

Substation Safety Field Orientation

2023 Substation Access Training for Contractors



Course Introduction

- This course is designed to provide contractor personnel working in SMUD substation facilities with the knowledge to enter the facilities safely.
- The minimum requirements included in this course must be reviewed and understood by all contractor personnel working within substation facilities.
- This course information should be available as a reference document while working onsite.

Course Introduction

- “Disclaimer: The information contained in this training is intended to assist contractors in providing a safe working environment for their employees. SMUD does not make any warranty, express or implied, nor does it assume any legal liability or responsibility for the accuracy and completeness of this training, nor does it relieve its contractors of the responsibility to perform its duties safely and to provide a safe work environment for their employees. SMUD shall not be liable for any loss or damage of whatever nature (direct, indirect, consequential, or other) except as expressly permitted in its contract with Contractor. “
- Depending on contractor personnel’s job responsibilities, contractor may be required to provide their personnel additional environmental, health, and safety-compliance training to satisfy state and federal regulations.

Contractor Responsibilities

Contractors working for SMUD are responsible for:

- Ensuring their employees attend this training prior to beginning any work at a SMUD substation facility.
- Following all guidelines outlined in this training.
- Ensuring their employees properly display hard hat sticker.
- Ensuring their employees carry the wallet card issued by SMUD.
- Asking questions, as needed, throughout the training.

Orientation Process

The orientation process for contractor personnel will consist of the following steps:

- Attend this training.
- Pass a Knowledge Check at the end of this training.
- Complete a site-specific safety walk-through of the substation facility (conducted by a SMUD onsite representative).
- Submit records of completion to SMUD.

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Module 1

General Safety Protocols

Accompanied and Unescorted Entrants

All contractors entering substation facilities will be accompanied by a qualified SMUD representative.

Exception: Unescorted contractors must complete additional training to acquire a substation key and be given security permissions for entry.

Station Security

Substations contain high voltage energized equipment and are enclosed by fences with gates to protect the public. Fences must be intact, and gates must be closed and locked at all times except when a Qualified Person has the station or gate under observation.



Security Levels

Certain substation facilities contain critical assets that require higher levels of security and entry permissions.

Key card access is required in these facilities.

Onsite SMUD representatives will escort contractors in and out of these facilities and communicate any additional security measures that may be needed.

Logging In and Out of Substation Facilities

Contractors who have unescorted access must contact SMUD security when entering and exiting the substation.

If entering a bulk substation, they must contact PSO as well.

Entering NERC Regulated Buildings

Many of SMUD's substation control rooms and most other buildings have additional security measures mandated by NERC criteria. Contractors must be escorted into these facilities by a qualified and trained SMUD representative. Escorted contractors need to present a valid government-issued identification to the SMUD representative.

Emergency Action Plan

The onsite SMUD representative is responsible for creating and communicating Emergency Action Plans (EAPs).

EAPs will be posted for each worksite and will indicate evacuation plans, key phone numbers, and how best to manage a medical emergency.



Emergency Response Equipment

Contractors shall supply their own emergency response equipment (e.g. First aid/bloodborne pathogen kits, fire extinguishers, etc.)



What to Do If an Incident Occurs

Contractors are responsible for immediately reporting all incidents involving damage to equipment or facilities. Near misses, close calls, illnesses, or injuries should also be reported to the onsite SMUD representative as soon as practical.

Intoxicants and Controlled Substances

All personnel are prohibited from using or being under the influence of intoxicants or non-medical prescribed controlled substances (drugs), or derivatives thereof, while on SMUD property.

Using prescription/non-prescription drugs is permitted if the medication does not jeopardize the employee's safety, health, and/or the safety of others.

Firearms and Weapons

Firearms, ammunition, bows, arrows or other weapons are not allowed on SMUD property.

Immediately report any incident involving firearms or weapons to the onsite SMUD representative.

TAILBOARD Briefings

A TAILBOARD briefing is a collaborative, in-depth discussion which references the contractor's site-specific safety plan, emergency action plan and OSHA regulations at an assembly site or jobsite between the contractor crew lead, the SMUD onsite representative and all personnel performing the work. TAILBOARDS must be conducted at the beginning of each shift, after extended delays and whenever conditions or tasks change.

Contractors must perform a Job Hazard Analysis/Safety Risk Analysis (JHA/SRA) for each high-risk task and develop a plan to mitigate all identified hazards.

Module 2

Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE)

Contractors are responsible for supplying their employees with Personal Protective Equipment.

PPE Requirements

At a minimum, the following is required before entering a SMUD substation.

- Head protection: Personnel must wear a hard hat or OSHA certified bump cap (E or C rated).
- Eye Protection: Personnel must wear ANSI-rated Z87.1 frontal eye protection at all times.
- FR Clothing: Personnel must wear fire resistant (FR) clothing that meets an HRC 2 rating if working on or near energized equipment.
- Footwear: Personnel must wear appropriate boots with adequate ankle support and rubber outsoles depending on job task.



High Visibility Clothing

Contractors exposed to public vehicular traffic and/or moving equipment shall wear appropriate suitable garments for high visibility, in accordance with ANSI/ISEA 107.

At night or in other low visibility conditions, the FR Class II vest is required when working within the minimum approach distances (MAD) on or near energized equipment.

Additional PPE

The following is required when exposure is possible:

- When exposed to burns, abrasions, and cut hazards, wear appropriate hand protection.

- Note: Electrical hazards require specific, electrically rate gloves.



- When exposed to noise above permissible exposure limits (85dBA over an 8-hour period) wear appropriate hearing protection.



- When exposed to flying objects or debris, wear appropriate face protection.



- When exposed to airborne dusts, mists, fumes, gasses, smoke, or vapors at or above permissible levels, wear appropriate respiratory protection.

- Note: Additional training and medical monitoring may be required to wear a respirator.



Module 3

General Hazards

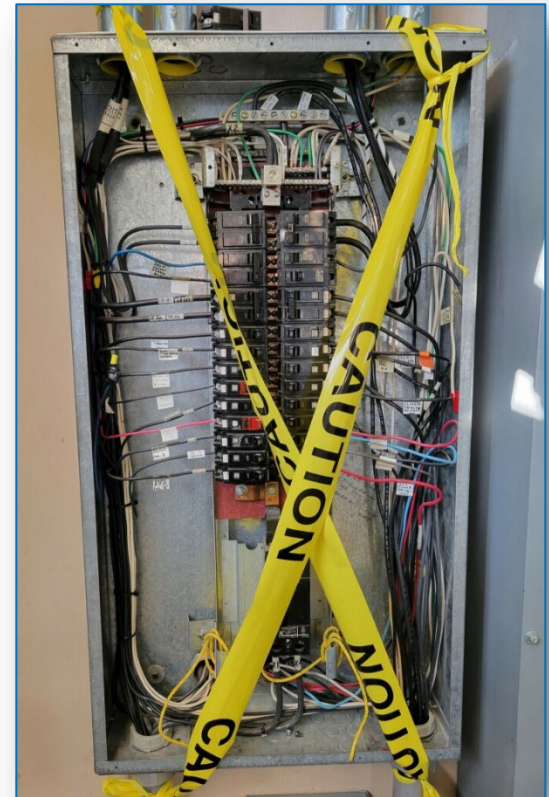
“DANGER” Tags

“DANGER Do Not Operate Tags” are used to mark equipment as non-operational **except** when receiving specific instructions from the person who installed the tag.

Never operate or remove any equipment that has a Caution Tag attached.

Plastic Barricade Tape

SMUD crews use plastic barricade tape during wiring practices to identify equipment and devices. Using the tape helps to prevent work-procedure errors that can cause system outages. When barricade tape is used, it must be non-conductive. Do not remove or perform work beyond this tape.



Working at Heights

Contractors exposed to fall hazards greater than 6 feet must wear adequate fall protection equipment.

An FR-Rated fall protection system may be required when working near energized equipment.

Open excavations shall have adequate protection to manage fall exposure. Barrier protection could include, barricading or covering, use of walkways with standard guardrails and fall protection system.

No Aluminum-Railed Ladders

Aluminum-railed ladders are *not* permitted.

Fiberglass-railed ladders with aluminum rungs *are* permitted.

Secure ladders

When working from a portable ladder, ensure that the ladder is used in the manner that it was designed. Ladders must be properly placed on a firm level surface and held, tied, or otherwise made secure to prevent slipping or falling.



Ladders Used in Trenches

Use ladders when working in trenches that are 4 feet or deeper to ensure employees' safety when entering and exiting the trenches.

Space the ladders so that workers in the excavation will not have to travel more than 25 feet laterally to reach an exit point (i.e., not more than 50 feet apart).

Scaffolding



§1637. General Requirements

If the contractor's work requires the use of scaffolding, the contractor is solely responsible to have scaffolding installed, modified, relocated, and dismantled by a certified scaffold erector.

The scaffolding must be inspected, tagged appropriately, and maintained by a competent person as described in Cal OSHA §1637. General Requirements.



Jewelry

Do not wear jewelry where there is a danger of electrical contact, crushing injuries, or where jewelry may snag on machinery, materials, or other objects.

Examples include but are not limited to: Rings, earrings, body piercings, watch chains, wrist bands, key chains, exposed neck chains and exposed medical alert jewelry.

Hazard Communications

Before handling a chemical, contractors must refer to the associated Safety Data Sheet (SDS).

Follow the precautions and use the protective devices and/or equipment identified on the SDS label.

Flammable Liquids

Contractors shall handle, store, and transport flammable liquids only in UL/DOT approved containers.

Label all containers (i.e. gas, diesel).



Store containers in approved storage/spill containment at least 75 feet away from ignition sources.

Contact the local environment field specialist through your onsite SMUD representative for specific information.

Compressed Gas Cylinders

Handle portable gas cylinders or containers with extreme care. Store them upright in a suitable, well-ventilated location and properly secure them to a fixed object with adequate restraints.

Store oxygen and acetylene tanks separately (20 feet apart) or separate them by a properly rated fire wall when they are not in use. Carts with appropriate divider may also be used.

Keep combustible materials and vegetation a minimum of 10 feet away from storage areas.

Ensure that protection caps are fully screwed on when cylinders are not in service.

Clearly mark all cylinders with the contents of the material being stored inside.

Hot Work Permit

A hot work permit is required to perform any operation involving open flame or producing heat and/or sparks. This work includes, but is not limited to welding, brazing, cutting, grinding, soldering, thawing pipe, torching, or chemical welding.

Fire Safety Protocols

Do not enter a smoke-filled control room or building.

If you are inside a building when a fire erupts, only attempt to fight a small fire if you are trained and it is safe to do so.

If the fire is too large to extinguish, evacuate the building and follow the emergency evacuation plan. If it is possible, pull the alarm.

Call 911 and notify your onsite SMUD representative.

Stay out of the building and do not allow entry.

Fire Systems, continued.

When working at facilities where buildings have fire suppression systems, the onsite SMUD representative must contact the local maintenance department for site specific protocols associated with alarms and system impairments.

Permit Required Confined Space (PRCS)

Substation transformers and circuit breaker tanks are considered a PRCS and require a procedure and permit for entry.

Contractors shall manage all PRCS entries to ensure the safety of personnel entering the spaces. The SMUD site representative will ensure the PRCS complies with SMUD procedures.

Other Confined Spaces (OCS)

Substation excavations over 4 feet deep and underground pull boxes are considered “Other Confined Spaces” (OCS).

Contractors shall manage all OCS entries to ensure the safety of personnel entering the spaces. The SMUD site representative will ensure the OCS complies with SMUD procedures.

Housekeeping

Contractors must maintain their work locations, facilities, and vehicles in a neat and orderly manner to promote a safe and healthful work environment.

Material and Tools

Material or tools should be carried at waist level when working around energized equipment. Carry long material, including ladders, in a horizontal position. Prevent any material or tools from accidentally encroaching on minimum working distances or from contacting energized conductors or equipment.

Pest Control & Weed Abatement Spraying

Pest control and weed abatement contractors must not raise spray wands above waist level when spraying around high-voltage equipment.

Vehicle Speed Limits

Maximum vehicle speed limits inside of a substation are **10mph** on designated roadways and 5mph in all other areas.



Moving Vehicles and Equipment Safely

Perform vehicle and equipment pre-inspection, this includes ensuring backup alarms are working. Before backing up in a vehicle, the driver must request the passenger or other personnel (if available) to observe the vehicle during the backing process.

Always use spotters when moving or relocating equipment in substation facilities.

Pull Boxes

Pull boxes are located throughout the yard.

Do Not drive over pull boxes.

The weight of a vehicle driving over a pull box will crush the aluminum cover and damage the control circuits within.

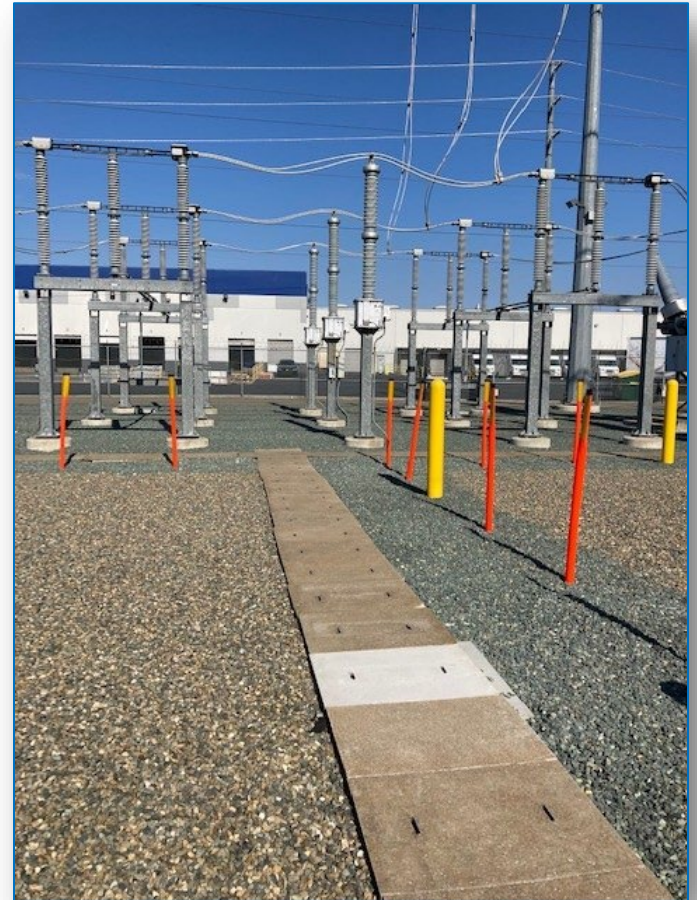


Underground Cable Trench

Underground cable trenches are located throughout many substation facilities. Use caution when driving over cable trenches as they have weight restrictions.

Do not drive equipment over T-sections, or other non-linear areas to avoid potential system failure.

Only drive over designated drivable sections of the trench.



Crane Work

- Lift plans should be submitted to SMUD and approved prior to crane work being performed inside a substation.
- Inspection dates must be current for the crane.
- Operators' NCCCO certificate must be valid, and operators experienced on the set up and operations of the crane.

Rigging

Only qualified personnel, or those under the direct supervision of qualified personnel, using properly rated rigging hardware that is designed for the application of work may perform rigging operations.

Contractors must ensure that all personnel are qualified prior to performing any rigging operations.

Rigging components, including but not limited to slings, shackles, ropes and pulleys should be inspected prior to each use.

Suspended Loads

Control all suspended loads using tag lines as the equipment is lifted into place.

Maintain the minimum working distance from all energized and ungrounded lines and conductors.



Plan the work so personnel are never working under suspended loads.

Operating Equipment

Contractors must ensure their personnel are qualified and properly trained to operate all equipment used within a substation facility. All equipment must be inspected to verify equipment is in good working order and safety alarms are functional.

Contractors shall not leave keys in equipment when personnel are not onsite. When equipment must be staged after hours near energized equipment, keys must be available to SMUD personnel in the event of an emergency and left in a pre-determined area.

Module 4

Excavation Safety



Know what's below.
Call before you dig.

Call 811 – USA NORTH

Contractors performing any excavation must always notify Underground Service Alert (USA) at least 2 working days before digging.

Call 811.

No excavation, including hand excavations, will occur without a valid and cleared USA ticket.

Contractors are responsible for maintaining markings and keeping tags current.

Substation Excavations

The Contractor shall provide SMUD with a schedule of work (with dates and times) for any excavation within ten feet of SMUD's electric distribution and transmission lines.

Work in proximity of underground electric distribution lines belonging to the Sacramento Municipal Utility District (SMUD) is regulated under "USA North's California Excavation Manual".

Notify the onsite SMUD representative immediately if damage occurs or is discovered during excavation.

Substation Excavations (Cont.)



TP0601 Requirements for excavation in proximity of
SMUD's underground transmission cables

For 115kv and 230kv underground transmission cables

TP0601 section 3.2

“ALL work within ten (10) feet of the underground transmission line(s) shall be in the presence of a SMUD Inspector (or a SMUD Qualified Electrical Worker) prior to the start of work. A 72-hour advance notice is required. Please contact SMUD Inspection Services’ at (916)732-4990 to schedule for inspections.”

TP0601 section 3.5

“When excavating within three (3) feet of the exact location of any SMUD transmission line, the contractor shall hand expose and protect the SMUD line prior to using power equipment. Hand-power tools may be used to remove street asphalt IF approved in advance by the SMUD Engineer.”

The onsite SMUD representative can provide you a copy of the TP0601

Substation Excavations

(Cont.)



TP0602 Requirements for excavation in proximity of
SMUD's underground distribution cables

For 100KV and below underground distribution lines

TP0602 section 3.3

“ALL work within ten (10) feet of the underground distribution line(s) shall be in the presence of a SMUD Inspector (or a SMUD Qualified Electrical Worker) prior to the start of work. A 72-hour advance notice is required. Please contact SMUD Inspection Services at (916) 732-4990 to schedule for inspections.”

TP0602 section 3.5

“When excavating within two (2) feet, the contractor shall hand expose and protect the SMUD line prior to construction.”

The onsite SMUD representative can provide you a copy of the TP0602

Hand Digging/Powered Excavation



Vehicle Grounding Required

Excavators must be properly grounded, as described in SMUD grounding manual while working near energized equipment.

Mud Buckets Required

Only mud buckets are allowed



If soil conditions dictate, a ripper bucket may be used, but only with **prior obtained** permission from SMUD representative.

Spotter Required

A spotter is required when excavating near energized equipment or underground circuits.

Distance will be determined by the onsite SMUD representative based on the likelihood of contact with energized equipment or circuits.

QEW Observer Required When Working Near Energized Equipment

In addition to having a spotter, a qualified electrical worker (QEW) is required when working within the MAD of exposed energized equipment.

Module 5

ARC Flash Safety

Flame Resistant (FR) Clothing Required

Contractors performing work on SMUD facilities shall always wear FR clothing when an arc flash hazard potential exists. This includes the following work:

- All switching operations; testing and grounding; performing work on or around energized conductor and equipment; and performing work in a panel, vault, or manhole with energized conductor and/or equipment.

Flame Resistant (FR) Clothing Required

When, FR clothing is worn as PPE, contractors shall not wear undergarments or clothing made of prohibited fabrics that when exposed to flames or electric arcs could increase the extent of the injury which could be sustained.

Prohibited fabrics include acetate, nylon, polyester, and rayon, either alone or in blends or clothing with pants, threads, or decals which are not approved for use on FR clothing.

Minimal Ratings for Single-Layer FR Clothing

All FR clothing including rain gear shall at a minimum meet an HRC 2 rating.

Hazardous Work Methods

SMUD's Substation Arc Flash program may require additional clothing when performing the hazardous work methods listed below, depending on how far you are from the hazard.

1. Testing de-energized: Using live-line tools to test conductors de-energized.
2. Protective Grounding: Installing /removing protective grounds to cleared and de-energized conductors.
3. Switching: Using live-line tools to open and close disconnect switches to isolate high voltage circuits.
4. Working near: Performing work near energized conductors where the chance of accidental contact may occur.

Arc Flash OSHA Requirements



§2940.11. Protection From Flames and Electric Arcs

Follow *Cal/OSHA-Title 8, Chapter 4, Sub-chapter 5, Group 2, Article 36, 2940.11*, and collaborate with SMUD for incident energy levels for whatever equipment is being worked on.

Arc-flash hazard analysis is used to determine both incident energy levels and associated flash-protection boundaries at various working distances from an exposed and energized component of the distribution or utilization system.

Module 6

High Voltage Safety

Qualified Electrical Worker

Only qualified electrical workers (QEW's) shall perform work that is required by regulation to be performed by a QEW.

Only a QEW or Qualified Person under continuous supervision or under the instruction of a QEW shall be assigned to work on conductors or equipment that have the potential to be energized in excess of 600 volts, phase-to-phase.

Clear It, Test It, Ground It

Working on De-energized Conductors or Equipment.

1. Clearances are required on conductors or equipment routinely operated in excess of 600 volts, phase-to-phase. Obtain these clearances from a qualified SMUD representative.
2. After the onsite SMUD representative is notified that the proper clearance is obtained, a qualified electrical worker shall test conductors de-energized.
3. Before work can be performed on de-energized conductors or equipment, a qualified electrical worker shall apply protective grounds.

Minimum Approach Distances



§2946. Provisions for Preventing Accidents Due to Proximity to Overhead Lines.

Always follow the **OSHA Title 8, Sec. 2946** minimum approach distances when working near energized equipment.

APPROACH DISTANCE TABLES

Table 1 Title 8, Section 2946

General Clearances Required from Energized Overhead High-Voltage Conductors

<i>Nominal Voltage (Phase to Phase)</i>	<i>Minimum Required Clearance (Feet)</i>
600 - 50,000	6
Over 50,000 - 345,000	10
Over 345,000 - 750,000	16
Over 750,000 - 1,000,000	20

Table 2 - Title 8, Section 2946

Boom-type lifting or hoisting equipment clearances required from energized overhead high-voltage lines.

<i>Nominal voltage (Phase to Phase)</i>	<i>Minimum Required Clearance (Feet)</i>
600 - 50,000	10
Over 50,000 - 75,000	11
Over 75,000 - 125,000	13
Over 125,000 - 175,000	15
Over 175,000 - 250,000	17
Over 250,000 - 370,000	21
Over 370,000 - 550,000	27
Over 550,000 - 1,000,000	42

NOTE: Qualified Electrical Workers function under a different set of minimum clearance distances. (See Title 8, Section 2940.2)

High Voltage Clearances

High voltage clearances are approved and managed by the operations department.

Clearance points are tagged with Man-on-Line tags and are locked, where it is physically possible (per the design of the equipment).

Walking Down Clearances

The onsite designated SMUD representative is responsible for directing the walking down of the clearance points for each clearance.

The personnel involved in the clearance walk down shall communicate their understanding of the clearance points and location of adjacent energized equipment.

Testing Circuit De-Energized

Perform a LIVE-DEAD-LIVE test in conjunction with the use of an approved high-voltage meter.

1. Test the meter to prove a live source.
2. Test the circuit that has been cleared and de-energized.
3. Test the meter a second time to a live source to prove it still works.

Vehicle Grounding

Vehicle grounds must be attached to the equipment frame on a clean paint-free surface to ensure a good electrical connection.

Galvanizing a bare metal surface is acceptable and will not alter the electrical properties of the ground connection.

Accidentally Contacting Energized Conductors

If a vehicle accidentally contacts an energized conductor:

- Stay in the vehicle until the hazard has been removed.
- If safe to do so, rotate the vehicle away from the energized source.
- Notify all personnel to stay away from the vehicle.
- Request that the supervisor/onsite SMUD representative de-energize the circuit, and ensure the area is safe.

Removing a Vehicle Ground Tail

When removing a vehicle ground tail:

1. Hand trace the cable from the vehicle back to the ground clamp.
2. Remove the ground clamp from the ground grid.
3. Hand trace the cable back to the vehicle.
4. Remove the ground from the vehicle.

Module 7

Homeless Camps & Personal Safety

Personal Safety Concerns

- Disease transmission
 - Needle sticks
 - Fecal matter
 - Broken skin / open wounds
- Electrical Hazards caused by tampering or vandalism
- Mental Stability – mental health / drug usage
 - Potential for violence
- Criminal Activity



Situational Awareness

Q: What is Situational Awareness?

A: Simply put, situational awareness is being aware of what is going on around you.

Q: Why is situational awareness important?

A: Situational awareness is important because it can help you avoid or escape a potentially dangerous or violent situation before you or someone else gets hurt.



Things to look for

- Unusual behavior for the situation
- Illegal activities taking place
- Number of people present
- Angry or otherwise unstable individuals
- Things that can hurt you, including traditional or makeshift weapons
- Escape routes
- Cover / concealment



Violent Crime Reporting

For forcible & life-threatening crimes (murder, mayhem, rape, robbery, kidnapping, etc.) in the field:

- Get to a safe location (you can't help others if you're not safe)
- Call 9-1-1 (this is the quickest response time)
- Be a good witness
- Call SMUD Security Operations to report incident (916)732-5911



Non-Violent Crime Reporting

For non-violent crimes in the field (except trespassing / illegal camping, vandalism)

- Call non-emergency line to report or file an online crime report with appropriate jurisdiction
- Contact SMUD Security Operations (916)732-5900 and complete a Statement of Witness form



General Safety Tips

General safety tips when working in the field:

- Go to the “mind lab” and think about how to handle possible scenarios you may face in the field BEFORE you go out
- Establish an emergency plan before starting work (medical or other)
- Stay aware to your surroundings on the job
- Know your escape routes
- Keep your cell phone charged / carry a back up battery pack
- Put non-emergency phone numbers in your phone
- Periodically check on your co-workers or check in with your supervisor
- If you don't feel safe, contact SMUD Security Operations or leave the area



Non-Emergency Contact Information

SMUD Security Operations:
(916) 732-5900

Sacramento County Sheriff's Department:
(916) 874-5115
(916) 874-7128 (Speech & Hearing Impaired Only)

Sacramento Police Department:
(916) 264-5471

Citrus Heights Police Department:
(916) 727-5500

Elk Grove Police Department:
(916) 714-5115

Folsom Police Department:
(916) 355-7231

Galt Police Department:
(209) 366-7000

El Dorado County Sheriff's Department:
(530) 621-5655

Placerville Police Department:
(530) 642-5280

Solano County Sheriff's Department:
(707) 421-7090

Rio Vista Police Department:
(707) 374-2300

Placer County Sheriff's Department:
(530) 886-5375

Yolo County Sheriff's Department:
(530) 666-8282



Questions?