" or 24" on center, made plumb, level and true, ready to receive gypsum board, as specified under "Light Gauge Framing".
- B. Install sound attenuation blanket insulation between studs, from floor to ceiling, in all toilet room walls and other special areas where noted.

3.2 INSTALLATION:

- A. Cut boards by scoring and breaking, or by sawing, working from face side, and scribe neatly where boards meet projecting surfaces.
- B. Use maximum practical lengths to minimize end joints. Bring boards into contact but do not force. Apply first to ceilings and soffits at right angles to framing, then to walls and bulkheads.
- C. Do not align joints at openings with opening edges. Stagger end joints. Joints shall not occur at same stud on opposite sides of partitions. Provide solid backing at end joints.
- D. For fastening proceed from center of boards toward edges and ends. Set fastener heads to form dimples but not break face paper.
- E. Fasten with screws in strict accordance with the manufacturer's printed directions, 8" on center at perimeter and 12" on center in field.
- F. Butter recessed edges with plastic cement, into which embed perforated tape. Cover tape with thin coat of cement to fill joint to smooth plane. Fill fastener head depressions smoothly with plastic cement. When dry, repeat filling until joints and depressions are flush. Sand to true, even, smooth surfaces.
- G. Tightly fit end joints, tape, fill and sand level to smooth finish.
- H. Finish abutting ends at sheets by trimming away all loose material and applying a thin strip of spackle not less than 12" wide over the joint. Finish surface smoothly and blend edges into surface of wall board.
- I. Apply joint compound and tape over joints, in strict accordance with the manufacturer's printed instructions, including proper feathering to provide a uniform smooth surface ready to receive finish, using Paragraph 3.2 F method.

END OF SECTION

GYPSUM BOARD DRY WALL

09260

Page 2

**SECTION 09650
RESILIENT FLOORING**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provision for items to be furnished or installed by them.
- B. Work requiring coordination includes concrete, ceramic tile, and carpet.
- C. Coordinate work where resilient tile abuts other finishes and provide necessary edge or divider strips as required.

1.2 SUBMITTALS:

- A. Submit samples and/or color chips for color selection by the Architect.
- B. Submit manufacturer's two-year guarantee against fault in material.

1.3 PRODUCT HANDLING:

- A. Deliver all material in manufacturer's original unopened containers with brand and name clearly marked thereon.
- B. Store all materials at minimum temperature of 70 degrees F, for at least 24 hours immediately before installation.
- C. Provide maintenance instructions for Owner's use.

1.4 ENVIRONMENTAL CONDITIONS:

- A. When installing tile and base, maintain a minimum temperature of 70 degrees F in all rooms for at least 48 hours before, during and after installation.

1.5 EXTRA STOCK:

- A. Provide extra packages of each color of all resilient floor tile and rubber base types, equal to one percent of each color, pattern and type required for the entire installation and turn over to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Vinyl composition tile: 1/8" X 12" X 12" meeting the requirements of Fed. Spec. L-T-00345.
- B. Asphalt primer: thin liquid cut-back type, composed of an asphalt base and a suitable light volatile solvent made especially for use with asphalt tile and weighing approximately 10 pounds per gallon. Primer: type approved by manufacturer of asphalt tile.

- C. Underlayment: latex type approved by manufacturer of the tile.
- D. Adhesive for resilient tile: water resistant type approved by manufacturer of the tile.
- E. Rubber base: meeting applicable requirements of Fed. Spec. ZZ-T-301, face highly polished; back pattern to provide adhesion, 1/8" thick, 4" high, with rounded top, rounded exposed edge on floor lip of set-on cove base, plain color as noted on the finish or color schedules. Color: non-fading and homogeneous throughout. Rubber stair treads shall be full width and depth of treads and shall be similar to Disc-o-tile as manufactured by Musson or approved equal.
- F. Adhesive for rubber base: latex cement approved by the manufacturer of the base.
- G. Protective edging: moulded vinyl strips 1-1/4" wide, beveled to protect edge of tile. Edging to match thickness of tile and terminating in a beveled edge not more than 1/16" thick.
- H. Division strips: consisting of white bronze top member not less than 1/8" thick, rebated to receive floor tile and riveted to a non-ferrous bottom member not less than 18 gauge and not less than 1-1/4" wide and deformed to provide anchorage to concrete sub-floor.
- I. Wax: water emulsion type approved by manufacturer of the respective floor tile.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Clean all surfaces of grease, dirt, paint, loose material, and other objectionable matter. Fill small holes, cracks, and depressions in sub-floors with underlayment.
- B. Carefully examine sub-floors and wall surfaces. Report in writing to the Engineer all projections above normal plane of floor, or other conditions (except the small holes, cracks and depressions specified above to be filled) which would prevent satisfactory execution of work or endanger its permanence. Do not start installation until concrete sub-floors and wall surfaces are well cured and dry and until satisfactory conditions have been remedied. Commencement of installation shall be evidence that all conditions are satisfactory.
- C. Before installing tile, prime all concrete sub-floors on or below grade with asphalt primer, using one gallon per 100 square feet.
- D. Do not begin installation of tile until work of all other trades, including painting, has been completed.

3.2 INSTALLATION:

- A. Install all resilient flooring in strict accordance with the manufacturer's printed instructions.
- B. Provide continuous metal division strips at all points of intersection between resilient tile and non-resilient types of flooring which finish flush with resilient tile, except where thresholds are required. Cut strips to exact required lengths and deliver to the project site in sufficient time to permit anchorage into fresh concrete. Division strips at doorways shall center on the doors. Piecing of division strips will not be allowed.

- C. Install protective edging at all exposed edges of resilient tile, except where thresholds are required. Secure edging to sub-floor with latex cement. Protective edging at doorways shall center on the door.
- D. Apply thin film of adhesive and spread evenly with a notched steel trowel. Adhesive shall be tacky, but not hard or dry, when tile are laid.
- E. Lay tile with the grain running in same direction and with staggered joint pattern.
- F. Start laying tile from midpoint of long axis of room so that tile on opposite sides of room will be of equal width.
- G. Lay tile with close joints. Fit neatly into recesses and to protective edging, division strips, pipes, equipment and other abutting work. Cement securely and solidly into place. Bevel bottom of tile so that top will finish flush with protective edging. Finished surfaces shall be in a true plane and flush throughout.
- H. Install rubber base at all perimeter walls of areas with floor finish of carpet, as well as vinyl asbestos tile, all in accordance with current printed instructions of manufacturer of the base. Install base with minimum number of joints. Cement solidly in place with adhesive. All joints shall be flush and completely sealed. Fit base tightly against walls and flooring. On completion, remove all adhesive, stain and dirt and leave base in perfect condition. Apply one coat of wax and polish to a uniform sheen.
- I. Install corner guards on all external corners of interior walls in new corridors and lobbies, regardless of wall construction or finish, unless otherwise noted.

3.3 CLEANING AND PROTECTION:

- A. When tile has seated sufficiently, clean with neutral cleaner, recommended by manufacturer of tile, to remove all cement, dirt and other foreign substances. Apply two coats of wax. Polish each coat separately with machine buffer.
- B. Cover floors immediately after cleaning and waxing with reinforced kraft paper, spot cemented at seams.

3.4 ADJUSTMENTS:

- A. When directed by the Engineer, remove protection from floors and examine all tile. Apply heat to tile which have not seated to a level plane flush with surrounding tile. Roll while warm.
- B. Remove all tile which have broken corners and fracture lines. Substitute new tile, cement in place, and wax and polish to match surrounding tile.

END OF SECTION

**SECTION 09705
RESINOUS FLOORING**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

- A. Definitions: Resinous flooring includes penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments and a two-component, general service epoxy coating.
- B. Related Work

1. SECTION 03300: CAST-IN-PLACE CONCRETE

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.
- B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.
 - 1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.4 QUALITY ASSURANCE:

- A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.
- B. Pre-Installation Conference
 - 1. General Contractor shall arrange a meeting not less than thirty days prior to starting work.
 - 2. Attendance
 - a. General Contractor
 - b. Engineer/Owner's Representative
 - c. Manufacturer/Installer's Representative

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.
- B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.
- C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 90°F/16 and 32°C.

1.6 PROJECT CONDITIONS:

- A. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.
- B. Utilities, including electric, water, heat (air temperature between 60 and 90°F/16 and 32°C) and finished lighting to be supplied by General Contractor.
- C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.
- D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.7 WARRANTY:

- A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation.

PART 2 - PRODUCTS

2.1 COLORS:

- A. Colors: As selected by the Engineer from manufacturer's standard colors.

2.2 EPOXY FLOORING:

- A. Stonclad GS coated with Stonkote GS4 as manufactured by Stonhard, Inc. is a nominal 1/4" (6mm) thick system comprised of a penetrating, moisture tolerant, two-component epoxy primer, a high performance, three-component mortar consisting of epoxy primer, a high performance, three-component mortar consisting of epoxy resin, curing agent and selected, graded aggregates blended with inorganic pigments and a two-component, 100% solids, general service, epoxy coating.
 - 1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

Compressive Strength.....	10,000 psi
(ASTM C-579)	
Tensile Strength.....	1,750 psi
(ASTM C-307)	
Percent Elongation.....	0.15
(ASTM D-638)	
Flexural Strength.....	4,000 psi
(ASTM C-580)	
Hardness.....	85-90
(ASTM D-2240/Shore D Durometer)	
Bond Strength.....	>400 psi
(ASTM D-4541)	(100% concrete failure)
Indentation.....	No Indentation
(MIL-D-3134F)	
Abrasion Resistance.....	0.1 gm max. weight loss
(ASTM D-4060, Taber Abrader CS-17 wheel)	
Coefficient of Friction.....	0.6
(ASTM D-2047)	
Flexural Modulus of Elasticity.....	2.0×10^6 psi
(ASTM C-580)	
Flammability.....	Self Extinguishing
(ASTM D-635)	Extent of burning 0.25 inches max.
Thermal Coefficient of	
Linear Expansion.....	3.5×10^{-5} in/in-°C
(ASTM E-831)	
Water Absorption.....	0.2%
(ASTM C-413)	
Heat Resistance Limitation	140°F/60°C
	(for continuous exposure)
	200°F/93°C
	(for intermittent spills)
Cure Rate allow.....	6 hours for foot traffic
(at 77°F/25°C)	18 hours for light traffic
	24 hours for normal operations

2.3 JOINT SEALANT MATERIALS:

- A. Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Substrate: Concrete preparation shall be by mechanical means and include use of a scabblor, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.2 APPLICATION:

- A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.
- B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.
- C. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using stainless steel finishing trowels.
- D. Coating: Remove any surface imperfections by lightly abrading and vacuuming the floor surface. Mix, squeegee apply and backroll coating with strict adherence to manufacturer's installation procedures and coverage rates.

3.3 FIELD QUALITY CONTROL:

- A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.
- B. The Owner will engage service of an independent testing laboratory to sample materials being used on the jobsite. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.
- C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.
- D. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.4 CURING, PROTECTION AND CLEANING:

- A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.
- B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.
- C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION

**SECTION 09900
PAINTING**

PART 1 - GENERAL

1.1 RELATED WORK:

- A. Coordinate with other prime and sub-contractors to assure proper incorporation of and provision for items to be furnished or installed by them.
- B. Work requiring coordination includes:
 - 1. Painting of miscellaneous steel.
 - 2. Exposed interior masonry walls.
 - 3. Hollow metal doors, frames and associated panels, and trim.
 - 4. Access panels, registers, grilles, louvers, electrical panels and boxes, diffusers, valve boxes and similar ferrous metal equipment built into place in walls, ceilings, fascias and soffits, except those having factory baked enamel finish.
 - 5. All miscellaneous steel and iron.
 - 6. All steel lintels or other exposed supported hangers.
- C. Do not paint non-ferrous metals such as aluminum, stainless steel, copper, or metals with baked enamel factory finish.

1.2 SUBMITTALS:

- A. Submit technical data for all types of paint.
- B. Submit chips or charts for color selection by the Engineer.

1.3 PRODUCT HANDLING:

- A. Keep space for storage of equipment and materials in clean orderly condition.
- B. Keep all waste and paint rags in tightly covered metal containers. Gather up all material and dispose of at end of each working day.
- C. Mount an approved type fire extinguisher immediately outside all paint storage areas.
- D. Deliver all materials in sealed containers bearing manufacturer's brand name and label.

1.4 ENVIRONMENTAL CONDITIONS:

- A. Do no finishing or painting when temperature is below 50 degrees F or during wet atmospheric conditions or on surfaces that are not absolutely dry.

1.5 PROTECTION:

- A. Furnish and lay drop cloths in all areas where painting and finishing work is being done, and protect all other work from defacement. Promptly replace all temporary protective coverings removed too early from any part of the work and make good any damage from neglect.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Materials shall be first grade products of well known manufacturers and delivered to the building in unbroken packages bearing the brand and name of the manufacturer and subject to inspection, analysis and approvals. Ingredients shall comply with the Fed. Spec. listed below:

Turpentine	Fed. Spec. TT-T-801
Drier	Fed. Spec. TT-D-651
White Lead	Fed. Spec. TT-W-251
Zinc-Oxide (Interior Use)	Fed. Spec. TT-P-460
Aluminum Pigment	Fed. Spec. TT-P-320
Colors in Oil	Fed. Spec. TT-P-381
Shellac (Pure Gum)	Fed. Spec. TT-S-300 Type I, light body
Putty	Fed. Spec. TT-P-791, Type 1
Zinc Dust Primer	Fed. Spec. TT-P-641, Type I, Class B
Paste Wood Filler	Fed. Spec. TT-F-336

6-208 Speedhide Inhibitive Primer	Fed. Spec. TT-C-530
6-7 Speedhide Block Filler	Fed. Spec. TT-F-0010098
6-1 Speedhide Primer Sealer	Fed. Spec. TT-P-56B
6-90 Speedhide Lo-Sheen Enamel	Fed. Spec. TT-E-508
77-4 PPG Paste Wood Filler	Fed. Spec. TT-F-336B
Rez Floor and Trim Varnish	Clear Gloss Fed. Spec. TT-V-0071E
6-2 Speedhide Emulsion Sealer	Fed. Spec. TT-P-650A

- B. Paint shall be well ground and thoroughly mixed, shall not cake in the container and shall be readily broken up to a smooth uniform consistency. Colors shall be pure, non-fading pigments finely ground in linseed oil and of first grade. As work progresses, samples may be taken from the buckets in use for testing purposes.
- C. Brand names, specified hereinafter, are of PPG Industries except where other brands are specified by name and manufacturer. Brand names are specified for the purposes of establishing standards of type and quality for estimating purposes. Similar approved equal materials as manufactured by Sherwin-Williams, Pratt and Lambert, or other approved manufacturer will be acceptable, provided the submittals have been approved by the Engineer.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Inspect all surfaces to assure that they are dry and in proper condition to receive finish. Take any necessary corrective actions required before proceeding.
- B. Remove all dirt, rust, scale, cementitious materials and erection marks from metal work prior to painting, using benzine, steel wool and wire brushes if necessary. Clean and repaint damaged areas of shop prime coats with metal primer.
- C. Test all plaster and masonry surfaces for moisture content with approved type electrical moisture meter before starting painting work. Moisture content must not exceed 15%.

3.2 WORKMANSHIP:

- A. Make colors of undercoats each lighter than the succeeding coat. Colors shall be submitted and selected.
- B. Make surface finishes uniform in thickness, texture and color and free from sagging, corduroy, brush marks, and other imperfections. Make finish coats free from noticeable laps and brush marks. Sand any coat judged unsatisfactory by the Engineer and apply additional coats required to achieve satisfactory finish.
- C. Spray painting will be permitted on masonry units upon request if proper provisions are made to mask and protect adjacent surfaces.
- D. Apply all materials in strict accordance with the manufacturer's current printed instructions.

3.3 APPLICATION:

- A. Each coat must be inspected prior to application of succeeding coats.
- B. All coats must be thoroughly dry before proceeding to additional coats.
- C. In addition to prime coat, paint all exterior iron and steel with one intermediate coat and one final coat - total of 3 coats. This work includes all such items as gratings, manhole covers, grilles and similar accessories.
- E. Paint all exposed interior iron and steel work one intermediate coat and one final coat in addition to primer - total of 3 coats. This work includes doors and frames, access panels, lintels, access plates, covers and similar items.

3.4 SCHEDULE OF FINISHES:

A. Interior

- 1. Unit masonry - painted:
 - 1 coat PPG Speedhide Block Filler 6-7
 - 2 coats PPG Speedhide Lo-Sheen Enamel 6-90
- 2. Iron and steel of all types including miscellaneous metal, hollow metal doors and frames and similar items:
 - 1 coat PPG Speedhide Inhibitive Primer 6-208
 - 2 coats PPG Speedhide Lo-Sheen Enamel 6-90

Note: 1st coat not required if factory primed - spot prime abraded areas only.

Note: Use 1 coat PPG Speedhide White Galvanized Primer 6-206 for 1st coat on all galvanized metal.

Note: Sand between coats.

3. Rough Carpentry Lumber:
1 coat PPG Speedhide Exterior Primer 6-9 prior to installation on all surfaces in contact with other materials, or concealed from view after installation.
4. Plywood:
1 coat PPG Rez Primer Sealer
2 coats PPG Speedhide Lo-Sheen Enamel 6-90.
5. Exposed Drywall Surfaces:
1 coat PPG Speedhide Emulsion Sealer 6-2.
2 coats PPG Speedhide Lo-Sheen Enamel 6-90.

END OF SECTION

SECTION 09980
FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section describes the requirements for furnishing and installing fiberglass reinforced plastic panels according to manufacturer's recommendation.

1.2 SUBMITTALS:

- A. Submit in accordance with Section 01300 Submittals
 - 1. Two samples of each type of panel, each type of trim and fastener.
 - 2. Shop Drawings: Indicate the location and dimension of joints and fastener attachments.
 - 3. Installation Guide #6211.

1.3 QUALITY ASSURANCE:

- A. Provide panels and molding only from the manufacturer specified to ensure warranty and color harmonization of accessories.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Delivery of Materials: Package sheets on skids or pallets for shipment to project site.
- B. Storage of Materials: Store panels in a dry place at the project site.
- C. Handling: Remove foreign matter from face of panel by use of a soft bristle brush, avoiding abrasive action.

1.5 PROJECT CONDITIONS:

- A. Installation shall not begin until building is enclosed, permanent heating and cooling equipment is in operation, and residual moisture from plaster, concrete or terrazzo work has dissipated.
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
- C. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Class III [C] Interior Finish. Wall panels shall be KEMLITE Glasbord with Surfaseal fiberglass reinforced plastic panels as manufactured by KEMLITE COMPANY, Joliet, Illinois, U.S.A. Phone: 1-800-435-0080 or 1-815-467-8600, Fax: 1-815-467-8666.

1. WALL PANELS

Finish, thickness and color to be:

- a. embossed .09" (2.3mm) Glasbord-P with Surfaseal
color: 85 white

Alternate products shall meet or exceed the following Glasbord properties:

- 1. Independent laboratory ASTM E-84 testing.
- 2. Class C Flame Spread of 200 or less, Smoke Developed of 450 or lower per ASTM E-84 latest version.
- 3. Barcol Hardness (scratch resistance) per ASTM D-2583 of:
42 for embossed .09" (2.3mm) Glasbord-P
55 for embossed .12" (3.0mm) Glasbord-PWI
55 for smooth .075" (1.9mm) Glasbord-PSI
60 for embossed .10" (2.5mm) Glasbord-CGI
- 4. Panels will exhibit no more than a 0.038% weight loss after a 25 cycle Taber Abrasion Test.
- 5. Gardner Impact Strength of 16 in./lbs. (19cm/kg) for Glasbord-P and Glasbord-CGI, and 18 in./lbs. (21 cm/kg) for Glasbord PSI per ASTM D-3029.
- 6. Meets USDA/FSIS Requirements.
- 7. ICBO Report Number 4583.

3.1 PREPARATION:

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
- B. Do not begin installation until backup surfaces are put into satisfactory condition.

3.2 APPLICATION:

- A. Do all cutting with carbide tipped saw blades or drill bits, or cut with snips.
- B. Install panels with manufacturer's recommended gap for panel field and corner joints.
- C. Fastener holes in the panels must be predrilled 1/8" (3.2 mm) oversize.
- D. For application of adhesive, follow adhesive manufacturer's recommendation.
- E. Using products acceptable to manufacturer, install the frp panel system in accordance with panel manufacturer's printed instructions. Installation Guide #6211.

3.3 CLEANING:

- A. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

END OF SECTION

**SECTION 15470
SEWAGE LIFT STATION**

PART 1 - GENERAL:

1.1 SCOPE:

This Section specifies the sewage lift station for the lavatory which shall be installed in the Main Treatment Room.

1.2 APPLICABLE STANDARDS:

Equipment shall comply with all ANSI, ASTM, AWWA, AFI, ASME and all other applicable Federal, State and Municipal Codes, including revisions to the date of Contract.

1.3 GENERAL REQUIREMENTS:

- A. Standard Products: Materials and equipment shall be the standard products of a manufacturer regularly engaged in, and with a successful history of the manufacture of the products and shall essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening. Equipment shall be supported by a service organization that is reasonably convenient to the site, as determined by the Engineer.
- B. Nameplates: Lift stations shall have the manufacturer's name, address, type or style number, and model or serial number secured to the system.
- C. Verification of Dimensions: The Contractor shall become familiar with all details of the Work, verify all dimensions in the field, and shall advise the Engineer of any discrepancies before performing the Work.

1.4 SUBMITTALS:

- A. Shop Drawings to be submitted shall consist of: a complete list of equipment and materials, including manufacturer's technical literature; performance charts and curves; catalog cuts; and installation instructions. Shop drawings shall show all principal dimensions and all other information necessary to clearly identify the construction and operation of the lift station. Drawings shall show the proposed anchorage and layout of equipment and appurtenances, and equipment relationship to other parts of the Work, including clearances for maintenance and operation.

1.5 MANUFACTURER'S SERVICES:

- A. Services of a manufacturer's representative who is experienced in the installation, adjustment and operation of the equipment shall be provided. The representative shall supervise the installation, adjustment, and testing of the equipment.

1.6 DELIVERY AND STORAGE:

- A. All equipment delivered and placed in storage at the site shall be stored with protection from weather, humidity and temperature variation, dirt and dust, or other contaminants.

PART 2 - PRODUCTS:

2.1 GENERAL:

- A. The Contractor shall furnish and install a sewage lift station as detailed on the applicable Contract Drawings and defined herein. The manufacturer of the lift station shall be ABS Pumps, Inc. of Meridan, Connecticut or approved equal.

2.2 GRINDER PUMP:

- A. The Contractor shall furnish and install one Model V2 ABS PIRANHA Grinder Pump to deliver 40 USGPM against a total head of 35 feet. The motor shall be 2 HP, 3450 RPM connected for operation on a 460 volt, 60 HZ, 3 phase service. The motor shall be an integral part of the pumping unit. The pump discharge size shall be 1-¼ inches.
- B. The grinder unit shall be capable of shearing and reducing to a fine slurry all material normally found in domestic and commercial sewage such as sanitary napkins, disposable diapers, cloth diapers, wash rags, wood, plastic, etc. The slurry shall be capable of freely passing through a 1-¼ inches piping system including check valves.
- C. The pump shall be of the centrifugal type with the rotating cutter mounted on the pump shaft directly against the impeller. The stationary cutter shall be mounted in an adjustable bottom plate. The bottom plate shall be cast with grooves threading outward from the center opening of the plate to the outer diameter. The impeller shall be a multiple vane centrifugal type. The cutter material shall be similar to an AISI 440C stainless steel with the addition of cobalt, vanadium, and molybdenum for superior abrasion resistance and a hardness of 58-62 Rockwell C.
- D. The common pump and motor shaft shall be 420 stainless steel supported by a heavy duty lower single row ball bearing and an upper sealed single row ball bearing, all models. The cutting elements and impeller shall be designed to keep the overhung load distance to a minimum. All fasteners shall be 304 stainless steel.
- E. Shaft Seals: Each pump shall be equipped with two seals. The lower seal (pump side) shall be of the mechanical type with silicon carbide faces. The upper seal shall be a lip type seal mounted at a slight angle to the shaft.
- F. Seal Failure Warning System: The seals shall be separated by an oil chamber. An electronic probe shall be provided in the oil chamber to detect the leakage of water. A solid-state device mounted in the pump control panel shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber the probe shall activate a warning light in the control panel.
- G. The motor shall be of the submersible type rated for 2 HP at 3450 RPM. The full load current shall not exceed 3.1 amps at 460 volts. The motor shall be FM approved for Class 1, Division 1, Group C & D locations.
- H. The motor shall be oil-filled and shall have Class "F" insulation. The rotor and stator shall be enclosed in a Type 316 stainless steel outer housing. Bi-metallic thermal switches shall be imbedded in each phase of the winding to sense high temperature. The rating of the switch shall be 120°C ± 5°C. The control current shall be connected through the bi-metallic switches so the motor is shut down should a high temperature condition exist. The switches shall be self-resetting when the motor cools. Power cable shall be rated for explosion proof environment.

2.2 BASIN:

- A. Basin shall be of molded, lay-up and spray technique, reinforced polyester resin and fiberglass construction. The basin shall have a minimum wall thickness of 3/16-inch. A 4-inch diameter inlet hub of the caulking type or O-ring seal type shall be provided, location as specified.

2.3 COVER:

- A. Basin shall have an epoxy coated steel cover with an access plate from which the Piranha V2 grinder pump, discharge pipe, and control floats are supported permitting pump, piping, and floats to be removable as a unit without disturbing the main steel cover. Integral to the access plate shall be an inspection opening permitting removal of the control floats without disturbing the access plate or main cover. Pump power cable, float cables and pump discharge shall exit the access plate through sealing grommets and an 1-1/4-inch NPT flange respectively. Access plate shall have two lifting eyes and the main cover shall have a 2-inch flanged vent.

2.4 PIPING:

- A. Discharge piping shall be 1-1/4-inch diameter galvanized steel, completely assembled to the pump and terminating at the access plate with an 1-1/4-inch NPT flange. An 1-1/4-inch diameter bronze swing check valve shall be supplied loose for field installation in the discharge line from the basin.

2.5 FLOATS:

- A. Three air-filled polypropylene float switches shall be provided for pump on/off control and high level alarm.

2.6 CONTROLS:

- A. All control elements shall be housed in a NEMA 1 steel enclosure. Control elements shall include a 2HP rated contactor, overload protection, H-O-A switch, audible alarm, start/run capacitors and start relay, seal minder, seal minder alarm with buzzer and silence switch, terminal strip and 1/2-inch to 3/4-inch knockouts mounted on the bottom of enclosure for ease of installation.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. The Contractor shall submit general installation procedures for the lift station along with an accurate time estimate for installation, and an approximate schedule for delivery and installation.
- B. The equipment installed by the Contractor shall be installed in accordance with the manufacturer's instructions after their inspection and approval, and prior to operation.
- C. Contractor shall cut concrete floor as required to install sewage lift station, and repair as necessary.

3.2 TESTING:

- A. After installation of the sewage lift station is complete, operating tests shall be carried out to assure that installation operates properly. The station and all interconnecting piping shall be tested for leaks.

Controls shall be tested to ensure that they operate correctly. If any deficiencies are revealed during any tests, such deficiencies shall be corrected and the tests shall be reconducted.

END OF SECTION

SECTION 16010
BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL:

1.1 SCOPE:

This Section includes general administrative and procedural requirements for electrical installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 1:

- A. Submittals.
- B. Coordination.
- C. Record documents.
- D. Maintenance manuals.
- E. Rough-ins.
- F. Electrical installations.
- G. Cutting and patching.

1.2 RELATED WORK:

- A. The contractor shall comply with drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this and the other sections of Division 16.

1.3 SUBMITTALS:

- A. The contractor shall follow the procedures specified in Division 1 Section "SUBMITTALS". The contractor shall increase, by the quantity listed below, the number of electrical related, product data, and samples submitted, to allow for required distribution plus two copies of each submittal required, which will be retained by the Engineer.
 - 1. Product Data: 1 additional copy of each item.
 - 2. Samples: 1 addition as set.
- B. Additional copies may be required by individual sections of these Specifications.

1.4 COORDINATION:

- A. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

1.5 RECORD DOCUMENTS:

- A. The contractor shall prepare record documents in accordance with the requirements in Division 1. In addition to the requirements specified in Division 1, indicate installed conditions for:
 - 1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and circuit breaker size and arrangements.
 - 2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

1.6 MAINTENANCE MANUALS:

- A. Prepare maintenance manuals in accordance with Division 1. In addition to the requirements specified in Division 1, include the following information for equipment items:
 1. Description of function, normal operating characteristics and limitations, and complete nomenclature and commercial numbers of replacement parts.
 2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
 3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 4. Servicing instructions and lubrication charts and schedules.

1.7 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION:

3.1 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 2 through 16 for rough-in requirements.

3.2 ELECTRICAL INSTALLATIONS:

- A. The contractor shall sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. The contractor shall comply with the following requirements:
 1. Coordinate electrical systems, equipment, and materials installation with other building components.
 2. Verify all dimensions by field measurements.
 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work.
 6. Give particular attention to large equipment requiring positioning prior to closing in the building.

BASIC ELECTRICAL REQUIREMENTS

7. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.
8. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
9. Install systems, materials, and equipment to conform with approved submittal data to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Engineer.
10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
11. The contractor shall install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

3.3 CUTTING AND PATCHING:

- A. The contractor shall perform cutting and patching in accordance with, the following requirements:
 1. The contractor shall perform cutting, fitting, and patching of electrical equipment and materials required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials in existing structures.
 - f. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer observation of concealed Work.
 2. Cut, remove, and legally dispose of selected electrical equipment, components, and materials as indicated, including but not limited to removal of electrical items indicated to be removed and items made obsolete by the new Work.
 3. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
 4. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
 5. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.
 6. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

7. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION

**SECTION 16100
RACEWAYS, BOXES, AND CABINETS**

PART 1 - GENERAL:

1.1 SCOPE:

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Raceways include the following:
 - 1. Rigid metal conduit.
 - 2. Electrical metallic tubing (EMT).
 - 3. Flexible metal conduit.
 - 4. Liquidtight flexible conduit.
 - 5. Rigid nonmetallic conduit.
 - 6. Surface raceways.
- C. Boxes, enclosures, and cabinets include the following:
 - 1. Device boxes.
 - 2. Outlet boxes.
 - 3. Pull and junction boxes.
 - 4. Cabinets and hinged cover enclosures.

1.2 RELATED WORK:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 16 Section "Wiring Devices" for devices installed in boxes and floor box service fittings.

1.3 SUBMITTALS:

- A. The contractor shall submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. The contractor shall submit product data for surface raceway, wireway and fittings, hinged cover enclosures, and cabinets.
- C. The contractor shall submit shop drawings for nonstandard boxes, enclosures, and cabinets. Include layout drawings showing components and wiring.

1.4 QUALITY ASSURANCE:

- A. The contractor must comply with NFPA 70 "National Electrical Code" for components and installation.

- B. The contractor shall provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- C. The contractor shall comply with NECA "Standard of Installation."
- D. The contractor shall coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, the contractor shall use manufacturers offering Products that may be incorporated in the Work which include, but are not limited to, the following:
- B. Subject to compliance with requirements, the contractor shall provide Products by of one of the following:
 - 1. Metal Conduit and Tubing:
 - a. Monogram Co., AFC.
 - b. Alfex Corp.
 - c. Allied Tube and Conduit, Grinnell Co.
 - d. Anamet, Inc., Anaconda Metal Hose.
 - e. Anixter Brothers, Inc.
 - f. Carol Cable Co., Inc.
 - g. Cole-Flex Corp.
 - h. Flexcon, Inc., Coleman Cable Systems, Inc.
 - i. Spiraduct, Inc.
 - j. Triangle PWC, Inc.
 - k. Wheatland Tube Co.
 - 2. Nonmetallic Tubing and Conduit:
 - a. Anamet, Inc., Anaconda Metal Hose.
 - b. Amco Corp.
 - c. Breeze-Illinois, Inc.
 - d. Can-Tex Industries, Harsco Corp.
 - e. Carlon.
 - f. Certainteed Corp, Pipe & Plastics Group.
 - g. Cole-Flex Corp.
 - h. Condux International, Electrical Products.
 - i. Electri-Flex Co.
 - j. George-Ingraham Corp.
 - k. Hubbell, Inc., Raco, Inc.

RACEWAYS, BOXES, AND CABINETS

- l. R&G Sloan Manufacturing Co., Inc.
 - m. Spiraduct, Inc.
 - n. Thomas & Betts Corp.
- 3. Conduit Bodies and Fittings:
 - a. Scott Fetzer Company, Adalet-PLM.
 - b. American Electric, Construction Materials Group.
 - c. Emerson Electric Co., Appleton Electric Co.
 - d. Carlon.
 - e. Hubbell, Inc., Killark Electric Manufacturing Co.
 - f. General Signal, O-Z/Gedney Unit.
 - g. Spring City Electrical Manufacturing Co.
- 4. Surface Metal Raceway:
 - a. Airey-Thompson Co., Inc., A-T Power Systems.
 - b. American Electric, Construction Materials Group.
 - c. Butler Manufacturing Co., Walker Division.
 - d. The Wiremold Co., Electrical Sales Division.
- 5. Surface Nonmetallic Raceway:
 - a. Anixter Brothers, Inc.
 - b. Butler Manufacturing Co., Walker Division.
 - c. Hubbell, Inc., Wiring Device Division.
 - d. JBC Enterprises, Inc., Enduro Fiberglass Systems.
 - e. Panduit Corp.
 - f. United Telecom, Premier Telecom Products, Inc.
 - g. Thermotools Co.
 - h. The Wiremold Co., Electrical Sales Division.
- 6. Boxes, Enclosures, and Cabinets:
 - a. Scott Fetzer Company, Adalet-PLM.
 - b. Butler Manufacturing Co., Walker Division.
 - c. Cooper Industries, Midwest Electric.
 - d. Electric Panelboard Co., Inc.
 - e. Erickson Electrical Equipment Co.
 - f. American Electric, FL Industries.
 - g. Hoffman Engineering Co., Federal-Hoffman, Inc.
 - h. Hubbell Inc., Killark Electric Manufacturing Co.
 - i. General Signal, O-Z/Gedney.
 - j. Parker Electrical Manufacturing Co.
 - k. Raco, Inc., Hubbell Inc.
 - l. Robroy Industries, Inc., Electrical Division.
 - m. Spring City Electrical Manufacturing Co.
 - n. Square D Co.
 - o. Thomas & Betts Corp.
 - p. Woodhead Industries, Inc., Daniel Woodhead Co.

2.2 METAL CONDUIT AND TUBING:

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Rigid Aluminum Conduit: ANSI C80.5.
- C. Electrical Metallic Tubing and Fittings: ANSI C80.3 with set-screw or compression-type fittings.
- D. Flexible Metal Conduit: Aluminum.
- E. Flexible Metal Conduit: Zinc-coated steel.
- F. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.
- G. Fittings: NEMA FB 1, compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING:

- A. Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Schedule 40 or 80 PVC.
- B. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2.4 SURFACE RACEWAY:

- A. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceway.
- B. Surface Metal Raceway: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating suitable for painting.
- C. Surface Nonmetallic Raceway: 2-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.

2.5 OUTLET AND DEVICE BOXES:

- A. Sheet Metal Boxes: NEMA OS 1.
- B. Cast Metal Boxes: NEMA FB 1, type FD, cast fer alloy box with gasketed cover.
- C. Nonmetallic Boxes: NEMA OS 2.

2.6 PULL AND JUNCTION BOXES:

- A. Small Sheet Metal Boxes: NEMA OS 1.
- B. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 CABINETS AND ENCLOSURES:

- A. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
- B. Cabinets: NEMA 250, type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. The contractor shall examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS:

- A. Outdoors: Use the following wiring methods:
 - 1. Exposed: Rigid or intermediate metal conduit.
 - 2. Concealed: Rigid or intermediate metal conduit.
 - 3. Underground, Single Run: Rigid nonmetallic conduit.
 - 4. Underground, Grouped: Rigid nonmetallic conduit.
 - 5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
 - 6. Boxes and Enclosures: NEMA Type 3R or Type 4.
- B. Indoors: Use the following wiring methods:
 - 1. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquidtight flexible metal conduit.
 - 2. Damp or Wet Locations: Rigid steel conduit.
 - 3. Exposed: Electrical metallic tubing or rigid nonmetallic conduit.
 - 4. Concealed: Electrical metallic tubing, electrical nonmetallic tubing, or rigid nonmetallic conduit.
 - 5. Boxes and Enclosures: NEMA Type 1, except in damp or wet locations use NEMA Type 4, stainless steel.

3.3 INSTALLATION:

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

- C. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.
- D. Install raceways level and square and at proper elevations. Provide adequate headroom.
- E. Complete raceway installation before starting conductor installation.
- F. Support raceway as specified in Division 16 Section "Supporting Devices."
- G. Use temporary closures to prevent foreign matter from entering raceway.
- H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
- I. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
- J. Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, except as otherwise indicated.
- K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.
- L. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1 inch (25 mm) concrete cover.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in the concrete.
 - 3. Run conduit larger than 1-inch trade size (size 27) parallel to or at right angles to main reinforcement.
 - 4. When at right angles to reinforcement, place conduit close to slab support.
 - 5. Transition nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
- M. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
 - 1. Run parallel or banded raceways together, on common supports where practical.
 - 2. Make bends in parallel or banded runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.
- N. Join raceways with fittings designed and approved for the purpose and make joints tight.
 - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration.
 - 2. Use bonding jumpers where joints cannot be made tight.
 - 3. Use insulating bushings to protect conductors.
- O. Tighten set screws of threadless fittings with suitable tool.

- P. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.
- Q. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- R. Install pull wires in empty raceways. Use No. 14 AWG (1.6 mm) zinc-coated steel or monofilament plastic line having not less than 200-lb (90 kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.
- S. Telephone and Signal System Raceways 2-Inch Trade Size (Size 53) and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet (45 m) and with a maximum of two 90-deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.
- T. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
1. Where conduits enter or leave hazardous locations.
 2. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
 3. Where otherwise required by the NEC.
- U. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.
- V. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.
- W. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceway is installed for such circuits and it passes through concrete, install in a nonmetallic sleeve.
- X. Do not install aluminum conduit embedded in or in contact with concrete.
- Y. Surface Metal Raceway: Install a separate green ground conductor in raceway from the junction box supplying the raceway to receptacle or fixture ground terminals.
1. Select each surface metal raceway outlet box to which a lighting fixture is attached to be of sufficient diameter to provide a seat for the fixture canopy.

2. Where a surface metal raceway is used to supply a fluorescent lighting fixture having central stem suspension with a backplate and a canopy (with or without extension ring), the backplate and canopy will serve as the outlet box and no separate outlet box need be provided.
 3. Provide surface metal raceway outlet box, in addition to the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end stem suspension.
 4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed (provide a backplate slightly smaller than the fixture canopy), no additional surface mounted outlet box need be installed.
- Z. Install hinged cover enclosures and cabinets plumb. Support at each corner.
- AA. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.
- 3.4 PROTECTION:
- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.
- 3.5 CLEANING:
- A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

**SECTION 16140
WIRING DEVICES**

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUBMITTALS:

- A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each product specified.
- C. Operation and maintenance data for materials and products specified in this Section to include in the "Operating and Maintenance Manual".

1.4 QUALITY ASSURANCE:

- A. Comply with NFPA 70 "National Electrical Code" for devices and installation.
- B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 COORDINATION:

- A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.
- B. Cord and Plug Sets: Match cord and plug sets to equipment requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wiring Devices:
 - a. Eagle Electric Mfg. Co., Inc.
 - b. General Electric Co.
 - c. Hubbell Inc.
 - d. Leviton Mfg. Co., Inc.
 - e. Pass & Seymour/Legrand.
 - 2. Multi-Outlet Assemblies:
 - a. Airey-Thompson Co., Inc.
 - b. Dual-Lite.
 - c. Isoduct Energy Systems.
 - d. Kellems Div., Hubbell, Inc.
 - e. Wiremold Co.

2.2 WIRING DEVICES:

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices."
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: Ivory except as otherwise indicated or required by Code.
- D. Receptacles, Straight-Blade and Locking Type: Comply with UL Standard 498, "Electrical Attachment Plugs and Receptacles," heavy-duty grade except as otherwise indicated.
- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
 - 1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," feed-through type, with integral NEMA 5-20R duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without an adapter.
 - 2. Isolated Ground Receptacles: Equipment grounding contacts are connected only to the green grounding screw terminal of the device and have inherent electrical isolation from the mounting strap.

WIRING DEVICES

16140

Page 2

- a. Devices: Listed and labeled as isolated ground receptacles.
 - b. Isolation Method: Integral to the receptacle construction and not dependent on removable parts.
- F. Pendant Cord/Connector Devices: Matching, locking type, plug and plug receptacle body connector, NEMA L5-20P and L5-20R, heavy-duty grade.
- 1. Bodies: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
 - 2. External Cable Grip: Woven wire mesh type made of high-strength galvanized-steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.
- G. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
- 1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.
 - 2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- H. Snap Switches: Quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
- I. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permits separate or common feed connection.
- 1. Switch: 20 ampere, 120-277 V a.c.
 - 2. Receptacle: NEMA configuration 5-15R.
- J. Dimmer Switches: Modular full-wave solid-state units with integral, quiet on-off switches, and audible and electromagnetic noise filters.
- 1. Wattage rating exceeds connected load by 30 percent minimum, except as otherwise indicated.
 - 2. Control: Continuously adjustable slide, toggle or rotary knob. Single-pole or 3-way switch to suit connections.
 - 3. Incandescent Lamp Dimmers: Modular dimmer switches for incandescent fixtures; switch poles and wattage as otherwise indicated, 120 V, 60 Hz with continuously adjustable rotary knob, toggle, or slide, single-pole with soft tap or other quiet switch. Equip with electromagnetic filter to eliminate noise, RF and TV interference, and 5-inch (127-mm) wire connecting leads.
 - 4. Fluorescent Lamp Dimmers: Modular dimmer switches compatible with dimmer ballasts. Trim potentiometer adjusts low-end dimming. Dimmer-ballast combination is capable of consistent dimming to a maximum of 10 percent of full brightness.
- K. Telephone Jack: 4-position, modular, latching-plug type, flush in face of wall plate.

WIRING DEVICES

16140

Page 3

- L. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:

1. Color: Matches wiring device except as otherwise indicated.
2. Plate-Securing Screws: Metal with heads colored to match plate finish.
3. Material for Finished Spaces: Steel with wrinkled finish, white baked enamel, suitable for field painting, except as otherwise indicated.
4. Material for Unfinished Spaces: Galvanized steel.

2.3 MULTI-OUTLET ASSEMBLIES:

- A. Comply with Standard UL 5, "Surface Metal Raceways and Fittings."
- B. Components of Assemblies: Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard corrosion-resistant finish.
- D. Raceway Material: Nonmetallic.
- E. Wire: No. 12 AWG.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.

3.2 IDENTIFICATION:

- A. Comply with Division 16 Section "Electrical Identification."
 1. Switches: Where 3 or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.
 2. Receptacles: Identify the panelboard and circuit number from which served. Use machine-printed, pressure-sensitive, abrasion-resistant label tape on face of plate and durable wire markers or tags within outlet boxes.

3.3 GROUNDING:

- A. Isolated Ground Receptacles: Connect to isolated grounding conductor routed to designated isolated equipment ground terminal of electrical system.

3.4 FIELD QUALITY CONTROL:

- A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 2 times.
- B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.
- C. Replace damaged or defective components.

3.5 CLEANING:

- A. General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

**SECTION 16195
ELECTRICAL IDENTIFICATION**

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section includes identification of electrical materials, equipment, and installations.

1.2 RELATED WORK:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Schedule of identification nomenclature to be used for identification signs and labels.
- D. Samples for each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

1.4 QUALITY ASSURANCE:

- A. Comply with NFPA 70.
- B. Comply with ANSI C2.

1.5 SEQUENCING AND SCHEDULING:

- A. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
- B. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Labelmark Co.; Labelmaster Subsidiary.
 2. Brady USA, Inc.; Industrial Products Div.
 3. Calpico, Inc.
 4. Carlton Industries, Inc.
 5. Champion American, Inc.
 6. Cole-Flex Corp.
 7. D&G Sign and Label.
 8. EMED Co., Inc.
 9. George-Ingraham Corp. (The).
 10. Grimco, Inc.
 11. Ideal Industries, Inc.
 12. Kraftbilt.
 13. LEM Products, Inc.
 14. Markal Corp.
 15. National Band & Tag Co.
 16. Panduit Corp.
 17. Radar Engineers.
 18. Ready Made Sign Co.; Cornerstone Direct Corp. Div.
 19. Seton Name Plate Co.
 20. Standard Signs, Inc.

2.2 RACEWAY AND CABLE LABELS:

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
1. Color: Black legend on orange field.
 2. Legend: Indicates voltage and service.
- C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
- D. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- E. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).

- F. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
1. Size: Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
 2. Compounded for permanent direct-burial service.
 3. Embedded continuous metallic strip or core.
 4. Printed Legend: Indicates type of underground line.
- G. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
- H. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch-(0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- I. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
- J. Aluminum-Faced Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, and punched for the fastener. Preprinted legends suit each application.
- K. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2 inches (51 by 51 mm) by 0.05 inch (1.3 mm).

2.3 ENGRAVED NAMEPLATES AND SIGNS:

- A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Engraving stock, melamine plastic laminate, 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved Legend: Black letters on white face.
 2. Punched for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch (1-mm), galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch (6.4-mm) grommets in corners for mounting.
- E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS:

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to 185 deg F (Minus 4 to 85 deg C).
4. Color: As indicated where used for color coding.

B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- F. Identify feeders over 600 V with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
 1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to conduits concealed within wall.
 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
 4. Entire surface of exposed conduits.
- G. Install painted identification as follows:
 1. Clean surfaces of dust, loose material, and oily films before painting.
 2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
 3. Apply one intermediate and one finish coat of silicone alkyd enamel.
 4. Apply primer and finish materials according to manufacturer's instructions.
- H. Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of the systems listed below for identification.

1. Bands: Pretensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.
 2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25 feet (7.6 m) in congested areas.
 3. Colors: As follows:
 - a. Fire-Alarm System: Red.
 - b. Fire-Suppression Supervisory and Control System: Red and yellow.
 - c. Combined Fire-Alarm and Security System: Red and blue.
 - d. Security System: Blue and yellow.
 - e. Mechanical and Electrical Supervisory System: Green and blue.
 - f. Telecommunications System: Green and yellow.
- I. Install Caution Signs for Enclosures Over 600 V: Use pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.
- J. Install Circuit Identification Labels on Boxes: Label externally as follows:
1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
 2. Concealed Boxes: Plasticized card-stock tags.
 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- K. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches (400 mm), use a single line marker.
1. Limit use of line markers to direct-buried cables.
 2. Install line marker for underground wiring, both direct buried and in raceway.
- L. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
1. 208/120-V System: As follows:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - d. Neutral: White.
 - e. Ground: Green.
 2. 480/277-V System: As follows:
 - a. Phase A: Yellow.
 - b. Phase B: Brown.
 - c. Phase C: Orange.
 - d. Neutral: White.
 - e. Ground: Green.

3. Factory-apply color the entire length of the conductors, except the following field-applied, color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- M. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.
 1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
 2. Fasten tags with nylon cable ties; fasten bands using integral ears.
- N. Apply identification to conductors as follows:
 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
 2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
 3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.
- O. Apply warning, caution, and instruction signs and stencils as follows:
 1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
 2. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- P. Install identification as follows:
 1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use lettering 2 inches (51 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment.

- a. Panelboards, electrical cabinets, and enclosures
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Electrical substations.
 - e. Motor control centers.
 - f. Motor starters.
 - g. Push-button stations.
 - h. Power transfer equipment.
 - i. Contactors.
 - j. Control devices.
 - k. Transformers.
 - l. Telephone switching equipment.
 - m. Call system master station.
 - n. Fire-alarm master station or control panel.
 - o. Security-monitoring master station or control panel.
2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION

**SECTION 16452
GROUNDING**

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.2 RELATED WORK:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 15 Section "Sewage Lift Stations" for station grounding beyond that provided by a supply-circuit equipment grounding conductor.

1.3 SUBMITTALS:

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

1.4 QUALITY ASSURANCE:

- A. Comply with NFPA 70.
- B. Comply with UL 467.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Apache Grounding; Nashville Wire Products.
2. Boggs: H. L. Boggs & Co.
3. Chance: A. B. Chance Co.
4. Dossert Corp.
5. Erico Inc.; Electrical Products Group.
6. Galvan Industries, Inc.
7. Hastings Fiber Glass Products, Inc.
8. Heary Brothers Lightning Protection Co.
9. Ideal Industries, Inc.
10. ILSCO.
11. Kearney.
12. Korns: C. C. Korns Co.
13. Lightning Master Corp.
14. Lyncole XIT Grounding.
15. O-Z/Gedney Co.
16. Racor, Inc.
17. Salisbury: W.H. Salisbury & Co., Utility.
18. Thomas & Betts, Electrical.
19. Utilco Co.

2.2 GROUNDING AND BONDING PRODUCTS:

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.3 WIRE AND CABLE GROUNDING CONDUCTORS:

- A. Conform to NEC Table 8 for conductor properties, including stranding.
1. Material: Aluminum and copper. Use only copper wire for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
- B. Equipment Grounding Conductors: Insulated with green color insulation.
- C. Grounding-Electrode Conductors: Stranded cable.
- D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
- E. Bare Copper Conductors: Conform to the following:
1. Solid Conductors: ASTM B 3.
 2. Assembly of Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.

2.4 MISCELLANEOUS CONDUCTORS:

- A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

- B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
- C. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.

2.5 CONNECTOR PRODUCTS:

- A. Pressure Connectors: High-conductivity-plated units.
- B. Bolted Clamps: Heavy-duty type.
- C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.6 GROUNDING ELECTRODES AND TEST WELLS:

- A. Grounding Rods: Copper-clad steel.
- B. Grounding Rods: Sectional type; copper-clad steel.
 - 1. Size: 3/4 inch by 120 inches (19 by 3000 mm).
 - 2. Size: 5/8 inch by 96 inches (16 by 2400 mm).
- C. Plate Electrodes: Copper, square or rectangular shape. Minimum 0.10 inch (3 mm) thick, size as indicated.
- D. Test Wells: Fabricate from 15-inch- (400-mm-) long, square-cut sections of 8-inch- (200-mm-) diameter, Schedule 80, PVC pipe.

PART 3 - EXECUTION

3.1 APPLICATION:

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
 - 1. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
 - a. Feeders and branch circuits.
 - b. Lighting circuits.
 - c. Receptacle circuits.
 - d. Single-phase motor or appliance branch circuits.
 - e. Three-phase motor or appliance branch circuits.
 - f. Flexible raceway runs.
 - g. Armored and metal-clad cable runs.

2. **Busway Supply Circuits:** Install separate equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding-bar terminal on busway.
 3. **Isolated Grounding-Receptacle Circuits:** Install a separate insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at the equipment grounding-conductor terminal of the applicable derived system or service, except as otherwise noted.
 4. **Isolated Equipment Enclosure Circuits:** For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at the equipment grounding-conductor terminal of the applicable derived system or service, except as otherwise indicated.
 5. **Nonmetallic Raceways:** Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
 6. **Air-Duct Equipment Circuits:** Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
 7. **Water Heater, Heat-Tracing, and Antifrost Heater Circuits:** Install a separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
- B. **Signal and Communication Systems:** For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from Grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
1. **Service and Central Equipment Locations and Wiring Closets:** Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
 2. **Terminal Cabinets:** Terminate grounding conductor on cabinet grounding terminal.
- C. **Separately Derived Systems:** Where NEC requires grounding, ground according to NEC Paragraph 250-26.
- D. **Metal Poles Supporting Outdoor Lighting Fixtures:** Ground pole to a grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.
- E. **Connections to Lightning Protection System:** Bond grounding conductors, including grounding-conductor conduits, to lightning protection down conductors or lightning protection grounding conductors in compliance with NFPA 780.

- F. Common Ground Bonding with Lightning Protection System: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system grounding conductor and install in conduit.

3.2 INSTALLATION:

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Electrical Room Grounding Bus: Space 1 inch (25 mm) from wall and support from wall 6 inches (150 mm) above finished floor, except as otherwise indicated.
- C. Grounding Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.
1. Drive until tops are 2 inches (50 mm) below finished floor or final grade, except as otherwise indicated.
 2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.
- D. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- E. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 inches (600 mm) below grade.
- F. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.
- G. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.
- H. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- I. Test Wells: One for each driven grounding electrode, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1-inch- (25-mm-) maximum-size crushed stone or gravel.
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC Paragraph 250-81(c), using a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG. Where base of concrete foundation is less than 20 feet (6 m) in length, coil excess conductor within base of concrete foundation. Bond grounding conductor to reinforcing steel to

at least 4 locations, and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to a grounding electrode external to concrete.

3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
- C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.
- F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
- H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.4 FIELD QUALITY CONTROL:

- A. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
- B. Maximum grounding to resistance values are as follows:
 - 1. Equipment Rated 500 kVA and Less: 10 ohms.
 - 2. Equipment Rated 500 to 1000 kVA: 5 ohms.
 - 3. Equipment Rated More than 1000 kVA: 3 ohms.
 - 4. Unfenced Substations and Pad-Mounted Equipment: 5 ohms.
 - 5. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
- D. Report: Prepare test reports of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.5 ADJUSTING AND CLEANING:

- A. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

**SECTION 16460
TRANSFORMERS**

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes general-purpose and specialty dry-type transformers and voltage regulators with windings rated 600 V or less.

1.2 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUBMITTALS:

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each product specified, including dimensioned plans, sections, and elevations. Show minimum clearances and installed features and devices.
- C. Wiring diagrams of products differentiating between manufacturer-installed and field-installed wiring.
- D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience.
- E. Operation and maintenance data for materials and products to include in the "Operating and Maintenance Manual" specified in Division 1.
- F. Field test reports of tests and inspections conducted according to Part 3 of this Section.

1.4 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: A firm experienced in manufacturing components that comply with the requirements of these Specifications and that have a record of successful in-service performance.
- B. Field-Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated.
- C. Comply with NFPA 70 "National Electrical Code."
- D. Comply with IEEE C2 "National Electrical Safety Code."
- E. Listing and Labeling: Products are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Temporary Heating: Apply temporary heat according to manufacturer's recommendations within the enclosure of each ventilated type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Transformers:
- a. Acme Electric Corp.
 - b. Bryant Electric.
 - c. Challenger Electrical Equipment Co.
 - d. Federal Pacific Transformer Co.
 - e. General Electric Co.
 - f. Hevi-Duty Electric.
 - g. Line Power Mfg. Corp.
 - h. MagneTek, Jefferson.
 - i. Master Electronic Controls.
 - j. Matra Electric, Inc.
 - k. Micron Industries Corp.
 - l. NWL Transformers.
 - m. Parker Electrical Mfg. Co.
 - n. Rapid Power Technologies, Inc.
 - o. ROMAC Supply Co.
 - p. Siemens Energy & Automation, Inc.
 - q. Square D Co.
 - r. R.E. Uptegraff Mfg. Co.
 - s. Westinghouse Electric Corp.

2.2 TRANSFORMERS, GENERAL:

- A. Transformers: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
- B. Cores: Grain-oriented, nonaging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
- D. Internal Coil Connections: Brazed or pressure type.

2.3 GENERAL-PURPOSE, DRY-TYPE TRANSFORMERS:

- A. Comply with NEMA Standard ST 20 "Dry-Type Transformers for General Applications."
- B. Transformers: Two-winding type, 3-phase units using 1 coil per phase in primary and secondary.
- C. Windings: All copper.
- D. Low Sound Level Units: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE Standard C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."
- E. Features and Ratings: As follows:
 - 1. Enclosure: Indoor, ventilated, dripproof.
- F. Insulation Class: 185 deg C or 220 deg C class for transformers 15 kVA or smaller; 220 deg C class for transformers larger than 15 kVA.
 - 1. Insulation Temperature Rise: 150 deg C maximum rise above 40 deg C, for 220 deg C class insulation; 115 deg C maximum rise for 185 deg C class insulation.
- G. Taps: For transformers 3 kVA and larger, full capacity taps in high-voltage winding are as follows:
 - 1. 15 kVA through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.

2.4 FINISHES:

- A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
- B. Outdoor Units: Comply with "Enclosure Coating System" Article of IEEE Standard C57.12.28 "Pad-Mounted Equipment Enclosure Integrity."

2.5 SOURCE QUALITY CONTROL:

- A. Factory Tests: Design and routine tests conform to referenced standards.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Arrange equipment to provide adequate spacing for access and for cooling air circulation.
- B. Identify transformers and install warning signs according to Division 16 Section "Electrical Identification."

- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not furnished, use those specified in UL 486A and UL 486B.

3.2 GROUNDING:

- A. Ground transformers and systems served by transformers according to Division 16 Section "Grounding."

3.3 FIELD QUALITY CONTROL:

- A. Test Objectives: To ensure transformer installation is operational within industry and manufacturer's tolerances, install according to Contract Documents, and suitable for energizing.
- B. Test Labeling: Upon satisfactory completion of tests for each unit, attach a dated and signed "Satisfactory Test" label to the tested component.
- C. Schedule tests and provide notification at least one week in advance of test commencement.
- D. Report: Submit a written report of observations and tests. Report defective materials and workmanship.
- E. Tests: Include the following minimum inspections and tests according to the manufacturer's instructions. Conform to IEEE Standard Test Code C57.12.91 for dry-type units, test method, and data correction factors.
 - 1. Inspect accessible components for cleanliness, mechanical, and electrical integrity, for presence of damage or deterioration, and to ensure removal of temporary shipping bracing. Do not proceed with tests until deficiencies are corrected.
 - a. Include internal inspection through access panels and covers.
 - b. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, where not available, those of UL standards 486A and 486B.
 - 2. Insulation Resistance: Perform megohmmeter test of primary and secondary winding-to-winding and winding-to-ground. Use a minimum test voltage of 1,000 V d.c. Minimum insulation resistance is 500 megohms.
 - 3. Duration of Each Test: 10 minutes.
 - 4. Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.
- F. Test Failures: Correct deficiencies identified by tests and retest. Verify that equipment meets the specified requirements.

3.4 ADJUSTING:

- A. After completing installation, cleaning, and testing, touch up scratches and mars on finish to match original finish.
- B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout the normal operating cycle of the facility. Record voltages and tap settings to submit with test results.

END OF SECTION

**SECTION 16470
PANELBOARDS**

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section includes lighting and power panelboards and associated auxiliary equipment rated 600 V and less.
- B. Related Sections include the following:
 - 1. SECTION 16195: ELECTRICAL IDENTIFICATION for labeling materials.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS:

- A. Product Data: For each type of panelboard, accessory item, and component specified.
- B. Shop Drawings: For panelboards. Include dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include the following:
 - 1. Enclosure type with details for types other than NEMA 250, Type 1.
 - 2. Bus configuration and current ratings.
 - 3. Short-circuit current rating of panelboard.
 - 4. Features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
 - 5. Wiring Diagrams: Details of schematic diagram including control wiring and differentiating between manufacturer-installed and field-installed wiring.
- C. Panelboard Schedules: For installation in panelboards. Submit final versions at contract completion.
- D. Maintenance Data: For panelboard components to include in the maintenance manuals. Include manufacturer's written instructions for testing circuit breakers.

1.3 QUALITY ASSURANCE:

- A. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NFPA 70.
- C. Comply with NEMA PB 1.

1.5 EXTRA MATERIALS:

- A. Keys: 6 spares of each type for panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
 - 2. General Electric Co.; Electrical Distribution & Control Div.
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D Co.

2.2 PANELBOARD FABRICATION:

- A. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
 - 1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
- B. Front: Secured to box with concealed trim clamps, unless otherwise indicated. Front for surface-mounted panelboards shall be same dimensions as box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.
- C. Directory Frame: Metal, mounted inside each panelboard door.
- D. Bus: Hard drawn copper of 98 percent conductivity.
- E. Main and Neutral Lugs: Compression type.
- F. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
- G. Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.
- H. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.
- I. Special Features: Include the following features for panelboards as indicated:
 - 1. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box.
 - 2. Hinged Front Cover: Entire front trim hinged to box with standard door within hinged trim cover.

3. Split Bus: Vertical bus of indicated panelboards divided into 2 vertical sections with connections as indicated.
4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and floor.

J. Feed-through Lugs: Sized to accommodate feeders indicated.

2.3 LOAD CENTERS:

A. Overcurrent Protective Devices: Plug-in, full-module circuit breaker.

1. Circuit Breakers for Switching Lights at Panelboards: Indicated as Type SWD.
2. Circuit Breakers for Equipment Marked Type HACR: Indicated as Type HACR.

B. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS:

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.

2.5 DISTRIBUTION PANELBOARDS:

A. Doors: In panelboard front, except omit in fusible-switch panelboard, unless otherwise indicated. Secure door with vault-type latch with tumbler lock, all keyed alike.

B. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

2.6 OVERCURRENT PROTECTIVE DEVICES:

A. Molded Case Circuit Breaker: NEMA AB 1

1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
2. Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for heating, air-conditioning, and refrigerating equipment.
3. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
4. Circuit Breakers, 400 A and Larger: Field-adjustable short-time and continuous current settings.
5. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

6. Shunt Trip: Where indicated.

2.8 CONTROLLERS:

- A. Motor Controllers: NEMA ICS 2, Class A combination controller equipped for panelboard mounting, with the following accessories and pilot devices as indicated:
 - 1. Individual control power transformers.
 - 2. Fuses for control power transformers.
 - 3. Indicating lights.
 - 4. Seal-in contact.
 - 5. Convertible auxiliary contacts as indicated, minimum of 2.
 - 6. Push buttons.
 - 7. Selector switches.
- B. Contactors: NEMA ICS 2, Class A combination controller equipped for panelboard mounting, with the following accessories and pilot devices as indicated:
 - 1. Individual control power transformers.
 - 2. Fuses for control power transformers.
 - 3. Indicating lights.
 - 4. Seal-in contact.
 - 5. At least one convertible auxiliary contact. Provide more as indicated.
 - 6. Push buttons.
 - 7. Selector switches.
- C. Controller Disconnect Switches: Fusible switch integral with or adjacent to and interlocked with controller.
- D. Controller Disconnect Switches: Motor-circuit protector integral with or adjacent to and interlocked with controller.
 - 1. Auxiliary contacts on disconnect de-energize external control source.
- E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held general-purpose controller, with current rating, poles, and connections as indicated; factory mounted in indicated panelboard.
 - 1. Control Power Source: Control-power transformer of capacity indicated, with fused primary and secondary terminals, and connected to main bus ahead of contactor connection.
 - 2. Control Power Source: 120-V branch circuit as indicated.

2.9 ACCESSORY COMPONENTS AND FEATURES:

- A. Accessory Set: Include tools and miscellaneous items as required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install panelboards and accessory items according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- D. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
- E. Install filler plates in unused spaces.
- F. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.

3.2 IDENTIFICATION:

- A. Identify field-installed wiring and components and provide warning signs as specified in Division 16 Section "Electrical Identification."
- B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.

3.3 GROUNDING:

- A. Make equipment grounding connections for panelboards as indicated.
- B. Provide ground continuity to main electrical ground bus as indicated.

3.4 CONNECTIONS:

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL:

- A. Prepare for acceptance tests as follows:
 - 1. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
 - 2. Make continuity tests of each circuit.
- B. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

3.6 ADJUSTING:

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.7 CLEANING:

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

END OF SECTION

SECTION 16476
DISCONNECT SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SCOPE:

A. This Section includes individually mounted switches and circuit breakers used for the following:

1. Service disconnect switches.
2. Feeder and equipment disconnect switches.
3. Feeder branch-circuit protection.
4. Motor disconnect switches.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. SECTION 16140: WIRING DEVICES for attachment plugs and receptacles, and snap switches used for disconnect switches.
2. SECTION 16476: DISCONNECT SWITCHES AND CIRCUIT BREAKERS for individually Enclosed, fused power-circuit devices used as feeder disconnect switches.

1.3 SUBMITTALS:

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for disconnect switches, circuit breakers, and accessories specified in this Section.

C. Field test reports indicating and interpreting test results.

D. Maintenance data for tripping devices to include in the operation and maintenance manual.

1.4 QUALITY ASSURANCE:

A. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide disconnect switches and circuit breakers by one of the following:
 - 1. Fusible Switches:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. General Switch Corp.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D Co.
 - f. Westinghouse Electric Corp.; Distribution & Control Business Unit.
 - 2. Molded-Case Circuit Breakers:
 - a. Eaton Corp.; Cutler-Hammer Products.
 - b. General Electric Co.; Electrical Distribution and Control Division.
 - c. General Switch Corp.
 - d. Siemens Energy & Automation, Inc.
 - e. Square D Co.
 - f. Westinghouse Electric Corp.; Distribution & Control Business Unit.
 - 3. Combination Circuit Breaker and Ground Fault Trip:
 - a. General Electric Co.; Electrical Distribution and Control Division.
 - b. Siemens Energy & Automation, Inc.
 - c. Square D Co.
 - d. Westinghouse Electric Corp.; Distribution & Control Business Unit.
 - 4. Molded-Case, Current-Limiting Circuit Breakers:
 - a. General Electric Co.; Electrical Distribution and Control Division.
 - b. Siemens Energy & Automation, Inc.
 - c. Square D Co.
 - d. Westinghouse Electric Corp.; Distribution & Control Business Unit.

2.2 DISCONNECT SWITCHES:

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.

C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

1. Other Wet or Damp Indoor Locations: Type 4.

2.3 ENCLOSED CIRCUIT BREAKERS:

A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.

C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.

D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

E. Circuit Breakers, 400 A and Larger: Field-adjustable, short-time and continuous-current settings.

F. Molded-Case Switch: Where indicated, molded-case circuit breaker without trip units.

G. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

H. Shunt Trip: Where indicated.

I. Accessories: As indicated.

J. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.

1. Other Wet or Damp Indoor Locations: Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.

B. Install disconnect switches and circuit breakers level and plumb.

C. Install wiring between disconnect switches, circuit breakers, control, and indication devices.

D. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

- E. Identify each disconnect switch and circuit breaker according to requirements specified in Division 16 Section "Electrical Identification."

3.2 FIELD QUALITY CONTROL:

- A. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

- 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

- B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.3 ADJUSTING:

- A. Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated.

3.4 CLEANING:

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION

**SECTION 16481
MOTOR CONTROLLERS**

PART 1 - GENERAL

1.1 SCOPE:

- A. This Section includes AC motor-control devices rated 600 V and less that are supplied as enclosed units.
- B. Related Sections include the following:
 - 1. Division 16 Section "Electrical Identification" for labeling materials.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS:

- A. Product Data: For products specified in this Section. Include dimensions, ratings, and data on features and components.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- C. Maintenance Data: For products to include in the maintenance manuals.
- D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

1.3 QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing parts, maintenance, and repairs.
- B. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.
- C. Comply with NFPA 70.
- D. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

1.4 COORDINATION:

- A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

- B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.5 EXTRA MATERIALS:

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

- 1. Spare Incandescent Indicating Lamps: Furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. ABB Power Distribution, Inc.; ABB Control, Inc. Subsidiary.
 - 2. Allen-Bradley Co.; Industrial Control Group.
 - 3. Crouse-Hinds ECM.; Cooper Industries, Inc. Div.
 - 4. Eaton Corp.; Westinghouse & Cutler-Hammer Products.
 - 5. Furnas Electric Co.
 - 6. General Electric Co.; Electrical Distribution & Control Div.
 - 7. Siemens Energy & Automation, Inc.
 - 8. Square D Co.

2.2 MANUAL MOTOR CONTROLLERS:

- A. Description: NEMA ICS 2, general purpose, Class A with toggle action and overload element.

2.3 MAGNETIC MOTOR CONTROLLERS:

- A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

- B. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.

- C. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.

- 1. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a Nationally Recognized Testing Laboratory.
 - 2. Nonfusible Disconnect: NEMA KS 1, heavy-duty, nonfusible switch.

MOTOR CONTROLLERS

16481

3. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.

- D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, and with appropriate adjustment for duty cycle.
- E. Overload Relay: NEMA ICS 2, Class 10 tripping characteristics selected to protect motor against voltage unbalance and single phasing.

2.4 ENCLOSURES:

A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.5 ACCESSORIES:

- A. Devices are factory installed in controller enclosure, unless otherwise indicated.
- B. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
- C. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.
- D. Control Relays: Auxiliary and adjustable time-delay relays.
- E. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

PART 3 - EXECUTION

3.1 APPLICATIONS:

- A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
- B. Select horsepower rating of controllers to suit motor controlled.
- C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.
- D. Use manual controllers for 3-phase motors up to 5 hp not requiring automatic or remote control.
- E. Use manual controllers for 3-phase motors up to 7-1/2 hp not requiring automatic or remote control.
- F. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.

- G. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

3.2 INSTALLATION:

- A. Install independently mounted motor-control devices according to manufacturer's written instructions. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.
- C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.

3.3 IDENTIFICATION:

- A. Identify motor-control components and control wiring according to Division 16 Section "Electrical Identification."

3.4 CONTROL WIRING INSTALLATION:

- A. Bundle, train, and support wiring in enclosures.
- B. Connect hand-off-automatic switch and other automatic control devices where available.
 - 1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
 - 2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 CONNECTIONS:

- A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.6 FIELD QUALITY CONTROL:

- A. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
 - 1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.
 - 2. Remove and replace malfunctioning units with new units, and retest.

3.7 CLEANING:

- A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

END OF SECTION

MOTOR CONTROLLERS

16481

Page 4

Attachment

***Field Health and Safety Plan
Shallow Bedrock Groundwater Interim Action
Former Powerex, Inc. Facility
Auburn, New York***

Prepared for:

***General Electric Company
1 Computer Drive South
Corporate Environmental Programs
Albany, New York 12205***

Prepared by:

***Radian Engineering, Inc
155 Corporate Woods
Suite 100
Rochester, New York 14623***

November 16, 1995

Radian Engineering Inc.

**Field Health and Safety Plan
Shallow Bedrock Groundwater Interim Action
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TABLE OF CONTENTS

	Page
1.0 INTRODUCTION	1-1
1.1 Applicability	1-1
1.2 Scope of Work	1-3
1.3 Responsibility	1-3
1.3.1 Project Manager	1-3
1.3.2 Field Task Leader	1-3
1.3.3 Project Health and Safety Officer	1-4
1.3.4 Site Safety Officer	1-4
1.3.5 Employee Responsibilities	1-5
1.3.6 Subcontractor Responsibilities	1-6
2.0 PREVIOUS SITE WORK	2-1
2.1 Site Background	2-1
2.2 Site Concerns	2-2
3.0 HAZARD ANALYSIS	3-1
3.1 Hazard Analysis for Design Activities	3-1
3.2 Hazard Analysis for Construction Activities	3-1
3.3 Chemical Hazards	3-2
4.0 AIR MONITORING REQUIREMENTS	4-1
4.1 Total Hydrocarbon Monitoring	4-1
4.2 Combustible Gas Indicator Surveys	4-1
4.3 Integrated Sampling	4-4
5.0 PERSONAL PROTECTIVE EQUIPMENT	5-1
5.1 Non-Intrusive Activities	5-1
5.2 Intrusive Activities	5-1
5.3 Respiratory Protection	5-2
6.0 WORK ZONES AND SITE CONTROL	6-1
6.1 Work Zones	6-1
6.2 Buddy System	6-1
6.3 Emergency Response	6-2
6.4 Site Entry and Exit	6-2
6.5 Communication	6-2

TABLE OF CONTENTS (Continued)

	Page
7.0 DECONTAMINATION PROCEDURES	7-1
7.1 Personnel Decontamination	7-1
7.2 Equipment Decontamination	7-1
8.0 SAFE WORK PRACTICES	8-1
8.1 Operation of Drilling Equipment	8-1
8.2 Excavations	8-2
8.3 Underground Utilities	8-2
8.4 Electric Power Lines	8-2
8.5 Temperature Extremes	8-2
8.5.1 Heat Stress	8-2
8.5.2 Cold Stress	8-3
8.6 Noise	8-4
8.7 Demolition Activities	8-4
8.8 Biological Hazards	8-4
8.9 Other Safe Work Practices	8-4
9.0 EMERGENCY PROCEDURES AND ACCIDENT REPORTING	9-1
9.1 Anticipated Emergencies	9-1
9.2 Responsibilities	9-1
9.3 Notification and Initial Response	9-1
9.4 Equipment Failure	9-2
9.5 Employee Injury or Illness	9-3
9.6 Emergency Equipment	9-3
9.7 Emergency Telephone Numbers	9-3
9.8 Accident Reporting	9-3
9.9 Route to Hospital	9-5
10.0 EMPLOYEE TRAINING	10-1
10.1 Initial Briefing	10-1
10.2 Follow-up Briefings	10-2
11.0 MEDICAL CONSIDERATIONS	11-1
12.0 DOCUMENTATION	12-1

TABLE OF CONTENTS (Continued)

- ATTACHMENT A Known Chemical Constituents and Maximum Concentrations in Groundwater, Soils and Surface Water
- ATTACHMENT B Published Airborne Exposure Limits for Hazardous Substances Known or Suspected to be Present
- ATTACHMENT C Contingency Plan with Emergency Procedures, Former Powerex, Inc., Facility, Auburn, New York
- ATTACHMENT D Emergency Reporting Forms

LIST OF FIGURES

	Page
1-1 Site Map	1-2
9-1 Route to Hospital	9-6

LIST OF TABLES

	Page
4-1 Exposure Measurement Criteria and Response Plan	4-2
4-2 Combustible Gas Indicator Criteria and Action Plan	4-3
9-1 Emergency Contacts and Phone Numbers	9-4
9-2 Directions to Hospital	9-7

1.0

INTRODUCTION

Radian Engineering, Inc. (Radian) has been contracted by the General Electric Company (GE) to design and oversee the construction of a dual-phase extraction and treatment system at the former Powerex, Inc. (Powerex) facility located along the boundary of the Town of Aurelius and the City of Auburn, Cayuga County, New York. The site is shown in Figure 1-1. This Field Health and Safety Plan (FHSP) specifies the minimum precautions and protective measures that employees of Radian (hereafter referred to simply as "employees") must take to minimize risks to their health and safety and the environment while performing field activities associated with the project. Each employee entering the site must become familiar with this FHSP and abide by its requirements. This FHSP incorporates, by reference, all applicable requirements of the Occupational Safety and Health Administration (OSHA) in 29 CFR Parts 1910 and 1926. This FHSP will be modified as necessary by Radian's Project Manager or Project Health and Safety Officer (PHSO) in response to new information which becomes available.

1.1

Applicability

The project site is subject to OSHA regulations in 29 CFR § 1910.120. This FHSP therefore addresses topics such as decontamination procedures, site control, and instrument maintenance and calibration procedures. This FHSP is not be construed as applying to, or providing advice or protection to, any person other than a Radian employee or an employee of its subcontractor(s). Other contractors, subcontractors, or consultants who are on site but not working for Radian will be responsible for their own health and safety, and for compliance with all applicable regulations. Radian will, however, notify the owner or its representative, either verbally or in writing, if it observes any unsafe or non-compliant actions occurring on site.

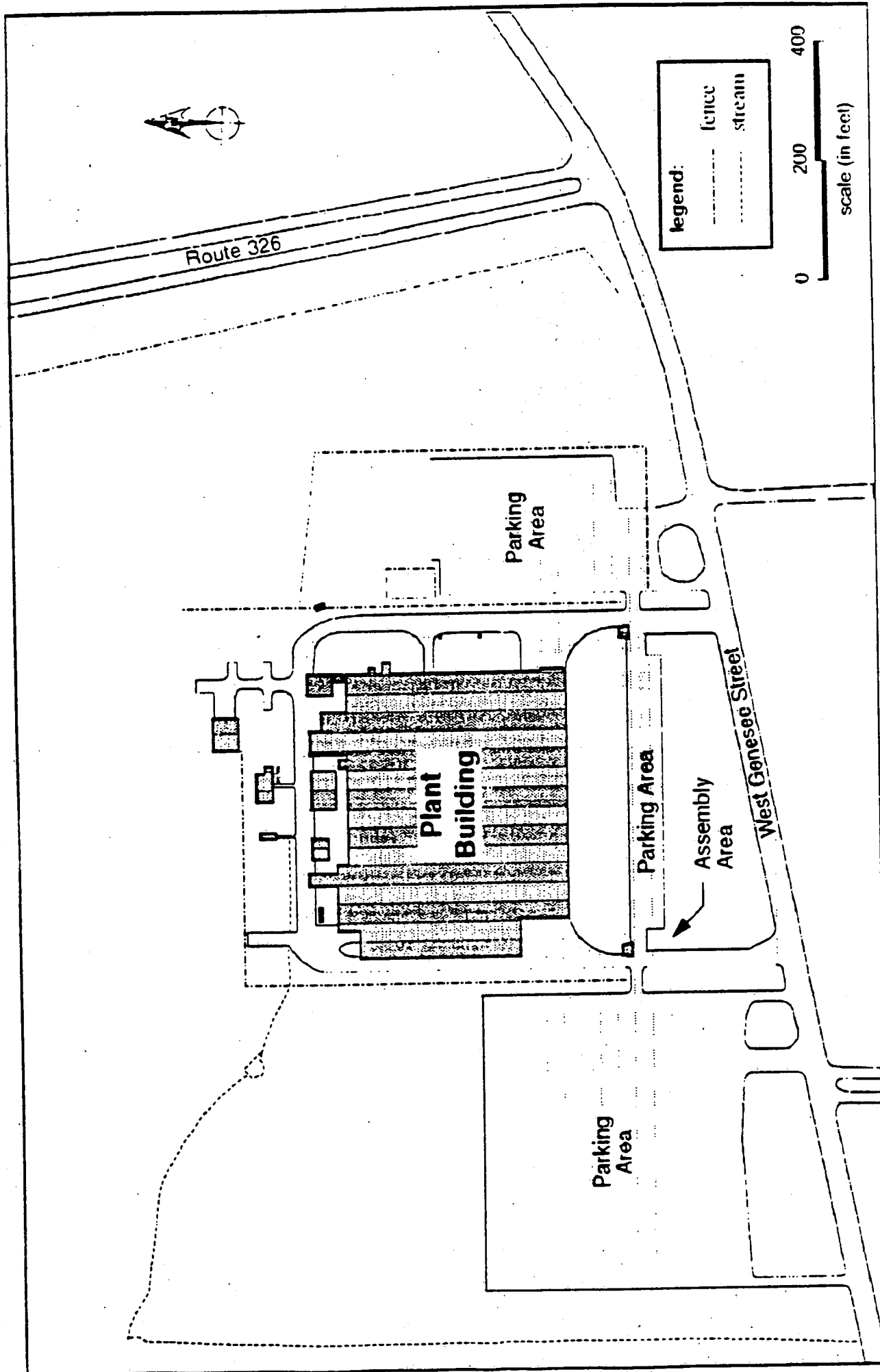


Figure 1-1. Site Map

1.2 **Scope of Work**

This FHSP is applicable to specific tasks conducted by Radian during design and construction supervision associated with a dual-phase extraction and treatment system at the former Powerex facility. During the design phase, anticipated field tasks will consist of non-intrusive site reconnaissance, such as visual inspections and site walks. During the construction phase, Radian will perform oversight activities for the following field tasks:

- Well installation;
- Collection of soil, groundwater, and/or vapor samples; and
- General construction activities.

1.3 **Responsibility**

This section outlines the health and safety responsibilities of project personnel. Radian employees who will have overall responsibility for establishing and implementing safe work practices on this project are the: Project Manager, Field Task Leaders (FTLs), PHSO, and Site Safety Officer (SSO).

1.3.1 **Project Manager**

The Project Manager, Mr. Chris Koerner, P.E., assumes overall responsibility for executing the health and safety contractual obligations, and for communicating administrative health and safety issues with GE and Radian project personnel.

1.3.2 **Field Task Leader**

The FTL will be James Siegfried, P.E., a Senior Engineer at Radian. James Baxter, C.P.G., a Senior Geologist, will act as Radian's FTL in Mr. Siegfried's absence. They will be responsible for managing Radian's activities in accordance with this FHSP, the

defined project scope, and other requirements. They will be responsible for assigning an SSO for each field effort during the project. The FTLs will facilitate communication between GE project representatives, Radian's Project Manager, Radian's field team, and its on-site subcontractors.

1.3.3 Project Health and Safety Officer

Carolyn Solomon, C.I.H., C.S.P., will perform the role of PHSO. Her responsibilities include:

- Preparing the FHSP;
- Reviewing and confirming any requests for changes in the FHSP; and
- Providing technical support to the FTLs and the SSO.

1.3.4 Site Safety Officer

An SSO will be assigned by the FTL for each field activity where Radian will have employees on site. The Radian employee assigned as the SSO will have completed the OSHA 8-hour supervisory training as specified in 29 CFR § 1910.120.

Responsibilities of the SSO include:

- Assuring that a complete copy of this FHSP is at the site and that all Radian employees have access to and are familiar with it, and that field activities by employees and subcontractors are conducted in a manner consistent with this FHSP;
- Assuring that all appropriate employee records and certificates are available;
- Establishing and monitoring compliance with site control areas and procedures;

- Ensuring that employees have, use, and properly maintain specified personal protective, monitoring, decontamination and other health and safety equipment;
- Maintaining a high level of safety awareness among employees and communicating pertinent matters to them promptly;
- Informing subcontractors of potential health or safety hazards that have been identified and of the site emergency procedures;
- Notifying the PHSO and FTLs of any unanticipated hazards or situations which are not adequately addressed by this plan;
- Conducting on-site briefings of field team members and subcontractors as needed;
- Making advance arrangements (as necessary) with emergency response/assistance organizations and implementing any required on-site emergency response activities; and
- Preparing any required incident reports.

If an unsafe act or condition is observed by the SSO, he or she has the authority to stop work until the unsafe condition has been corrected.

1.3.5 Employee Responsibilities

All on-site employees, including subcontractors, will accept responsibility for following the FHSP and performing work in a safe manner. Employees are expected to:

- Read and understand this plan;
- Perform work safely;
- Report any unsafe conditions to the SSO; and
- Be aware of, and alert for, signs and symptoms of exposure to the physical and chemical hazards identified in Section 3.0 of this plan.

1.3.6

Subcontractor Responsibilities

Each Radian subcontractor performing work on site during this project will be responsible for:

- Developing a site-specific health and safety plan that complies with the requirements set forth by pertinent regulations, and which is at least as stringent as this FHSP, unless the subcontractor chooses to adapt this FHSP for its own use;
- Providing the FTL with a copy of its site-specific health and safety plan, so that Radian personnel are informed of any additional hazards introduced by the subcontractor;
- Ensuring that its on-site employees comply with its site-specific health and safety plan;
- Identifying a site health and safety coordinator; and
- Reporting health and safety problems to Radian's SSO.

As previously stated, this FHSP is not to be construed as applying to, or providing advice or protection to, any person other than a Radian employee or an employee of its subcontractor(s).

2.0 PREVIOUS SITE WORK

2.1 Site Background

The former Powerex facility is a 55.4-acre site located along the boundary of the Town of Aurelius and the City of Auburn in Cayuga County, New York. The plant was constructed in 1951 by GE. GE manufactured a variety of electrical components at the site, including radar system components, printed circuit boards and, beginning in 1959 or 1960, semiconductor components. Powerex purchased the site in January 1986 and continued the manufacture of high-voltage semiconductors. Powerex ceased manufacturing in May 1990 and closed the plant. GE repurchased the site from Powerex in November 1990, and the plant remains inoperative.

Waste solvents were reportedly disposed of in two unlined evaporation pits at the site, one located in the field west of the plant building (the purported "West Evaporation Pit") and one located immediately north of the plant building (the "North Evaporation Pit"). The purported West Evaporation Pit is reported to have been abandoned in 1962, at which time the North Evaporation Pit was brought into service. In 1966 or 1967, a waste solvent tank (the "Waste Solvent Tank") was installed at the northwest corner of the plant building, and use of the North Evaporation Pit was reportedly discontinued. Waste solvents stored in this tank were transported off-site two or three times a year for reclamation and/or disposal. The Waste Solvent Tank was closed by Powerex in December 1988 pursuant to a closure plan approved by the New York State Department of Environmental Conservation (NYSDEC). Thereafter, drums were used to store waste solvents.

Waste solvents were also stored in two small underground tanks located along the east side of the plant building (the "Laboratory Waste Solvent Tanks"). These tanks, installed around 1960, were reportedly used to collect waste solvents from the engineering laboratory, and were reportedly periodically emptied into 55-gallon drums, which in turn were emptied into the drain leading to the North Evaporation Pit. Use of the Laboratory

Waste Solvent Tanks was reportedly discontinued in 1966/1967, when the Waste Solvent Tank was installed.

Investigation of subsurface environmental conditions at the site began in June 1979 with the sampling of surface soil in the North Evaporation Pit. Another limited investigation at the North Evaporation Pit occurred in May 1985. Dunn Geoscience Corporation was retained by GE and began a more systematic investigation of subsurface environmental conditions in December 1985. The facility was officially added to New York State's Registry of Inactive Hazardous Waste Disposal Sites in October 1987, based on information available from GE's initial investigation activities, which showed the presence of volatile organic compounds (VOCs) in soil and groundwater at the site.

2.2 Site Concerns

A considerable amount of information is available from previous investigative activities. All work performed under the design and construction tasks will occur in areas already characterized for health and safety risks and/or areas where potential exposures can be reasonably predicted. Possible health and safety hazards are detailed in this FHSP. Use of the protective equipment and procedures specified in this FHSP will minimize these hazards.

3.0 HAZARD ANALYSIS

This section presents a summary of hazards associated with the scope of work described in Section 1.2.

3.1 Hazard Analysis for Design Activities

Hazards associated with design activities are minimal due to the limited scope of field activities anticipated. Excavation into contaminated soils or groundwater is not anticipated. Hazards associated with visual reconnaissance include:

- Slipping and tripping hazards from steep grades or uneven terrain;
- Exposure to biological hazards (i.e., poison ivy, biting/stinging insects);
- Work in remote locations;
- Exposure to sun (sunburn); and
- Exposure to heat and/or cold.

3.2 Hazard Analysis for Construction Activities

Radian personnel who will be monitoring construction activities may be exposed to the following hazards, in addition to those listed above.

- Excavation hazards, including accidental exposure of buried utilities;
- Electrical hazards from accidental contact with overhead power lines and use of electrically powered field equipment;
- Being struck by heavy equipment;
- Drilling hazards;
- Noise from heavy equipment;

- Hazards associated with demolition activities; and
- Chemical hazards.

Most of the hazards identified above will be controlled through the use of acceptable construction safety practices and common sense. These include the safe work practices listed in Section 8.0.

3.3 Chemical Hazards

Most activities are not expected to result in exposure to an airborne concentration of a substance above its OSHA Permissible Exposure Limit (PEL), except possibly during intrusive activities (i.e., drilling or excavation). Work will be discontinued if field measurements or observations indicate that there is potential for exposure to a hazard that was not anticipated or which poses a risk to the health of employees on site.

Attachment A lists the chemicals detected in environmental samples from past site investigations, and their maximum known concentrations in groundwater, soils, and surface water. Attachment B lists the published airborne exposure limits for these chemicals. The chemicals detected at the site include several chlorinated hydrocarbons, and acetone, methanol, toluene, ethylbenzene and xylenes. Acute health effects associated with these chemicals include central nervous system effects (such as light-headedness, dizziness, headache, nausea).

4.0

AIR MONITORING REQUIREMENTS

Air monitoring for organic vapors and combustible atmospheres is required whenever intrusive activities are performed. Organic vapors will be monitored in the breathing zone and at the source area (i.e., borehole, excavation) during intrusive activities to determine the appropriate level of personal protective equipment (PPE). Chemical monitoring response criteria are presented in Tables 4-1 and 4-2. The action level of 25 ppm in Table 4-1 is based one-half the PEL for trichloroethylene (TCE), which is the most prevalent chlorinated hydrocarbon on-site.

4.1

Total Hydrocarbon Monitoring

Monitoring for total hydrocarbons (THC) will be performed at 30-minute intervals during intrusive activities into the soil or during activities which may expose employees to the vapor/water stream. The THC monitor will be either an organic vapor analyzer (OVA) or photoionization detector (PID) with an 11.7 eV lamp. Readings will be taken in the breathing zone of employees closest to the intrusive activities and/or the vapor/water stream. The instrument shall be calibrated at the start and end of each work day. Calibration data and breathing zone readings shall be maintained in the field logbook.

When the response plan in Table 4-1 calls for contingency monitoring for vinyl chloride, this will be conducted using a Draeger hand-held pump and vinyl chloride detector tubes in the range of 0.25 - 6.0 parts per million (ppm).

4.2

Combustible Gas Indicator Surveys

During soil intrusive activities, readings will be taken with a combustible gas indicator (CGI) if organic vapor readings are continuously greater than 100 ppm. Above 100 ppm, an explosive atmosphere could potentially develop; the CGI will indicate if dangerous levels are present. Readings should be taken as close as safely possible to the borehole. The response plan in Table 4-2 will be consulted for appropriate responses.

Table 4-1

Exposure Measurement Criteria and Response Plan

Breathing Zone Concentrations	Response
General Monitoring for Organic Vapors	
< 25 ppm THC	Limited hazard. No special action. Continue taking readings at least once every 30 minutes.
25-250 ppm THC	Level C protection required. Set up work zones. Institute contingency monitoring. Institute CGI monitoring. Take vinyl chloride detector tube readings every 30 minutes and take THC readings continuously.
> 250 ppm	Stop work. Take action to reduce vapor levels.*
Contingency Monitoring: Detector Tubes	
> 0.5 ppm vinyl chloride	Notify PHSO to determine if integrated sampling or real-time surveys are needed.
> 1.0 ppm vinyl chloride	Stop work. Take action to reduce vapor levels* and notify the PHSO and Project Manager, who will determine further action.

Note: Responses are to be based on samples taken at employee breathing zones.

*Actions that may be taken to reduce vapor levels include covering exposed soils with plastic sheeting.

Table 4-2

Combustible Gas Indicator Criteria and Action Plan

Readings (% LEL)	Action
0-10%	Limited explosion hazard. Continue monitoring until THC readings drop below 100 ppm.
10-25%	Potential explosion hazard. Take action to reduce vapor levels* and notify PHSO.
> 25%	Stop work. Evacuate site. Notify the PHSO and Project Manager.

*Actions that may be taken to reduce vapor levels include covering exposed soils with plastic sheeting or operating excavation equipment at a slower rate.

Integrated Sampling

Integrated sampling (to determine time-weighted exposures to the site contaminants) is not anticipated to be necessary. Should any of the following occur, the PHSO will determine if integrated sampling or more complex real-time surveys are needed:

- THC readings consistently exceed the 25 ppm THC action level;
- Detector tube readings for vinyl chloride are consistently greater than 0.5 ppm; or
- On-site employees observe signs of significant exposure.

5.0 PERSONAL PROTECTIVE EQUIPMENT

PPE requirements for anticipated field activities are summarized in the following subsections.

5.1 Non-Intrusive Field Activities

Level D Protection:

- Long pants or coveralls;
- Safety glasses;
- Steel-toed boots; and
- Hearing protection (if noisy equipment is in use nearby).

5.2 Intrusive Activities

Level D Protection:

- Disposable coveralls;
- Safety glasses with side shields;
- Hard hats;
- Steel-toed boots;
- Hearing protection (if heavy equipment is in use); and
- Nitrile gloves (if handling soils or water samples).

If air monitoring results indicate the need to upgrade to Level C protection, the following PPE will be added:

- Chemical-resistant Tyvek®, taped at the bottom of the sleeves and legs;
- Chemical-resistant safety boots or slip-ons;
- Nitrile outer gloves with latex inner gloves, or double-layered NDEX (nitrile) gloves; and
- Air purifying respirators with combination organic vapor cartridges and high efficiency particulate filters.

5.3 Respiratory Protection

Respiratory protection will be available for use if air monitoring data indicate that airborne concentrations of VOCs exist in the general work area at or above the response criteria presented in Table 4-1. If required, individuals will wear half- or full-facepiece respirators with combination organic vapor cartridges and high efficiency particulate filters.

All personnel using respirators will, within the previous year, have (1) received respirator training, (2) been fit-tested, and (3) been certified medically fit to wear a respirator.

Personnel who must use respirators will be clean-shaven. Respirators will be maintained in accordance with good industrial hygiene practices. They will be inspected and cleaned daily, and will be stored in zip-locked plastic bags when not in use.

Air-purifying respirators are not effective for protection in atmospheres where vinyl chloride vapors are present. If vinyl chloride detector tube sampling indicates that the 1.0 ppm action level has been exceeded, work will be halted, and the PHSO notified for further action.

6.0 WORK ZONES AND SITE CONTROL

6.1 Work Zones

For tasks that require Level C protection, the SSO will segregate the site into zones based upon historical knowledge, monitoring data, the nature of the tasks to be performed, and site conditions, as follows:

- **Exclusion Zone (EZ).** A work area involving potential contact with contaminants which will have its boundaries marked and to which access will be limited to employees or Radian's subcontractors who have the requisite training and protective equipment. A log of employees or Radian's subcontractor(s) who enter the EZ will be maintained (this may take the form of a sign-in sheet), and entry of unauthorized personnel will be prohibited. The boundaries will be changed as necessary, depending upon the SSO's judgement regarding work conditions, air monitoring, etc.
- **Contamination Reduction Zone (CRZ).** A marked area outside the EZ, used for employee and equipment decontamination, equipment storage and supply, and employee rest. This area will have minimal or no contamination. The location of the CRZ will be subject to change based on the SSO's judgement considering work conditions, air monitoring, etc.
- **Support Zone (SZ).** An area located outside the CRZ, where administrative and other support functions can be performed. SZ locations will be established by the SSO. Factors considered will include the distance from the EZ and CRZ, visibility, accessibility, freedom from potential contamination, etc. The only marked SZ boundaries will be at the edge of an EZ or CRZ.

6.2 Buddy System

Each employee or subcontractor(s) working in an EZ or CRZ at a site regulated by OSHA under 20 CFR § 1910.120 must be under the observation of at least one other employee or Radian's subcontractor(s) in or close to that area.

6.3 Emergency Response

If a worker within the EZ is injured or becomes ill, and is unable to leave the zone without assistance, first aid will be initiated or appropriate assistance obtained. The nearest hospital is Auburn Memorial Hospital; a route map is provided as Figure 9-1 and, for ease of access during field work, on the back cover of this document. The directions to the hospital from the site are presented in Table 9-2. The hospital phone number is (315) 255-7011.

6.4 Site Entry and Exit

Access to the site will occur through access points specified by GE. Only personnel identified as "authorized" will be permitted to enter the work site. A list of authorized personnel will be maintained by the SSO.

If Level C protection is involved, all persons entering a designated work zone will be required to wear the personal protective equipment ensemble specified in Section 5.0. The following protocols will be followed during site exit from an EZ:

- All personnel will exit through the designated exit point; and
- All personnel will proceed through appropriate decontamination, as specified in Section 7.0.

6.5 Communication

Communication between workers on site will be maintained verbally. Standard hand signals (described in Section 9.3) will also be used as necessary. A portable telephone will be available on site for use in case of an emergency. The signal for site evacuation is three blasts from an airhorn.

7.0

DECONTAMINATION PROCEDURES

To minimize the movement of contaminants from an EZ to other areas via contaminant-laden PPE or equipment, a decontamination station will be established in a designated CRZ at one edge of the Level C work area (EZ) for employee/subcontractor and equipment decontamination. At a minimum, the station should consist of a plastic-covered work area with decontamination supplies, galvanized steel or plastic tubs to hold detergent solution and rinse water, and a scrub brush.

7.1

Personnel Decontamination

The following steps should be taken, as appropriate, to decontaminate personnel leaving a Level C work area:

1. Place equipment and sample containers on a plastic sheet;
2. Scrub outer boots with a brush and detergent water, rinse in clear water, and store;
3. Remove disposable protective garments (i.e., outer gloves, boot covers) and dispose of in labeled container;
4. Remove respiratory protection and place on a plastic sheet;
5. Remove and dispose of inner gloves; and
9. Thoroughly wash face and hands in fresh potable water.

7.2

Equipment Decontamination

Personnel must take the following steps to decontaminate PPE and sample containers being removed from a Level C work area into the CRZ:

- Wash reusable equipment in detergent solution, then rinse;
- Dry sample containers with paper towels (if necessary) and place on a clean plastic sheet;

- Remove and discard spent respirator cartridges. Wash respirator with detergent water and rinse in clean water; and
- Treat respirator with a commercially available disinfectant designed for respirator cleaning (isopropyl alcohol or an iodine solution can be used if necessary, but may degrade rubber components). Store clean respirator in a closed plastic bag, away from sources of contamination.

Personnel must take the following steps to clean up following completion of work in a Level C work area:

- Dispose of all washing and rinsing solutions in a drum labeled "Decontamination Solution." Mark the drum with the date of first accumulation.
- Place all PPE and related waste materials (disposable gloves and garments, tape, plastic sheets, etc.) into labeled containers for proper management. Mark the container "PPE/Debris" and include the date of first accumulation.

8.0 SAFE WORK PRACTICES

This section discusses safe work practices intended to address the hazards listed in Section 3.0 of this FHSP.

8.1 Operation of Drilling Equipment

Drill rig operations may present such hazards as being struck by flying or falling objects during the raising or lowering of the derrick, and hazards associated with the connection and disconnection of drill bits and casing. Safety glasses and hard hats will be worn within the drilling area at all times.

One of the primary physical hazards associated with drilling operations is associated with placement and operation of the drill rig. Due to the potential for variable conditions of the ground beneath the rig, proper positioning and blocking of the rig will be essential to prevent shifting or collapse. The drilling subcontractor should be included in initial safety meetings and asked to review the procedures he uses for the safe operation and placement of the rig.

The following guidelines are intended to address other hazards associated with work around moving equipment:

- Workers must make their presence known as they near the equipment, and stay within the visibility range of the person operating the equipment. The use of fluorescent work vests should be considered for work near heavy equipment;
- Personnel must be aware of rotating equipment. Loose clothing or jewelry should not be worn, and long hair should be tied back;
- Workers should observe traffic patterns and stay out of the way; and
- An assistant should be present to point out obstacles and direct movements when the drill rig is being moved.

8.2 Excavations

The excavation contractor will provide a competent person (as defined in 29 CFR § 1926.650) to perform daily inspections of the excavation. In addition, Radian's FTL will serve as Radian's competent person, and will provide oversight of the daily inspections. Radian employees will stay at least 4 feet from the edges of all excavations. Entry into trenches or excavations is not anticipated for work by Radian employees on this project. Under no circumstances will a Radian employee enter an excavation greater than 4 feet in depth unless confined space procedures are instituted and a confined space permit is obtained. If it becomes necessary to enter an excavation, this FHSP will be modified to include confined space procedures.

8.3 Underground Utilities

Buried utility lines are to be marked prior to any soil intrusive activity. Buried utility lines will be located by contacting local utility companies to request marking and possible lock-out of utilities at the project site.

8.4 Electric Power Lines

Care shall be taken to ensure that equipment does not contact overhead power lines, by observing at least a 50-foot minimum clearance distances between equipment and power sources.

8.5 Temperature Extremes

8.5.1 Heat Stress

When ambient temperatures are above 75°F, field personnel are advised to wear lightweight clothing (including hats and long-sleeved shirts) and use a sunscreen on exposed skin surfaces to protect themselves from sunburn. Field personnel will be aware of the symptoms of heat exhaustion, which include the following: pale, cool, moist skin; heavy

sweating; dizziness; and nausea. Frequent breaks and consumption of water are encouraged to avoid heat-related problems. Heat stroke, a more serious form of heat stress, is indicated by the following symptoms: red, hot, dry skin; lack of, or reduced, perspiration; nausea; dizziness and confusion; and a strong, rapid pulse. If these symptoms become apparent, employees are required to stop work, begin first aid, and seek medical attention. Symptoms of heat exhaustion and heat stroke should be acted on immediately.

8.5.2 Cold Stress

Factors that can contribute to cold stress on the body include: exposure to temperatures below 30°F, high winds, and humidity or dampness. The most severe form of cold stress is hypothermia (the body's inability to maintain proper temperature). The early signs of hypothermia are excessive shivering and drowsiness. If symptoms of hypothermia occur, begin first aid, and call emergency medical services or the facility nurse will be called. Frostbite is another injury caused by exposure to low temperatures. It occurs when ice crystals form in body tissues, usually the nose, ears, chin, cheeks, fingers, or toes. Frostbite symptoms begin with a flushing of the skin. The color of the affected area will then change to white or grayish-blue. The frostbitten area may feel very cold and numb. If symptoms of frostbite are observed, medical help should be sought at once.

Cold stress can be prevented by using good common sense. All personnel should wear appropriate, water-resistant clothing in cold, damp weather. Special attention must be given to parts of the body which are especially subject to frostbite. Wearing several layers of clothing is the best method for reducing exposure. Head liners under hard hats will be used for ear protection and to reduce heat loss from the head. Each employee is advised to bring extra clothing to the site, to ensure that additional layers are available if needed, or that damp clothing can be changed.

8.6 Noise

Noise levels in excess of 85dBA are expected to occur periodically in the vicinity of heavy equipment, and in the vicinity of motors and pumps associated with the dual-phase extraction and treatment system. To protect field personnel from hearing loss, hearing protection will be required within a 25-foot radius of heavy equipment usage. Hearing protection is also required when operators are working within a 5-foot radius of pumps or motors associated with the treatment system.

8.7 Demolition Activities

Limited demolition activities will be undertaken during the project. To minimize hazards, these will be conducted per 29 CFR Part 1926, Subpart T, which provides guidance on topics such as Preparatory Activities (29 CFR § 1926.850), Removal of Walls (29 CFR § 1926.856), and Mechanical Demolition (29 CFR § 1926.859).

8.8 Biological Hazards

Biological hazards may exist in field work areas, depending upon indigenous plant and animal populations and seasonal variations. Hazards that might be encountered during warmer weather include biting insects, poison ivy, and snakes. Deer ticks are known carriers of the rickettsial organism that causes Lyme disease. In grassy and wooded areas, personnel should wear socks or boots which cover the ankles to limit exposure to ticks. The SSO will ensure that field personnel are able to recognize poisonous vines and shrubs, such as poison ivy, so that these can be avoided. Long pants and long-sleeved shirts will limit contact with such vegetation.

8.9 Other Safe Work Practices

The following list includes other safe work practices intended to address site health and safety:

- Strive to approach and conduct work from the upwind side.
- Practice contamination avoidance. Avoid sitting down, kneeling, or laying equipment on the ground, avoid obvious sources of contamination such as puddles, and avoid unnecessary contact with on-site objects.
- Do not eat, drink, or smoke in areas of the site that are suspected of being contaminated (never in the drilling or excavations areas, or an EZ).
- Use good lifting skills when handling heavy objects; use legs rather than bending at the waist, and keep the load close to the body.
- Make sure electrically powered equipment used in the field is in good working order; check for worn or frayed cords; use only extension cords approved for outdoor use.

9.0 EMERGENCY PROCEDURES AND ACCIDENT REPORTING

Emergency procedures and information for the former Powerex facility are contained in this section of the FHSP and in Attachment C.

9.1 Anticipated Emergencies

Emergency conditions that could potentially occur at this site include:

- Medical emergency;
- Fire emergency;
- Unplanned chemical release; and
- Injury from physical hazards on site.

9.2 Responsibilities

The SSO is responsible for ensuring that appropriate emergency procedures are followed and that the PHSO and the Project Manager are notified if an emergency situation involving an employee or Radian's subcontractor(s) occurs at the site.

9.3 Notification and Initial Response

A daily sign-in/sign-out form will be completed by all employees and Radian subcontractors for the purpose of keeping track of all personnel in case of emergencies. The SSO is to be notified of any on-site emergency. Upon the occurrence of an emergency, including an unplanned chemical release, fire or explosion, within or adjacent to the site, all employees and Radian subcontractor(s) will be alerted and the affected area evacuated immediately except for emergency response personnel. Emergency situations will be evaluated by the SSO and appropriate initial emergency response measures will be undertaken, if appropriate. Re-entry will occur only to assist injured or ill employees, and

only after appropriate PPE has been donned. If a fire (beyond the incipient stage) or explosion occurs anywhere on-site, the local fire department will be alerted.

An airhorn (or direct verbal communication) will be utilized to alert employees to evacuate the affected area. Upon activation of an alarm (three blasts from an airhorn), employees in or near the affected area, with the exception of those involved in initial emergency response activities, will proceed to the designated assembly area, located in the parking lot adjacent to the westernmost of the two security huts in front of the main plant building (see Figure 1-1). The SSO will account for all employees, Radian's subcontractors, and visitors by comparing the personnel present with the daily work area access roster.

Standard hand signals will also be used as necessary:

- Hand gripping throat, indicating, "Can't breathe" or "Out of air";
- Grip partner's wrist, indicating "Leave area immediately - no debate!";
- Hands on top of head, indicating "Need assistance";
- Thumbs up, indicating "Yes" or "Okay"; and
- Thumbs down, indicating "No" or "A problem".

9.4 Equipment Failure

If a failure or alteration of PPE occurs that reduces the protection factor (i.e., torn garment or respirator cartridge breakthrough), the employee (and buddy) will immediately leave the work area and not re-enter until the cause is known and/or the item has been repaired or replaced. If any other equipment fails to operate properly, the SSO will be notified and will then determine the effect of that failure on operations. If the failure adversely affects the safety of all employees and subcontractors (i.e., failure of monitoring equipment) or prevents completion of the planned tasks, all personnel will leave the work area until appropriate corrective actions have been taken.

9.5 Employee Injury or Illness

If an employee is injured or ill, other employees will initiate or obtain appropriate first aid and, if required, make contact with the designated physician or medical facility and/or summon an ambulance.

9.6 Emergency Equipment

During construction or soil intrusive activities, the SSO will ensure that the following equipment is readily available at the site:

- Portable telephone;
- First aid kit; and
- A,B,C-rated fire extinguisher.

9.7 Emergency Telephone Numbers

Table 9-1 contains the emergency contacts and telephone numbers for this site. As appropriate, Table 9-1 will be posted at the site by the SSO.

9.8 Accident Reporting

All accidents, including those which do not result in injury or illness, are to be reported to the Project Manager, GE site contact, and PHSO within 24 hours of their occurrence. The report form to be used is shown in Figure D-1 (included in Attachment D). Incidents causing accidental chemical exposure are to be reported using the report form shown in Figure D-2 (included in Attachment D). Emergency situations are to be reported to GE project personnel immediately.

Table 9-1

Emergency Contacts and Phone Numbers

Emergency Services	Contact	Phone Number
Fire Department/Ambulance/Emergency	---	(315) 252-7242 or (315) 253-3211
Police Department	---	(315) 253-3231
Emergency Health Care Facility	Auburn Memorial Hospital	(315) 255-7011
State Emergency Response Hotline	---	(800) 457-7362 or (315) 426-7519
National Response Center	---	(800) 424-8802
CHEMTREC (Chemical emergency advice)	---	(800) 424-9300
Poison Control Center	---	(800) 282-3171
Radian's Project Health and Safety Officer	Lyn Solomon	(716) 292-1870
Radian's Project Manager	Chris Koerner	(703) 713-6493
GE Contact	Paul Hare	(518) 458-6613
Site Caretaker	Joe Barwinczak	(315) 253-7321

Route to Hospital

The nearest hospital to the site is Auburn Memorial Hospital. A map of the route to the hospital is provided in Figure 9-1, as well as on the back cover of this document. A description of the route is provided in Table 9-2. As appropriate, Table 9-2 will be posted at the site by the SSO.

Table 9-2

Directions to Hospital

Primary (Green) Route:

Turn left on to Genesee Street off of plant access road(s).

Go *through* 9 lights and turn left on to North Street (same as Route 34 North) at the tenth light. The ninth light is a pedestrian light. The turn on to North Street is approximately 1.5 to 1.6 miles from the plant access roads.

Go *through* 5 lights and turn right on to Lansing Street at the sixth light. The turn on to Lansing Street is approximately 0.6 miles from the turn off of West Genesee Street.

Auburn Memorial Hospital is on the left side of Lansing Street, approximately 0.1 miles from North Street. The entrance to Emergency is just past the main entrance to the hospital.

Alternate (Yellow) Route:

Turn left on to West Genesee Street off of the plant access road(s).

Go to first light and turn left on to Route 326 East, just past McDonald's, about 0.1 to 0.2 miles from the plant access roads.

Go to the first light and bear right on to Route 20 East (same as Route 5 East). The turn on to Route 20 East is approximately 0.6 miles from West Genesee Street.

Go *through* 3 lights and turn left on to North Street (same as Route 34 North) at the fourth light. The turn on to North Street is approximately 1.1 miles from the turn off of Route 326 East.

Go *through* 2 lights and turn right on to Lansing Street at the third light. The turn on to Lansing Street is approximately 0.5 miles from Route 20 East.

Auburn Memorial Hospital is on the left side of Lansing Street, approximately 0.1 miles from North Street. The entrance to Emergency is just past the main entrance to the hospital.

10.0

EMPLOYEE TRAINING

All personnel involved in field activities will be trained in accordance with the OSHA standards in 29 CFR § 1910.120. This regulation requires that all personnel potentially exposed to hazardous conditions at hazardous waste sites receive 40 hours of health and safety training, including training in respirator use and fit testing, prior to engaging in hazardous waste operations, as well as 8-hours of refresher training annually. The FTL will be trained to the supervisory level, having completed an additional 8 hours of supervisor training, and all Radian field team members will be trained in first aid and cardiopulmonary resuscitation (CPR).

10.1

Initial Briefing

All personnel assigned to the project will receive a site-specific health and safety and personal protective equipment briefing from the SSO. Subcontractors should also be included in the initial briefing. This briefing will discuss:

- Basic operational safety, emphasizing the hazards expected on-site;
- Use of personal protective equipment;
- Work practices by which the employee can minimize risks from the hazards;
- Site controls;
- Personnel and equipment decontamination facilities and procedures;
- Prohibited site activities;
- The buddy system; and
- Emergency response.

Follow-up briefings will be provided by the SSO prior to any significant change in operations. Additional training may be required if unanticipated problems occur on site or if a change in the scope of work occurs.

11.0

MEDICAL CONSIDERATIONS

All Radian project personnel who may be required to use respiratory protection will be enrolled in an on-going medical surveillance program as per the requirements of 29 CFR § 1910.120. All such personnel will have had a medical examination within 12 months prior to the start of field activities, and will have the appropriate physician's certification for respirator use.

Employees' training certificates for completion of 40 hours of health and safety training and medical monitoring, mandated by 29 CFR § Section 1910.120, are maintained by the PHSO in Radian's office located at 155 Corporate Woods, Suite 100, Rochester, New York. Documentation of site-specific training will be maintained in the project file. Summaries of any health and safety incidents or injuries, as well as air monitoring data, will be recorded in a field logbook and also maintained in the project file.

ATTACHMENT A

**Known Chemical Constituents and Maximum Concentrations in
Groundwater, Soils and Surface Water**

Table 1
Contaminants in Groundwater

Substance	Known or Suspected Present	Known or Expected Maximum Conc.	Hazards	Data Quality and Quantity
1,2-dichloroethylene	K	374,000 ug/L	T	1
vinyl chloride	K	64,000 ug/L	T	1
trichloroethylene	K	1,400,000 ug/L	T	1
acetone	K	3,600,000 ug/L	T	1
toluene	K	2,400 ug/L	T	1
xylene	K	21,800 ug/L	T	1
methylene chloride	K	717,000 ug/L	T	1
benzene	K	31 ug/L	T	1
carbon disulfide	K	312 ug/L	T	1
1,2-dichlorobenzene	K	57.9 ug/L	T	1
ethylbenzene	K	550 ug/L	T	1
1,1-dichloroethylene	K	90 ug/L	T	1
tetrachloroethylene	K	65,400 ug/L	T	1
1,1,2-trichloroethane	K	29,300 ug/L	T	1
methyl ethyl ketone	K	290,000 ug/L	T	1
methyl isobutyl ketone	K	827 ug/L	T	1
chloroform	K	250 ug/L	T	1
2-hexanone	K	23.4 ug/L	T	1
styrene	K	2.23 ug/L	T	1
1,1-dichloroethane	K	22.8 ug/L	T	1
chloroethane	K	1.6 ug/L	T	1
methanol	K	3,580,000 ug/L	T	1
benzoic acid	K	75.9 ug/L	T	1
bis(2-ethylhexyl)phthalate	K	20 ug/L	T	1
di-n-butyl phthalate	K	<20 ug/L	T	1
naphthalene	K	<20 ug/L	T	1
n-nitro-sodiphenyl amine	K	<20 ug/L	T	1
4 methyl phenol	K	10.7 ug/L	T	1
phenol	K	86.1 ug/L	T	1

Known or Suspected Present:

K = Known; S = Suspected

Concentration Units:

ug/L = micrograms per liter

Hazards:

I = Ignitable; C = Corrosive; R = Reactive; T = Toxic; U = Unstable; X = Radioactive; O = Other.

Data Quality & Quantity:

- 1 = Considerable data; substantial level of comfort; adequately characterizes expected site conditions.
- 2 = Limited data, or data may not be representative.
- 3 = No data, or data not considered representative.

Table 2
Contaminants in Subsurface Soils

Substance	Known or Suspected Present	Known or Expected Maximum Conc.	Hazards	Data Quality and Quantity
trichloroethylene	K	12,000,000 ug/kg	T	1
acetone	K	2,800,000 ug/kg	T	1
xylene	K	6,700,000 ug/kg	T	1
toluene	K	96,000 ug/kg	T	1
ethylbenzene	K	370,000 ug/kg	T	1
1,2-dichloroethylene	K	96,000 ug/kg	T	1
methylene chloride	K	9,000 ug/kg	T	1
1,2-dichlorobenzene	K	560 ug/kg	T	1
tetrachloroethylene	K	2,800 ug/kg	T	1
carbon tetrachloride	K	1,500 ug/kg	T	1
1,1,2-trichloroethane	K	6,900 ug/kg	T	1
naphthalene	K	4,560 ug/kg	T	1
2-methylnaphthalene	K	200 ug/kg	T	1
bis(2-ethylhexyl)phthalate	K	120 ug/kg	T	1
methanol	K	757,000 ug/kg	T	1

Known or Suspected Present:

K = Known; S = Suspected

Concentration Units:

ug/kg = micrograms per kilogram

Hazards:

I = Ignitable; C = Corrosive; R = Reactive; T = Toxic; U = Unstable; X = Radioactive; O = Other (define).

Data Quality & Quantity:

1 = Considerable data; substantial level of comfort; adequately characterizes expected site conditions.

2 = Limited data, or data may not be representative.

3 = No data, or data not considered representative.

Table 3
Contaminants in Surface Water

Substance	Known or Suspected Present	Known or Expected Maximum Conc.	Hazards	Data Quality and Quantity
acetone	K	217 ug/L	T	1
bromodichloromethane	K	<2 ug/L	T	1
chloroform	K	16 ug/L	T	1
1,2-dichloroethylene	K	222 ug/L	T	1
tetrachloroethylene	K	7.1 ug/L	T	1
1,1,2-trichloroethane	K	8 ug/L	T	1
trichloroethylene	K	240 ug/L	T	1
vinyl chloride	K	<10 ug/L	T	1

Known or Suspected Present:

K - Known; S - Suspected

Concentration Units:

ug/L = micrograms per liter

Hazards:

I = Ignitable; C = Corrosive; R = Reactive; T = Toxic; U = Unstable; X = Radioactive; O = Other.

Data Quality & Quantity:

1 = Considerable data; substantial level of comfort; adequately characterizes expected site conditions.

2 = Limited data, or data may not be representative.

3 = No data, or data not considered representative.

ATTACHMENT B

**Published Airborne Exposure Limits for Hazardous
Substances Known or Suspected to be Present**

Published Airborne Exposure Limits For Hazardous Substances Known or Suspected To Be Present

Substance	OSHA PEL/STEL	ACGIH TLV/STEL	NIOSH IDLH	Carcinogen?
1,2-dichloroethylene	200/NL	200/NL	4,000	No
vinyl chloride	1/5C	5/NL	NA	Yes
trichloroethylene	50/200	50/200	1,000	Yes
acetone	750/1000	750/1000	20,000	No
toluene	100/150	100/150	2,000	No
xylene	100/150	100/150	2,000	No
methylene chloride	500/1000C	50/NL	5,000	Yes
benzene	1/5	10/NL	3,000	Yes
carbon disulfide	4/12	10/NL	500	No
1,2-dichlorobenzene	NL/50C	NL/50C	1,000	No
ethylbenzene	100/125	100/125	2,000	No
1,1-dichloroethylene	1/NL	5/20	NA	Yes
tetrachloroethylene	25/NL	50/200	500	Yes
1,1,2-trichloroethane	10/NL	10/NL	500	Yes
1,1,1-trichloroethane	350/450	350/450	1,000	No
methyl ethyl ketone	200/300	200/300	3,000	No
methyl isobutyl ketone	50/75	50/75	3,000	No
chloroform	2/NL	10/NL	1,000	Yes
2-hexanone	5/NL	5/NL	5,000	No
styrene	50/100	50/100	5,000	Yes
1,1-dichloroethane	100/NL	200/250	4,000	No
chloroethane	1000/NL	1000/NL	20,000	No
naphthalene	10/15	10/15	500	No
methanol	200/250	200/250	25,000	No
carbon tetrachloride	2/NL	5/NL	300	Yes

Notes:

PEL: Permissible Exposure Limit defined as time-weighted average for an 8-hour work shift for an airborne concentration of a hazardous substance as listed by Occupational Safety and Health Administration (OSHA) in 29 CFR §1910, Subpart Z.

STEL: Short Term Exposure Limit defined as a 15-minute time-weighted average.

TLV: Threshold Limit Value defined as a time-weighted average for an airborne concentration to which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect, as established by the American Conference of Governmental Industrial Hygienists (ACGIH).

ATTACHMENT C

**Contingency Plan with Emergency Procedures,
Former Powerex, Inc. Facility
Auburn, New York**

**CONTINGENCY PLAN
WITH EMERGENCY PROCEDURES**

**Former Powerex, Inc. Facility
Auburn, New York**

**Revised
October 7, 1995**

1.0 INTRODUCTION

The former Powerex, Inc. (Powerex) facility is located on the north side of West Genesee Street along the boundary of the Town of Aurelius and the City of Auburn in Cayuga County, New York. Powerex ceased manufacturing operations and closed the facility in May 1990. The General Electric Company (GE) subsequently purchased the facility from Powerex in November 1990. Operations at the facility have not been resumed.

The facility is listed by the New York State Department of Environmental Conservation (DEC) as a Class 2 inactive hazardous waste disposal site. Such a designation requires that a Remedial Investigation and Feasibility Study (RI/FS) be performed and that a remedial program be developed and implemented at the site. GE contractors are currently performing the RI/FS pursuant to a Consent Order dated March 1993 with the DEC. Interim Remedial Measures (IRMs) are also being performed at the site pursuant to the order. The first IRM was performed in February 1994 and involved the removal of two small underground tanks which were reportedly used in the 1960s for the storage of waste solvents. The second IRM involved extension of the existing fencing to encompass additional areas of the site. This IRM was completed in December 1994. The third IRM has just begun and involves (a) removal of impacted sediments from the on-site drainage ditch, (b) installation of piping in the drainage ditch, and (c) abandonment, replacement and/or sliplining of certain storm sewer lines leading to the drainage ditch. This IRM should be completed in about six weeks.

The above activities, and occasional building decommissioning activities, may generate hazardous wastes requiring off-site transport for proper treatment and/or disposal at permitted facilities. Accordingly, this Contingency Plan with Emergency Procedures (Contingency Plan) has been developed in accordance with 6 NYCRR Part 372.

2.0 GENERAL

The purpose of this Contingency Plan is to minimize hazards to human health and/or the environment from fires, explosions, or any unplanned sudden or nonsudden release of hazardous waste or hazardous waste constituents to air, soil, or surface or ground water. General procedures are established which describe actions personnel will take in response to such events. The provisions of this plan will be carried out whenever there is a fire, explosion, or release of hazardous waste or hazardous waste constituents which could threaten human health and/or the environment. Volatile organic compounds (e.g. trichloroethene, acetone, methanol) are the dominant hazardous waste constituents at this facility, and are found in environmental media (e.g., soil, groundwater) in some areas of the site due to the disposal of waste solvents in the past.

This Contingency Plan may be supplemented by Health and Safety Plans (HASPs) developed by contractors performing work at the facility which may potentially involve the generation of hazardous wastes. Such HASPs include task-by-task analyses of potential physical, chemical and biological hazards. These HASPs also include descriptions of any required protective equipment, site control measures, and emergency response procedures.

3.0 CONTENT OF CONTINGENCY PLAN

This Contingency Plan describes the actions personnel working at the site will take in response to fires, explosions, or any unplanned sudden or nonsudden release of hazardous waste or hazardous waste constituents to air, soil, or surface or ground water at the facility. This plan includes the following:

- Designation of Emergency Coordinator;
- Arrangements made with local police and fire departments, hospital, and local emergency response agencies;
- Description of available emergency and spill-control equipment;
- Facility evacuation plan; and
- Emergency procedures to be followed in the event of an imminent or actual emergency situation.

Details regarding the above-listed items are presented below.

4.0 DESIGNATION OF EMERGENCY COORDINATOR

The persons qualified to act as Emergency Coordinator are listed in Table 1. However, to ensure the most timely response possible to an imminent or actual emergency situation, qualified on-site personnel may also be designated to perform this role. All of these persons have the authority to commit the resources necessary to carry out the procedures outlined in this Contingency Plan.

The Emergency Coordinator or his/her designee is responsible for determining whether this Contingency Plan needs to be implemented in response to an imminent or actual emergency situation. The Emergency Coordinator or his/her designee will be thoroughly familiar with all aspects of this plan, the activities being conducted at the site, the location and characteristics of any potentially hazardous wastes, the location of records, and the facility layout.

5.0 EMERGENCY AND SPILL-CONTROL EQUIPMENT

The following is a list and location of the emergency equipment that is currently available at the site:

- ABC-rated fire extinguishers located within the facility, including in the westernmost of the two security huts in front of the main plant building and in the office area in the front portion of the main plant building, at any location where remedial activities are in progress, and at location(s) used to store waste materials pending off-site transport to a permitted facility; and
- Telephones located in the westernmost of the two security huts in front of the main plant building and in the office area in the front portion of the main plant building.

Cellular telephones may also be employed during the performance of remedial activities. Fire hydrants are located along West Genesee Street in front of the facility for use by the fire department in the event of a fire which can not be extinguished with on-site equipment.

The following is a list of the spill-control equipment which will be maintained at the site:

- Absorbent materials;
- Containment booms;
- Empty containers (i.e., 55-gallon drums, overpacks and/or salvage drums);
- Chemical-resistant gloves and boots;
- Chemical-resistant coveralls (i.e., Tyvek suits); and
- Safety goggles and/or hard hats with splash shields.

The above-listed items will be kept in the immediate vicinity of any location where significant remedial activities are in progress. When not in such a location, they will be stored at the location(s) used to store waste materials pending off-site transport to a permitted facility. Other spill-control equipment may also be present on-site depending upon the nature of the remedial activities being performed.

6.0 FACILITY EVACUATION PLAN

All on-site personnel should sign in and out at the westernmost of the two security huts in front of the main plant building. In the unlikely event of an imminent or actual emergency situation requiring evacuation of the facility, any personnel inside the building should evacuate through the nearest access door. Personnel exiting the building should proceed directly to the assembly area, which is the parking lot adjacent to the westernmost of the two security huts in front of the main plant building. Personnel evacuating from other areas of the site should also proceed directly to the assembly area. The log sheet(s) will then be used to determine which, if any, personnel remain on-site. The signal for evacuation of the site is three blasts of a horn (e.g., air horn or vehicle horn). The access doors to the building and the assembly area are shown of Figures 1A and 1B.

7.0 COPIES AND AMENDMENTS OF CONTINGENCY PLAN

Copies of this Contingency Plan will be maintained at the facility and by the Emergency Coordinator or his/her designee. At the facility, a copy will be maintained in the westernmost of the two security huts in front of the main plant building and in the office area in the front portion of the main plant building. In addition, a copy will be maintained at any location where remedial activities are in progress. Copies of the HASPs will also be maintained at these locations, as appropriate.

Copies of this plan will be distributed to the local police and fire departments, hospital, and local emergency response agencies that may be called upon to provide emergency services. These agencies will also be afforded an opportunity to visit the site to familiarize themselves with the site layout, the properties of the waste materials potentially generated at the site, the places where on-site personnel would normally be working, the entrances to and roads within the facility, and possible evacuation routes.

Revisions and/or amendments to this Contingency Plan will be made whenever:

- The facility changes in a way that increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in the event of an emergency;
- The list of Emergency Coordinators changes;
- The list or location of emergency and/or spill-control equipment changes significantly; or
- The Contingency Plan fails in an emergency.

The police and fire departments, hospital, and local emergency response agencies that may be called upon to provide emergency services at the facility will be provided with any such revision and/or amendment.

8.0 EMERGENCY PROCEDURES

In the event that there is an imminent or actual emergency situation, the first action of an individual who discovers the emergency will be to contact the Emergency Coordinator given in Table 1. Emergency procedures will be initiated by the Emergency Coordinator or his/her designee in the manner outlined below.

8.1 Emergency Coordinator Response

Upon occurrence of an imminent or actual emergency situation requiring implementation of this Contingency Plan, the Emergency Coordinator or his/her designee will inform all personnel at the facility. In the unlikely event evacuation is necessary, this will be signaled with three blasts of a horn (e.g., air horn or vehicle horn). In addition, if assistance is needed, the appropriate state or local agencies having response roles will be notified by telephone. Table 2 provides a list of the state and local emergency response agencies and their respective telephone numbers. One of the available telephones is located next to the assembly area.

8.1.1 Identification of Released Materials

Upon a fire, explosion, or release, the Emergency Coordinator or his/her designee will identify the character, source, amount and extent of any released materials. This will be accomplished by observation, analysis or other practical means necessary. These initial observations will be forwarded to the proper emergency response teams with suggested precautions.

8.1.2 Assessment of Possible Hazards

The Emergency Coordinator or his/her designee, and other appropriate individuals, as necessary, will assess possible hazards to human health and/or the environment that might result from the incident. The assessment will consider both direct and indirect effects of the release, fire, or explosion.

8.1.3 Response Procedures

If the Emergency Coordinator determines that the facility has had a release, fire, or explosion which could threaten human health and/or the environment outside of the facility, he/she will report the findings as follows:

- If the assessment indicates that evacuation of local areas may be advisable, the appropriate local authorities must be notified immediately; and
- The DEC's 24-hour oil and hazardous material spill group [(800) 457-7362] and either the government official designated as the on-scene coordinator for this geographical area or the National Response Center [(800) 424-8802] must be immediately notified to report the (a) name and telephone number of reporter, (b) name and address of facility, (c) time and type on incident (e.g., fire, explosion, or release), (d) name and quantity of material(s)

involved, to the extent known, and (e) potential hazards to human health and/or the environment outside of the facility.

During an emergency, the Emergency Coordinator or his/her designee will take all reasonable measures to ensure that fires, explosions, and releases do not occur, recur, or spread to other hazardous waste at the facility. These measures may include, but are not limited to, ceasing any remedial activities, collecting and containing released waste materials, and removing or isolating containers.

After the emergency, the Emergency Coordinator or his/her designee will provide for treating, storing and/or disposing any recovered waste, contaminated soil and/or surface water, or any other material resulting from the emergency response. In the affected areas of the facility, the Emergency Coordinator or his/her designee will ensure that all emergency and/or spill-control equipment listed in this plan is cleaned or replaced before remedial activities are resumed.

8.2 Notification and Documentation

The Emergency Coordinator or his/her designee will document the time, date and details of any emergency incident that requires implementation of this Contingency Plan. The information to be recorded will include, but need not be limited to, the following:

- Name, address and telephone number of the owner;
- Name, address and telephone number of the facility;
- Date, time and type of incident (e.g., fire, explosion, or release);
- Name and quantity of material(s) involved;
- The extent of injuries, if any;
- An assessment of actual or potential hazards to human health and/or the environment, where applicable; and
- Estimated quantity and disposition of any recovered material(s) that resulted from the incident.

A written report on the incident containing the above-listed information will be submitted to the DEC within 15 days.

9.0 MEDICAL EMERGENCIES

Medical emergencies may not require implementation of this Contingency Plan. Nevertheless, directions to the local hospital and a map indicating the location of and route(s) to the hospital are provided in Table 3 and Figure 2, respectively. If needed, ambulance service can be arranged by contacting (315) 255-1146.

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Table 1

EMERGENCY COORDINATORS AND OTHER CONTACTS

**Former Powerex, Inc. Facility
Auburn, New York**

Primary Emergency Coordinator:

Paul Hare, C.P.G.	Office: (518) 458-6613
General Electric Company	Fax: (518) 458-9247
Corporate Environmental Programs	Mobile: (518) 423-7635
1 Computer Drive South	Beep.: (518) 435-3140*
Albany, New York 12205	Home: (518) 899-4807

Secondary Emergency Coordinators:

Jill Siebels	Office: (518) 458-6623
General Electric Company	Home: (518) 692-2058
Real Estate and Construction Operations	Mobile: (518) 577-8113
1 Computer Drive South	Fax: (518) 458-9247
Albany, New York 12205	

Daniel George	Office: (717) 443-9248
General Electric Company	Home: (717) 443-9248
Real Estate and Construction Operations	Mobile: (215) 870-2511
P.O. Box 1561	Fax: (717) 443-9384
640 Freedom Business Center	
King of Prussia, Pennsylvania 19406	

Facility Caretaker:

Joe Barwinczak	Site: (315) 253-7321
c/o General Electric Company	Home: (315) 252-1823
P.O. Box 1933	
West Genesee Street	
Auburn, New York 13021	

Table 1 (Continued)

EMERGENCY COORDINATORS AND OTHER CONTACTS

**Former Powerex, Inc. Facility
Auburn, New York**

Contractor Contacts:

Douglas Crawford, P.E.
O'Brien & Gere Engineers, Inc.
P.O. Box 4873
5000 Brittonfield Parkway
Syracuse, New York 13221

Office: (315) 437-6100
Fax: (315) 463-7554

Brian Dixon
OBG Technical Services, Inc.
P.O. Box 4873
5000 Brittonfield Parkway
Syracuse, New York 13221

Office: (315) 437-6400
Fax: (315) 437-9800

Donald Sauda
Blasland, Bouck & Lee, Inc.
P.O. Box 66
6723 Towpath Road
Syracuse, New York 13214

Office: (315) 446-9120
Fax: (315) 445-9161

Edward Lynch, P.E.
BBL Environmental Services, Inc.
P.O. Box 66
6723 Towpath Road
Syracuse, New York 13214

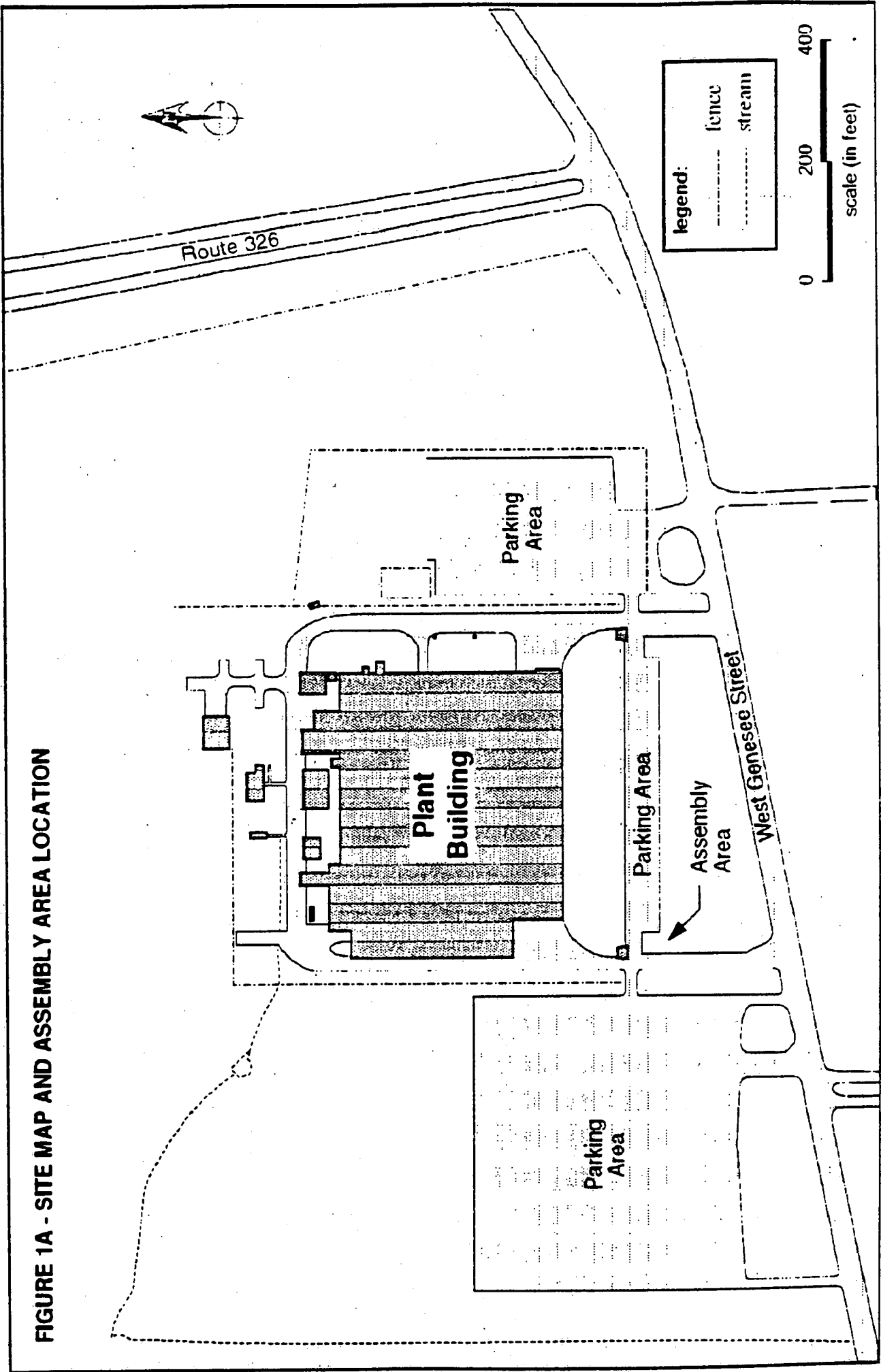
Office: (315) 446-9120
Fax: (315) 449-0017

James Siegfried, P.E.
Radian Engineering, Inc.
Suite 100
155 Corporate Woods
Rochester, New York 14623

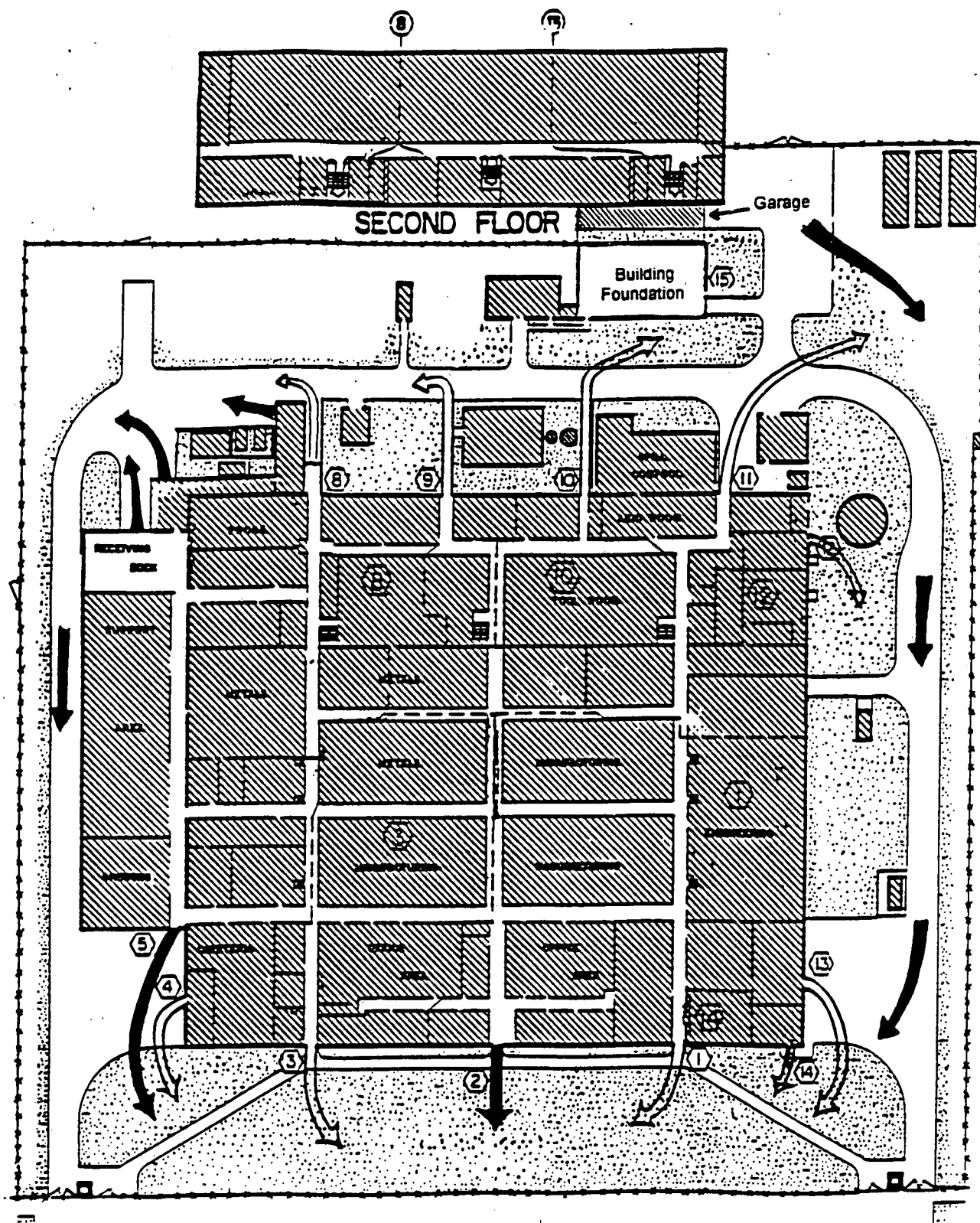
Office: (716) 292-1870
Fax: (716) 292-1878

- * To use a beeper, dial the number provided using a touch tone phone. The call will be answered. After you hear the beeps, punch in your phone number, complete with area code first, and then pause. You can then hang up. The person carrying the beeper will receive your phone number in about 60 seconds, and return your call.

FIGURE 1A - SITE MAP AND ASSEMBLY AREA LOCATION



**FIGURE 1B - Floor Plan with Egress Routes
and Assembly Area Location**



Assembly Area

Primary Egress Route

Secondary Egress Route
(available if unbolted in advance)

Table 2

State and Local Emergency Response Agencies

**Former Powerex Inc. Facility
Auburn, New York**

Fire Department	(315) 253-3211
Police Department	(315) 253-3231
Auburn Memorial Hospital	(315) 255-7011
Cayuga County Emergency Planning	(315) 253-4561
State Emergency Response Hotline	(800) 457-7362 (315) 426-7519
National Response Center	(800) 424-8802

Table 3

Directions to Auburn Memorial Hospital

**Former Powerex, Inc. Facility
Auburn, New York**

Primary (Green) Route:

Turn left onto West Genesee Street off of plant access road(s).

Go *through* 9 lights and turn left onto North Street (same as Route 34 North) at the tenth light. The ninth light is a pedestrian light. The turn onto North Street is approximately 1.5 to 1.6 miles from the plant access roads.

Go *through* 5 lights and turn right onto Lansing Street at the sixth light. The turn onto Lansing Street is approximately 0.6 miles from the turn off of West Genesee Street.

Auburn Memorial Hospital is on the left side of Lansing Street approximately 0.1 miles from North Street. The entrance to Emergency is just past the main entrance to the hospital.

Alternate (Yellow) Route:

Turn left onto West Genesee Street off of the plant access road(s).

Go to first light and turn left onto Route 326 East, just past McDonald's about 0.1 to 0.2 miles from the plant access roads.

Go to the first light and bear right onto Route 20 East (same as Route 5 East). The turn onto Route 20 East is approximately 0.6 miles from West Genesee Street.

Go *through* 3 lights and turn left onto North Street (same as Route 34 North) at the fourth light. The turn onto North Street is approximately 1.1 miles from the turn off of Route 326 East.

Go *through* 2 lights and turn right onto Lansing Street at the third light. The turn onto Lansing Street is approximately 0.5 miles from Route 20 East.

Auburn Memorial Hospital is on the left side of Lansing Street approximately 0.1 miles from North Street. The entrance to Emergency is just past the main entrance to the hospital.

ATTACHMENT D

Emergency Reporting Forms

Date: _____

Time: _____

Injured Person: _____

Location of Accident: _____

Company's First Aid: _____

Physician's Treatment: _____

Is Further Physician's Care Required? _____

Cause of Injury: _____

Prevention: _____

Comments: _____

Reported by: _____

Distribution: (initials)

Project Manager, Chris Koerner _____

PHSO, Lyn Solomon _____

Figure D-1. Accident Report Form

Name of Employee: _____ Employee Number: _____

Date(s) of Exposure: _____

Estimated Length of Exposure: _____

Name and Location of Site: _____

Project Number and Title: _____

Purpose of On-Site Activity: _____

Was a site-specific health & safety plan approved prior to site work? _____

Describe the exposure event (include how the exposure was identified): _____

Protective equipment in-use at time of the exposure:

Respiratory: _____ Face: _____

Eyes: _____ Hands: _____

Body: _____ Other: _____

Was a Radian Health & Safety Officer contacted after the exposure?: _____

(give name): _____

What were his or her instructions?: _____

Is follow-up sampling to identify specific compounds required?: _____

DISTRIBUTION (initials)

Project Manager, Chris Koerner _____

PHSO, Lyn Solomon _____

Figure D-2. Record of Accidental Chemical Exposure

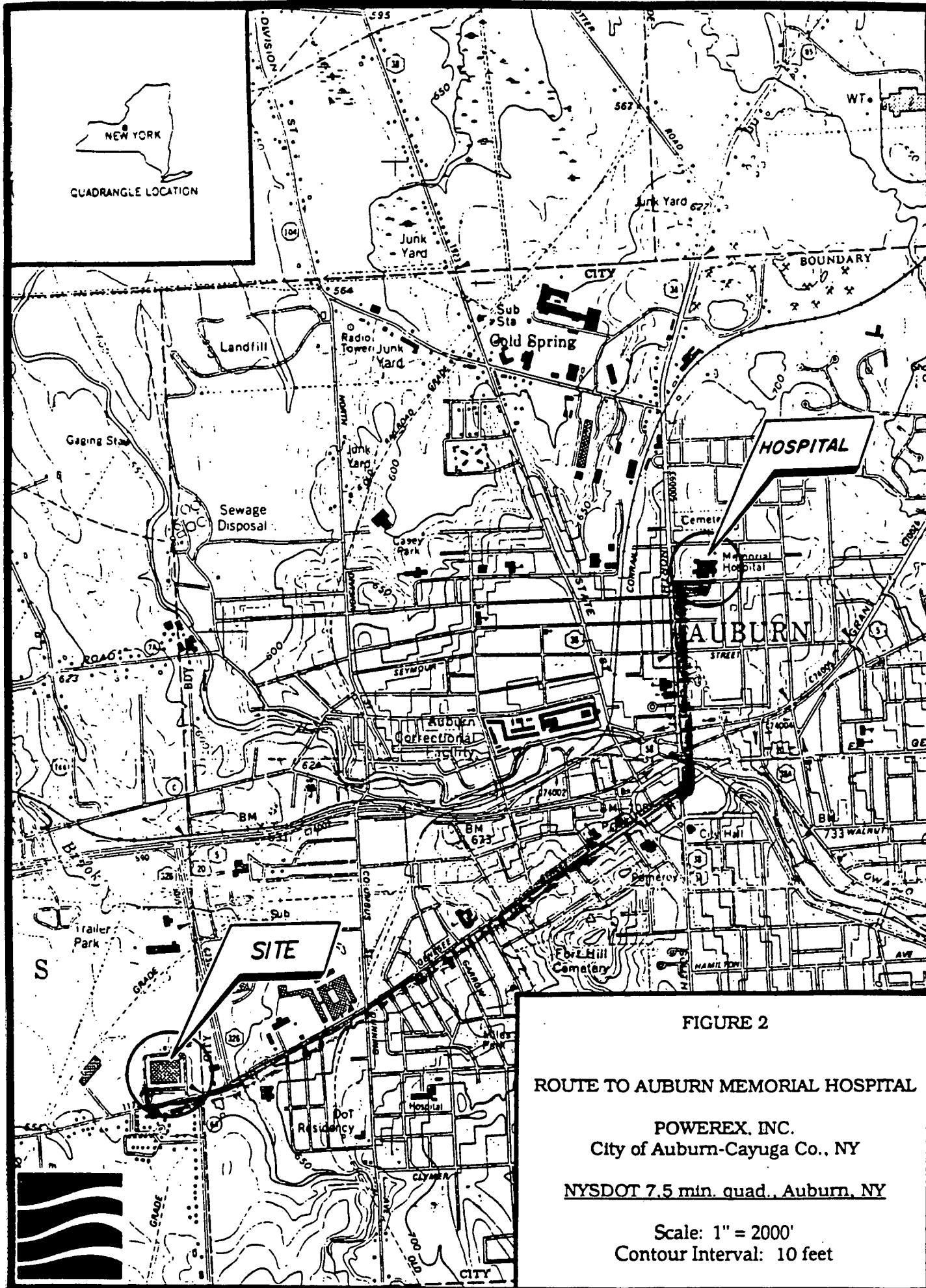


FIGURE 2

ROUTE TO AUBURN MEMORIAL HOSPITAL

POWEREX, INC.
City of Auburn-Cayuga Co., NY

NYSDOT 7.5 min. quad., Auburn, NY

