

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------|-------------------|---|------------------------------|-----|
| Prepare site (continued). | Fire. | Fire extinguishers shall be placed in work areas. The UXOSO shall establish smoking areas in compliance with the facility policy. Fire extinguishers will be available in all Aptim work trucks and office facilities. Site personnel shall complete annual fire extinguisher training. Use caution with vehicle exhaust systems in grassy areas. Flammable or combustible liquids will be stored in approved Type 1 or Type 2 safety cans. | 09.E.01 09.A.06 | L |
| | Chemical hazards. | The Exclusion Zones and Contamination Reduction Zones shall be set-up and appropriately marked with signage. The Emergency Eyewash station shall be inspected, cleaned, filled, and then placed in service. Notify all personnel of the emergency eyewash station location. | 28 06.B.02.b 06.B.01.b | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|---|---|--|
| Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon Repel® Permanone I® Drinking water Weather radio or AM/FM radio | Training Requirements: Site safety orientation Applicable AHAs HAZWOPER 40-Hour Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety Procedures | Daily site safety inspection (SSHO) – Check Known Allergies Questionnaire, training, and medical certifications against personnel roster Mechanized equipment (daily) Overhead and underground utilities Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks |

Activity Hazard Analysis (AHA)

| | | | | | | |
|--|--|--------------------|----------|--------------------------|--------------------------------|----------|
| Activity/Work Task: Visual Site Inspections and Civil Surveys | Overall Risk Assessment Code (RAC) (Use highest code) | M | | | | |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | | | | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | | | | |
| Date Prepared: 06/25/20, Revised 02/02/21 | | Frequent | Likely | Occasional | Seldom | Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E | E | H | H | M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E | H | H | M | L |
| | Marginal | H | M | M | L | L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Negligible | M | L | L | L | L |
| | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | | | | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | | | RAC Chart | |
| | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | | | E = Extremely High Risk | |
| Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | | | H = High Risk | | |
| | | | | M = Moderate Risk | | |
| | | | | L = Low Risk | | |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|--------------------------------------|---|--|--------------------------|----------|
| Arrival of new personnel at site. | Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | 01.B.03 01.E.01 28 | M |
| Visual site inspections and surveys. | Poor planning. | Complete Job Safety Analysis for each task. Use Hazard Assessment Resolution Program frequently – for each task to be completed. | | M |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | 14.A.01 | M |
| | Struck-by/against. | Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic. | 05.F | M |
| | Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO). | Personnel shall attend site-specific MEC Awareness (and recognition) Training prior to the commencement of any site activities. | 01.B.01 33.A.01 | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|--|---|---|-------------------|------------|
| Visual site inspections and surveys (continued). | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain. | 14.C.01-10 | M |
| | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | 05.A.08 | L |
| | Insect bites/West Nile virus. | Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-diethyl-m-toluamide, such as, Deep Woods OFF, 3M Ultrathon™, or equivalent and clothing insecticide preparations containing permethrins (Repel® Permanone® or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms. | 06.D.01 | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants Remove clothing or Tyvek® coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream / lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers known to contract poison ivy. Follow procedures outlined in the SSHP. | 06.D.03 | L |
| | Severe weather. | The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The SSHO will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. When lightning is observed within a 10 mile radius or upon hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). A waiting period of at least 30 minutes from the last nearby lightning strike will be observed before resuming activities. Follow procedures outlined in the SSHP. | 06.1 | L |
| | Hazardous atmospheres. | Personnel shall immediately notify the SSHO if odors are detected. | | L |
| Heat stress and cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT TLV values. | 06.I | M | |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|--|---------|--|-------------------------------|-----|
| Visual site inspections and surveys (continued). | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10-B:C fire extinguisher shall be available when refueling. Site personnel shall complete annual fire extinguisher training. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents. | 09.E.01 09.A.06 09.B.08 | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|--|--|---|
| Personal Protective Equipment - Level D: Hard hat Safety glasses Safety-toed boots Work gloves ANSI Class 2 reflective warning vests Equipment: Survey instrumentation Fire extinguishers Emergency eyewash First aid kit Deep-Woods Off or Ultrathon™ Repel® Permanone® Drinking water Weather radio or AM/FM radio | Competent Person (CP) / Qualified Person (QP): Brian Rhodes– CP/SSHO TBD– QP/First Aid and CPR Training Requirements: Site safety orientation HAZWOPER 40-Hour MEC Awareness Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety procedures | Daily site safety inspection (SSHO) – Brian Rhodes Daily site safety inspection (QCO) – TBD Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | | | | | |
|---|---|--------------------|----------|--------------------------|--------------------------------|----------|
| Activity/Work Task: Site Survey, Utility Clearance and Marking | Overall Risk Assessment Code (RAC) | L | | | | |
| Project Location: RSA-014 Redstone Arsenal, Huntsville AL | Risk Assessment Code (RAC) Matrix | | | | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | | | | |
| Date Prepared: 06/25/20, Revised 02/02/21 | | Frequent | Likely | Occasional | Seldom | Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E | E | H | H | M |
| | Critical | E | H | H | M | L |
| Reviewed by: Doug Russell/HSE Manager | Marginal | H | M | M | L | L |
| | Negligible | M | L | L | L | L |
| Notes: (activity description) This AHA serves as the hazard assessment. A licensed subcontractor will conduct a utility survey to locate subsurface drilling hazards using multiple geophysical methods, including electromagnetic induction and ground penetrating radar. Utility lines found in the immediate vicinity of the proposed limits of intrusive activity will be marked using color-coded surveyor paint. | Step 1: Review each “ Hazard ” with identified safety “ Controls ” and determine RAC (See above) | | | | | |
| | “ Probability ” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely. | | | | RAC Chart | |
| | “ Severity ” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | | | E = Extremely High Risk | |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA. | | | | H = High Risk | |
| | | | | M = Moderate Risk | | |
| | | | | L = Low Risk | | |

| Job Steps | Hazards | Controls | RAC |
|---|---|--|-----------|
| Walking the Site Lifting Equipment and Materials | Slips, trips, and falls | <ul style="list-style-type: none"> Inspect work areas for washes, potholes, or other surface irregularities that could cause slips, trips or falls. Always establish good footing. Maintain good housekeeping. Keep walkways clear of debris and tools. | L |
| | Muscle strains | <ul style="list-style-type: none"> Observe 50 pound individual lifting limit. Do not lift and twist. Get help for loads greater than 50 pounds. Train workers in safe lifting techniques. | L |
| Mobile Equipment | Striking workers or equipment | <ul style="list-style-type: none"> Use spotters when backing. Inspect area for overhead and underground hazards. Know the safest route to and from your work area. Use flags, traffic cones to control traffic. | L |
| Changed or Unanticipated Conditions | Safety or health hazards that may be derived from changed or unanticipated conditions | <ul style="list-style-type: none"> Modify the AHA as often as necessary to address new or unanticipated hazards. Use “Job Safety Analysis” form to facilitate field documentation. | NA |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|---|---|--|
| <ul style="list-style-type: none"> • Level D personal protection: safety boots, Safety eyewear, long pants protection, abrasion resistant gloves | <ul style="list-style-type: none"> • Tailgate safety meeting • HAZWOPER 40-hour • HAZWOPER 8-hour refresher • Worker must be trained in the safe application of task specific tools and materials • Brian Rhodes – CP/SSHO | <ul style="list-style-type: none"> • Inspect all equipment at least daily • Utility clearance checklist • Inspect non-construction equipment and power tools per manufacturer requirements. |

MEC SURFACE CLEARANCE

| ACTIVITY HAZARD ANALYSIS | | | | | | |
|---|--|--------------------|----------|--------------------------------|------------------|----------|
| Date Prepared: April 2021 Project Name: Corrective Measures Implementation at Multiple (9) Sites, Redstone Arsenal Huntsville AL Contract Number: W912DY-17-D-0003 Activity/Work Task: MEC Surface Clearance Activity Location(s): Madison County, AL Prepared By: Scott Schroepfer Task Start Date: Task Duration: Reviewed By: | Overall Risk Assessment Code (RAC) (Use highest code) | | | | L | |
| | Risk Assessment Code (RAC) Matrix | | | | | |
| | Severity | Probability | | | | |
| | | Frequent | Likely | Occasional | Frequent | Unlikely |
| | Catastrophic | E | E | Catastrophic | E | M |
| | Critical | E | H | Critical | E | L |
| | Marginal | H | M | Marginal | H | L |
| | Negligible | M | L | Negligible | M | L |
| | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | | | | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | | | RAC Chart | |
| "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | | | E = Extremely High Risk | | |
| | | | | H = High Risk | | |
| Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | | | M = Moderate Risk | | |
| | | | | L | | |

| Job Steps | Hazards | Controls | RAC |
|---|--|--|----------|
| Site access control | Unauthorized entry | Implement positive site access control before site operations. Maintain a constant watch or surveillance for intrusion of unauthorized personnel. Establish positive site access control before on-site operations using barricades, signs or other methods to ensure unauthorized access during tasks that could cause exposure to munitions and explosives of concern (MEC) or other safety and health hazards. Establish the minimum separation distance (MSD)/exclusion zone (EZ) before beginning material potentially presenting an explosive hazard (MPPEH) inspection and handling activities. Unexploded ordnance (UXO) teams will observe the team separation distance (TSD) when applicable. | L |
| Establish surface grid or clearance area. | MEC hazard/explosion, fire and over pressure | Deliver daily task specific briefings regarding the hazards associated with the task and procedures used to control/mitigate the hazards. All personnel inside the EZ will use required personal protective equipment (PPE) as indicated by the Site Safety and Health Plan (SSHP). Require attendance of all surface clearance personnel on the site-specific hazards and health and safety training given by the UXOSO. Instruct non-UXO personnel to not touch or disturb any potential MEC items. Non-UXO personnel will adhere to the instruction of the UXO Technician providing escort. | L |

| Job Steps | Hazards | Controls | RAC |
|---|--|--|-----|
| Establish surface grid or clearance area (continued). | MEC hazard/explosion, fire and over pressure (continued) | Use only trained and qualified UXO Technicians to perform MEC surface clearance activities as specified the training requirement section of this AHA. Suspend MEC operations when an electrical storm approaches to within 10 miles of the project location. | L |
| Walking and working on site | Adverse weather and lightning | Monitor warnings or indications of severe weather conditions and take appropriate precautions to protect personnel and property. Be aware of lightning, cease MEC operations from the first lightning strike within ten miles and wait 30 minutes from the last strike before field activities resume. Suspend all work activities when an electrical storm approaches to within 10 miles of the project location. | L |
| | Contact with moving vehicles | Be aware of vehicle traffic. Stay off of roads. | |
| | Cuts and lacerations | Wear Level D PPE with leather gloves per the Accident Prevention Plan (APP) for all tasks with the potential for cuts or lacerations. Train personnel in the proper use and selection of personal protective equipment and tools they must use to complete their task and the protection needed for hazards of exposed metal and other cut hazards. | |
| | Eye hazards | Wear protective eyewear that meets ANSI/ASSE Z81 to protect eyes from hazards associated with MEC operations. | |
| | Sprains and strains | Wear sturdy footwear. Avoid twisting or turning while opening doors and walking with hand-pulled equipment. Caution personnel about physical strain associated with strenuous activities that may be conducted on site. Personnel will use caution to not overexert themselves or overstrain muscles and joints. Know your limitations. | |
| | Slips, trips and falls | Wear sturdy footwear. Continually inspect work area for hazards and practice good housekeeping procedures and maintain clear work areas to remove trip hazards. Personnel will also be aware of uneven walking surfaces, animal burrows, ground surfaces tree roots, small scrubs and the potential for rocks and other trip hazards associated with the work site. Avoid walking near cliffs or on inclined/slopes greater than 30 degrees. | |

| Equipment | Training | Inspection |
|---|---|---|
| <p>Hand tools for excavating Handheld geophysical instruments Smart phone apps for noise, weather, temperature, etc.</p> <p><u>Personal Protective Equipment:</u></p> <p>Hard Hat - overhead hazards present Safety glasses with side shields Safety-toed boots Hearing protection when noise exceeds 85 dBA</p> | <p>UXO Technicians shall meet the training/certification requirements of DDESB Technical Paper 18.</p> <p>First aid trained staff <u>TBD</u></p> <p>40 hr HAZWOPER. 8 hr HAZWOPER annual refresher. Documentation of training will be kept on file at the project site. Initial Site Safety/Task Hazard Training. Current equipment operator certificate PPE Training.</p> | <p>Daily inspection of hand tools. Daily inspections and tests IAW manufacturer's instructions and recommendations. Geophysical instruments will be response tested daily at the test plot to ensure proper operations. All magnetometer tests will be recorded in their respective equipment test log.</p> |

Activity Hazard Analysis (AHA)

| | | |
|--|---|--|
| Activity/Work Task: Vegetation Clearance | Overall Risk Assessment Code (RAC) (Use highest code) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20, Revised 02/02/21 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Step 1: Review each “ Hazard ” with identified safety “ Controls ” and determine RAC (See above) | |
| | “ Probability ” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart |
| | “ Severity ” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk H = High Risk |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA. | M = Moderate Risk L = Low Risk |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|-----------------------------------|---|--|--------------------------|----------|
| Arrival of new personnel at site. | Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | 01.B.03 01.E.01 28 | M |
| Vegetation removal. | Poor planning. | Complete Job Safety Analysis for each task, as specified in “Job Safety Analysis (JSA).” Use Hazard Assessment Resolution Program frequently – for each task to be completed. | | M |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | 14.A.01 | M |
| | Struck-by/Against. | Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic. | 05.F | M |
| | Intrusive activities. | Follow procedure for intrusive activities prior to commencing clearing and grubbing activities. Follow MEC avoidance techniques in accordance with EM 385-1-97 during all vegetation removal. | 25.A.01 | M |
| | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain. | 14.C.01-10 | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------------|---|--|---|-----|
| Vegetation removal (continued). | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | 05.A.08 | L |
| | Use of heavy equipment. | Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial U.S. Army Corps of Engineers inspection (and documented). Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment. Heavy equipment shall be equipped with Falling Object Protective Structure. | 18.A 18.G 18.B 05.F 18.B.12 | M |
| | Injury from chain saws, wood/falling trees, chips, cuts, and noise. | Chain saw operators shall wear a specially designed helmet system (consisting of head, face, and hearing protection). Use gloves and chaps at all times when using saw. Operators shall wear chain saw protective boots with steel toes. Secure loose fitting clothing with duct tape. Keep other personnel at least two tree lengths away from tree being felled. Operators shall have escape routes planned that are at 45 degrees from the projected direction of the falling tree. Keep escape routes clear of all tools, materials, and wood/brush. Always cut away from the body. Shut off chain saws when walking between work areas. Have spotter assist when falling large or tall trees. Only cut trees, logs, or branches from ground height. Shut off engines before freeing pinched chains. Chain saw operators shall always hold the saw with both hands during cutting operations. Inspect chain saw before each use. Do not use saws in which any safety feature is not functioning. Frequently check and adjust tension on chain. Do not use saws with or dull cutters. Do not increase force used as cutters become dull. The idle speed shall be properly adjusted to prevent the chain from moving when the engine is idling. Keep bar groove clean. Use only new chains or professionally sharpened chains. Replace sprockets, which show signs of wear. Remain alert to kickback hazards and keep a firm, proper grip on chain saw at all times. All chain saws shall be equipped with automatic chain brake and other anti-kickback devices. Use wedges to prevent binding of the chain. Do not cut with the tip (nose) of the bar. Do not use dull chains. Do not overreach with chain saw. Personnel shall not operate chain saws above shoulder height. Personnel shall be familiar with cutting techniques. | 13.F 13.A 31.C | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------------|--|---|----------------------|-----|
| Vegetation removal (continued). | Tree pruning, falling, and brush removal/chipping. | Machete use is prohibited. Personnel operating weed whackers shall wear hearing protection and eye/face protection. Steel blade use on weed whackers is prohibited. The procedures outlined in <i>Safety and Health Requirements Manual</i> , Sections 31.C, 31.D and 31.E shall be conveyed to all personnel involved in the operations. Remain clear of feed and discharge chutes on chippers. | 31.C 31.D 31.E | M |
| | Fatigue. | Chainsaw and equipment operators shall be given ample rest breaks. | | M |
| | Insect bites/West Nile Virus. | Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon™ or equivalent and clothing insecticide preparations containing permethrins (Repel® Permanone® or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms. | 06.D.01 | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Remove clothing or Tyvek® coveralls by inside out method to avoid contact with potentially contaminated outer surface. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy. | 06.D.03 | L |
| | Severe weather. | The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions and will use lightning and severe weather detection devices to evaluate potential weather threats. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. When lightning is observed within a 10 mile radius or upon hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). A waiting period of at least 30 minutes from the last nearby lightning strike will be observed before resuming activities. Follow procedures outlined in Section 2.5 of the SSHP. | 06.I | L |
| | Hazardous atmospheres. | Personnel shall immediately notify the SSHO if odors are detected. | | L |
| | Heat stress and cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT TLV values. | 06.I | M |
| | Dust. | Dust shall be monitored and controlled. PPE use is required when working in contaminated areas. | 28 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------------|------------------|---|-------------------------------|-----|
| Vegetation removal (continued). | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10-pound A:B:C: fire extinguisher shall be available on heavy equipment. Site personnel shall complete annual fire extinguisher training. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents. | 09.E.01 09.A.06 09.B.08 | L |
| | Controlled burns | RSA Fire Department will plan controlled burns and manage their activities in relation to a Wildfire Control Plan. | 09.K | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|--|---|--|
| Personal Protective Equipment - Level D - Modified: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Disposable coveralls and protective gloves (when contact with irritating plants possible) Helmet systems for chain saw use Protective chaps for chain saw use Hearing protection Equipment: Magnetometers Geophysics Instruments Excavator or Bush Hog Equipped Skid Steer Fire Extinguishers Emergency Eyewash First Aid Kit Deep-Woods Off or Ultrathon™ Repel® Permanone® Drinking water Weather radio or AM/FM radio Chain saws Extra chains Plastic or wood wedges | Competent Person: (SSHO) Brian Rhodes Competent Person: (UXOSO) TBD Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 Applicable AHAs HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Biological hazard identification and control Emergency procedures Tornado shelter locations National Lightning Safety Institute Lightning Safety Procedures | Daily site safety inspection (SSHO) – Brian Rhodes Daily site safety inspection (UXOSO) – TBD Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Overhead and underground utilities Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | | |
|---|---|--|------------|
| Activity/Work Task: Intrusive Investigation | Overall Risk Assessment Code (RAC) (Use highest code) | L | |
| Project Location: Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | |
| Date Prepared: 6-2-21 | | Frequent Likely Occasional Seldom Unlikely | |
| Prepared by (Name/Title): Winston D Russell/HSE Manager | Catastrophic | E E H H M | |
| | Critical | E H H M L | |
| Reviewed by (Name/Title): | Marginal | H M M L L | |
| | Negligible | M L L L L | |
| Notes: (Field Notes, Review Comments, etc.) | Step 1: Review each “Hazard” with identified safety “Controls” and determine RAC (See above) | | |
| | “Probability” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart | |
| | “Severity” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk | |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA. | H = High Risk | |
| | | M = Moderate Risk | |
| | | L = Low Risk | |
| Job Steps | Hazards | Controls | RAC |
| Arrival of new personnel at site. | Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | L |
| Intrusive Investigation | Poor planning. | Complete JSA for each task, as specified in AMS 710-05-FM-01708, Sample Job Safety Analysis Worksheet “Job Safety Analysis (JSA).” Use Hazard Assessment Resolution Program frequently – for each task to be completed. | L |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | L |
| | Struck-by/Against. | Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic. | L |
| | Earth moving machinery | Only qualified personnel operate heavy equipment. Daily equipment inspections for safety equipment i.e., alarms, fire extinguisher, seat belt, ROPS, windows, mirrors, etc. Keep out of swing radius. Only approach equipment after making eye contact with operator, signaled to do so and machine placed in safe position. | L |

| Job Steps | Hazards | Controls | RAC |
|--------------------------------------|--|---|-----|
| Intrusive Investigation (continued). | Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO) contact. | Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas. Perform all work in accordance with approved Work Plan and applicable SOPs. Excavate to the side of anomalies. Only use hand tools to expose anomaly. Follow all applicable SOPs and EM 385 1-97. | L |
| | Blast overpressure fragmentation blast. | The UXO Safety Officer (UXOSO) is responsible for maintaining the minimum safe distance arcs indicated in the Work Plan for the fragmentation data sheet of the Munition with the Greatest Fragmentation Distance (MGFD) for the Munitions Response Site. | L |
| | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, wooded or uneven terrain. | L |
| | Accidental detonation of MEC. | Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Only UXO technicians will excavate or handle MEC. Personnel in the immediate vicinity of MEC operations will be kept to the minimum necessary for safe operations but no less than two UXO technicians. Do not subject MEC to heat, shock, or friction. Only hand excavation permitted when within one feet of MEC. Use magnetometers frequently to pinpoint the location of MEC. | L |
| | Non-UXO personnel. | Establish minimum separation distance (MSD) and Public Access Exclusion Distance (PAED) based on the Hazardous Fragmentation Distance of the MGFD and maintain site control. Stop all MEC operations when non-UXO personnel are within the MSD/PAED arc. | L |
| | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | L |
| | Insect bites/West Nile Virus. | Wear personal protective equipment and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms. | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls when necessary to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where body position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy. | L |

| Job Steps | Hazards | Controls | RAC |
|--------------------------------------|--|--|------------|
| Intrusive Investigation (continued). | Severe weather. | The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). Follow procedures outlined in the APP. | L |
| | Adjacent Test Areas | Coordinate with OB/OD for site entry since RSA-014S is adjacent. | L |
| | Heat stress and cold stress. | Follow procedures outlined in the APP/ Site Safety and Health Plan. | L |
| | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. | L |
| | Contact with chemical agent or other hazardous chemicals | CWM probability is "Unlikely" for the site. In event suspect CWM or hazardous chemicals are encountered, stop, work, move to up wind location and notify SSHO, RSA Garrison Safety, PM, HSEM and USACE. Follow standard 3Rs for MEC. | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|---|---|
| Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Magnetometers Geophysics Instruments Backhoe or mini excavator Fire Extinguishers Emergency Eyewash First Aid Kit Communication devices Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or weather APP | Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety Procedures | Daily site safety inspection (UXOSO) – TBD Daily site safety inspection (SUXOS) – Instrument function checks in accordance with SOPs Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | |
|--|---|--|
| Activity/Work Task: Excavation & Backfill | Overall Risk Assessment Code (RAC) (Use highest code) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract/Project Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20, Revised 02/03/21 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| | Negligible | M L L L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as certification of hazard assessment. | Step 1: Review each " Hazard " with identified safety " Controls " and determine RAC (See above) | |
| | " Probability " is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart |
| | " Severity " is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | RAC |
|--|---|--|----------|
| Verify overhead and underground utilities locations. Set up equipment for operation. Inspect equipment for use. Inspect work area where equipment is to be used. Isolate work area, as appropriate. Move equipment to work area. | Newly hired personnel and visitors. Unfamiliarity with: site, general (chemical, physical, environmental) site hazards, project safety rules and hazard control procedures, chain of command, and emergency procedures. | All personnel shall attend a site safety orientation. After personnel are trained in the contents of the Installation-Wide RSA Accident Prevention Plan (APP) and the Site Safety and Health Plan (SSHP), they shall sign the APP Acknowledgment Form and the SSHP Acknowledgment Form. Review emergency procedures and evacuation plans. | M |
| | Unqualified operator(s). | Verify operator is qualified and authorized for the equipment being used. Only personnel authorized by employer shall operate equipment. | M |
| | Failure to properly plan daily activities. | A Job Safety Analysis (JSA) shall be prepared by the crew prior to commencing daily activities. The JSA shall be used as a component of the morning Tailgate Safety Meeting. The JSA shall be revised at any time throughout the workday when new tasks are initiated, unforeseen circumstances arise, or if working conditions change. Personnel shall implement Hazard Assessment Resolution Process and Safety Step Back. Personnel to conduct focused and leading indicator "Target" observations. | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|-------------------|--|-----|
| See job steps above. | Complacency. | All personnel shall attend the morning safety meetings to re-focus themselves to hazards, emergency procedures and equipment, operational aspects, and change(s) in site/work conditions. Recommended control measures for the hazards shall be part of the discussion. | M |
| | Fire. | <p>Fire extinguishers shall be available in work areas. A 4-A:60-B:C fire extinguisher shall be available when refueling at the project site. Excavators shall be equipped with a 10-B:C fire extinguisher. Site personnel shall complete annual fire extinguisher training.</p> <p>The SSHO shall establish smoking areas. Smoke only in designated areas. Only discard cigarette butts in proper receptacles – never discard cigarette butts onto the ground. Smoking shall not be permitted within 50 feet of fueling operations.</p> <p>Use caution with vehicle exhaust systems in grassy areas. Do not run vehicles or equipment while parked in dry, grassy areas.</p> <p>Engines shall be shut off and allowed to cool before refueling. Follow AHA for “Fueling Operations.”</p> | M |
| | Unsafe equipment. | <p>Before excavating equipment is placed in use at the project, it shall be inspected and tested in accordance with the manufacturer’s recommendations and shall be certified in writing by a competent person to meet the manufacturer’s recommendations. Subsequent re-inspections will be conducted at least annually thereafter. These inspections shall be documented on a Checklist for Construction Equipment. All safety deficiencies noted during the inspection shall be corrected prior to the equipment being placed in service at the project.</p> <p>All excavating equipment shall be inspected by the operator prior to use on the project and shall then be inspected on a daily basis. Deficiencies in equipment shall be noted on the inspection form. Do not use equipment that is not in proper operating condition. Attach a “Danger – Do Not Use” tag to inoperable equipment, remove key from equipment, and give key to the supervisor when notifying him/her of the inoperable equipment..</p> <p>Verify all manufacturers' safety guards, features, controls, back-up alarms, horns, and equipment are functioning properly and as intended by the manufacturer.</p> <p>Install and maintain equipment attachments and their operating systems according to manufacturer's specifications.</p> <p>Make frequent visual inspections of quick-disconnect systems (systems for connecting attachments to excavators) especially after changing attachments.</p> <p>Verify controls are properly labels as to equipment function.</p> | M |

| Job Steps | Hazards | Controls | RAC | | | | | | | | | | | | | | |
|-------------------------------|---|---|-------------------------------|--|-------------|---------------|------------------|-----------------|-------------------|---------------|-------------------|-----------------|-------------------|------------------|---------------------|------------------|----------|
| See job steps above. | Overhead/aboveground hazards and utilities. | <p>Follow AMS-710-02-PR-01610, Utility Contact Prevention.</p> <p>Overhead and aboveground hazards shall be evaluated prior to moving equipment on the project site. Complete a Site Layout Plan prior to mobilizing the equipment. The plan shall identify all overhead and aboveground hazards in the active work area(s) and travel routes - include utilities, pipe racks, structures, restricted areas, pedestrian routes, and equipment/vehicle traffic.</p> <p>Power lines shall be assumed to be energized unless verified to be de-energized and visibly grounded. Operation beneath a power line that has not been verified as de-energized and grounded must maintain clearance distances stated below.</p> <table border="0"> <thead> <tr> <th><u>Nominal System Voltage</u></th> <th><u>Minimum Required Clearance Distance</u></th> </tr> </thead> <tbody> <tr> <td>Up to 50 kV</td> <td>10 feet (3 m)</td> </tr> <tr> <td>Over 50 - 200 kV</td> <td>15 feet (4.6 m)</td> </tr> <tr> <td>Over 200 - 350 kV</td> <td>20 feet (6 m)</td> </tr> <tr> <td>Over 350 - 500 kV</td> <td>25 feet (7.6 m)</td> </tr> <tr> <td>Over 500 – 750 kV</td> <td>35 feet (10.7 m)</td> </tr> <tr> <td>Over 750 – 1,000 kV</td> <td>45 feet (13.7 m)</td> </tr> </tbody> </table> <p>For over 1,000 kV, the minimum required clearance distance will be established by the utility owner/operator or professional engineer who is a qualified person with respect to electrical power transmission and distribution.</p> <p>Identify and provide temporary visual barriers that help prevent encroachment with the lines. In areas where it is not feasible to use barricades, spotters shall be provided; however, the minimum clearance distances from electrical lines must be observed.</p> <p>Each work crew member shall be trained in the electrocution hazards and emergency procedures associated with contacting energized power lines.</p> <p>Post overhead hazard warning signs as necessary.</p> | <u>Nominal System Voltage</u> | <u>Minimum Required Clearance Distance</u> | Up to 50 kV | 10 feet (3 m) | Over 50 - 200 kV | 15 feet (4.6 m) | Over 200 - 350 kV | 20 feet (6 m) | Over 350 - 500 kV | 25 feet (7.6 m) | Over 500 – 750 kV | 35 feet (10.7 m) | Over 750 – 1,000 kV | 45 feet (13.7 m) | M |
| <u>Nominal System Voltage</u> | <u>Minimum Required Clearance Distance</u> | | | | | | | | | | | | | | | | |
| Up to 50 kV | 10 feet (3 m) | | | | | | | | | | | | | | | | |
| Over 50 - 200 kV | 15 feet (4.6 m) | | | | | | | | | | | | | | | | |
| Over 200 - 350 kV | 20 feet (6 m) | | | | | | | | | | | | | | | | |
| Over 350 - 500 kV | 25 feet (7.6 m) | | | | | | | | | | | | | | | | |
| Over 500 – 750 kV | 35 feet (10.7 m) | | | | | | | | | | | | | | | | |
| Over 750 – 1,000 kV | 45 feet (13.7 m) | | | | | | | | | | | | | | | | |

| Job Steps | Hazards | Controls | RAC |
|----------------------|--|--|----------|
| See job steps above. | Underground utilities and other underground hazards. | <p>Follow AMS-710-02-PR-01610, Utility Contact Prevention. Follow any additional procedures for intrusive activities identified in APP and Work Plan prior to commencing intrusive activities.</p> <p>Utilities shall be located and marked prior to commencing intrusive activities. Contact utility one-call service (811) at least 48 hour but not more than 10 days prior to commencing intrusive activities, excluding weekends or any state or federal holidays. Retain a copy of mark-out ticket for documentation purposes and QC purposes. Documentation of utility mark-out must be completed using the Utility Mark-out Documentation form (EIG-HS-308.03).</p> <p>Evaluate the work areas, ground conditions, and travel paths to identify any sensitive underground structures, unstable areas, dangerous slopes, and existing open excavations.</p> <p>Complete a Site Layout Plan prior to mobilizing the equipment. The plan shall identify all underground utilities and other underground hazards in the active work areas and travel routes.</p> <p>Cease work immediately if unknown utilities or utility markers are uncovered.</p> <p>Use manual excavation within 3 feet of known utilities. Once the line or cable is exposed, heavy equipment can be used but must remain at least 3 feet from the exposed line or cable.</p> <p>Each work crew member shall be trained in electrocution hazards, explosion/fire hazards, and emergency procedures associated with contacting energized power lines and pipelines.</p> <p>Immediately contact Public Works Department in event utilities are encountered that were not previously marked. Notify Public Works in event any damage to utilities occur.</p> | M |
| | Hand injuries. | <p>Personnel shall wear appropriate leather, heavy cotton or synthetic gloves when handling materials with sharp edges, splinters, burrs, rough surfaces, etc.</p> <p>Items to be handled shall be inspected for sharp edges, splinters, burrs, rough surfaces, etc. prior to being handled.</p> <p>Personnel shall be aware of and avoid pinch point hazards.</p> | M |
| | Noise. | <p>All personnel shall wear hearing protection when operating noisy equipment.</p> <p>Personnel working in vicinity of noisy equipment shall wear hearing protection.</p> <p>Verify personnel noise exposures are safe by performing noise dosimetry.</p> | L |

| Job Steps | Hazards | Controls | RAC |
|----------------------|---------------------------------|---|----------|
| See job steps above. | Use of excavators and backhoes. | <p>Only qualified personnel shall be permitted to operate equipment.</p> <p>It is the responsibility of the operator to read and understand the manufacturer's operator manual, the manufacturer's recommendations for each type and model of equipment to be operated, and the requirements of AMS-710-02-PR-05700 prior to operating equipment. Operators must know the capacity and operating characteristics of the equipment to be operated.</p> <p>When mounting or dismounting equipment, clean shoes and hands before climbing. Always use handrails, grab rails, and steps. Maintain a three-point contact/control with steps and handholds. Never jump on or off equipment. Never attempt to mount or dismount a moving machine. Do not use steering wheel or control levers as a handhold. Lower the boom (and loader when equipped) to a safe position with the bucket/attachment on the ground and turn off the excavator before dismounting equipment.</p> <p>The equipment must be attended at all times or attachments must be placed in the "transport lock position" or lowered to the ground.</p> <p>The operator is responsible for keeping the windows clear and keeping cab clean at all times.</p> <p>Equipment operators must wear seat belt at all times and keep body (hands, arms, legs, head, etc.) inside the protected area of the cab. Operations are to be performed only from the operators control station.</p> <p>All equipment shall be operated at safe speeds and in a safe manner.</p> <p>If equipped with such, use the machine stabilizers.</p> <p>Loads must be carried as low as possible to maintain stability of the equipment and operator visibility.</p> <p>Do not operate equipment on grades steeper than those specified by the manufacturer. When operating on a sloped area, always move up or down the slope and not across the slope. Avoid making turns on inclines. If it is necessary, make turns wide and slowly with load carried low. When traveling up or down inclines, do so with loaded buckets facing uphill and empty buckets facing downhill.</p> <p>The operator of equipment shall not use cellular telephone devices or head/earphones for entertainment purposes while operating equipment. The use of cell phones and other communication devices are permitted for job-related communications or emergency situations, when the equipment is not operating.</p> | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|---|--|-----|
| See job steps above. | Use of excavators and backhoes (continued). | <p>The operator shall not use attachments for which they were not designed to be used for, e.g., using a bucket to transport telephone poles.</p> <p>Follow the manufacturer's instructions for using positive locks on quick-disconnect equipment.</p> <p>Securely latch attachments such as quick-disconnect buckets before beginning work.</p> <p>Make frequent visual inspections of quick-disconnect systems — especially after changing attachments.</p> <p>The operator is to stay alert and focused at all times when the excavator or backhoe is in operation.</p> | M |
| | Excavation and trenching. | All excavation and trenching activities will be conducted in accordance with AMS-710-02-PR-01600 <i>Excavation and Trenching</i> and EM-385-1-1 Section 25 <i>Excavation and Trenching</i> as applicable. | M |
| | Struck by and against | <p>Wear PPE with high visibility vests when walking or working near moving equipment or vehicles.</p> <p>Prevent unauthorized workers or bystanders from entering work areas with equipment operations.</p> <p>Verify "DANGER – STAY CLEAR" (or equivalent) warning sign(s) is visibly posted on the equipment.</p> <p>Personnel shall maintain a safe distance from operations. Keep alert for movement of equipment, loads, excavations, piles, and ejected matter.</p> <p>Personnel shall not be permitted in the swing radius of the equipment. Precautions must be implemented to keep personnel out of excavations and at least 10 ft. (3 m) away from the equipment and its maximum boom and/or counterweight swing radius when operating. Accessible areas within the swing radius of the equipment are to be barricaded to prevent personnel from being struck or crushed, as appropriate.</p> | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|-----------------------|--|------------|
| See job steps above. | | <p>Do not approach an excavator or backhoe without first establishing communication with the operator or spotter (eye contact and then a signal to proceed after the equipment has been shut down:</p> <ul style="list-style-type: none"> • Excavator bucket planted, powered down, and controls locked. • Backhoe bucket planted, engine shut off. <p>Don't allow anyone to stand under a suspended load or the boom, arm, or bucket.</p> <p>Operator to stop operations if personnel are observed within the swing radius.</p> | RAC |
| | Spotter operations. | <p>Use designated spotters as necessary and as determined by the operator or supervisor.</p> <p>Establish communication before starting work – hand signals, whistles, radios, air horn, audible alarm, or other means of effective jobsite communication.</p> <p>When a designated spotter is used, the equipment shall not be moved unless the designated spotter giving signals is in full view of the operator. The spotter must maintain line of site or communication with the equipment operator.</p> <p>For movement of mobile equipment in congested areas, a designated spotter shall be in full view of the operator and shall direct the movement. In some cases, multiple spotters may be required.</p> | M |
| | Sampling from bucket. | <p>Position the sampling support and collection area on the cab side of the excavator to minimize operator blind spots created by the excavator boom assembly.</p> <p>Verify the operator is aware of your intention to collect samples from the bucket.</p> <p>Prior to sampling, the equipment operator shall fully lower the bucket to the ground, set the safety lockout lever to isolate joystick controls, decelerate the engine to idle level and signal the sample technician it is safe to approach the bucket. For backhoes, the bucket shall be planted on the ground and the engine shut down prior to approaching the bucket to obtain a sample.</p> <p>Keep out from between the excavator bucket and fixed objects, vehicles, or equipment when sampling.</p> <p>The operator should swing the machine to where the boom is at least at a 45-degree angle away from the excavation.</p> | M |
| | Excavation hazards. | Follow the project Excavation/Trenching Plan. | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|------------------------------------|---|----------|
| See job steps above. | Dust or potential airborne hazards | Control dust by maintaining equipment operation rates. Control dust by applying water. Personnel shall stay out of dust and work from upwind when possible. Perform dust monitoring as specified in the SSHP. Real-time air monitoring will be executed in accordance with SSHP requirements to mitigate potential worker exposure. | M |
| Use heavy haul units | Dump truck operations. | Dump trucks shall be inspected and found to be in safe condition prior to being placed in service at the site. Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to used barricades, then spotters shall be provided; however, the minimum distances from electrical lines must be observed. Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing as necessary. Trucks shall be equipped with audible backup alarms. Cab shall be equipped with elevated bed indicator. Material shall not be loaded over cab of trucks. Personnel shall stay away from trucks when being loaded. Tires shall be inspected for accumulation of debris and cleaned as needed to avoid tracking on roadways. | L |
| See job steps above. | Slips, trips, and falls. | <p>Understand the hazards of slips, trips, and falls – consider the consequences.</p> <p>Do not jump from equipment or elevated surfaces.</p> <p>Clean-up work areas throughout the day and at the end of each workday.</p> <p>Use three-point contact rule for entering/exiting vehicles, trucks, and equipment.</p> <p>Use hand rails and other stationary objects (door frames, door knobs, steering wheels, walls, etc.) to increase stability.</p> <p>Use extra caution when walking on wet, muddy, frosty, icy, or snow-covered surfaces. Consider postponing work as necessary and feasible.</p> <p>Increase your awareness, keep alert, stay focused, and know your environment.</p> <p>Stay away from slopes, hills, and grades.</p> <p>Be cautious when using stairs.</p> <p>Remove snow and ice when possible (shoveling, chipping, and salt application).</p> <p>Apply traction aids, such as sand, gravels, and straw.</p> <p>Lower your center of gravity when necessary. Slow down - take smaller steps.</p> | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|---|---|----------|
| See job steps above. | Insect bites and stings. | <p>Review injury and illness potential with workers.</p> <p>Inspect work areas for bee nests and activity prior to commencing work in that area.</p> <p>Wear PPE, such as disposable coveralls, to keep insects away from the skin.</p> <p>Expect to encounter insects when working in warm weather – especially at locations with vegetation present.</p> <p>Use protective insect repellents containing DEET (Deep Woods Off or equivalent) to prevent insect bites, unless individual allergies and sensitivities prevent its use.</p> <p>Consider applying Permethrin (Repel® Permanone® or equivalent) preparations to clothing to repel ticks, chiggers, mosquitoes, and/or spiders.</p> <p>Check limbs/body for insects/ insect bites upon removing PPE and again during showering.</p> <p>Immediately notify supervisor or SSHO of insect bites, stings, irritations, rashes, or flu-like symptoms.</p> | L |
| | Contact dermatitis from poisonous and irritating plants (poison ivy, poison oak, and poison sumac). | <p>Learn to identify poisonous and irritating plants. Check around work areas to identify if poisonous and irritating plants are present.</p> <p>Identify workers who are known especially sensitive to poisonous and irritating plants and plan work accordingly.</p> <p>Wear Tyvek® coveralls to avoid skin contact with irritating plants.</p> <p>Immediately notify the SSHO if you suspect you contacted an irritating plant.</p> <p>Avoid unnecessary clearing of plant/vegetation areas.</p> <p>Remove clothing or Tyvek® coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces.</p> <p>Follow additional procedures outlined in the APP.</p> | L |
| | Severe weather. | <p>The SSHO to monitor weather conditions each day in order to plan and prepare for hazardous conditions.</p> <p>The SSHO to identify the nearest suitable storm shelter at each work location.</p> <p>Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate).</p> | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------|-----------------------|--|-----|
| See job steps above. | Heat and Cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT TLV values. | M |
| | Struck by material | Personnel shall never place themselves under suspended/overhead loads. Material shall be loaded over the dump bed and not allowed to pass over operator cab. Haul units shall be equipped with adequate Falling Object Protective Structure. All loads are to be covered when traveling on the road weather on base or off base. NO driver operator shall climb into truck or over 6 feet above ground level with out proper fall protection | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|--|--|--|
| <u>Personal Protective Equipment</u> Hard hat Safety glasses with side shields Safety-toed boots Work gloves Class 2 high visibility vests Hearing protection, as necessary <u>Other Equipment:</u> Fire Extinguishers Caution tape Excavation perimeter protection First Aid Kit Drinking water Weather radio Insect repellent with DEET (Deep Woods Off™ or equivalent) Repel Permanone™ Communication devices | Competent Person (CP) / Qualified Person (QP): CP/SSHO Brian Rhodes _____ Alternate CP/SSHO _____ QP/First Aid and _____ QP/First Aid and CPR Brian Rhodes _____ Training Requirements (as determined by the SSHO): Site safety orientation Emergency procedures Hearing conservation Applicable AHAs Lifting/back safety Fire extinguisher use Biological hazard identification and control Storm shelter location Lightning safety procedures Heat stress prevention and heat stroke treatment Cold stress prevention Excavation and trenching Subcontractor Personnel Proof of Training and Competency and Certifications of Employee Medical Surveillance Program Participation to be provided to the COR prior to the commencement of field operations for review and approval. | Daily site safety inspection (SSHO) Brian Rhodes Daily site safety inspection (QCO) _____ Initial and daily equipment inspections. Overhead utilities and hazards (prior to operating equipment in area) Locate underground utilities (prior to intrusive activities) Excavation (at least daily) Housekeeping (daily) Fire extinguisher (monthly) Equipment and tools inspection (daily and before use) Survey areas for poisonous plants, insects, and animals(each work area) Check body for ticks (each evening during tick season) Identify closest usable storm shelter that is available |

Activity Hazard Analysis (AHA)

| | | | | | | | |
|--|---|--|--------------------|----------|--------------------------------|------------|----------|
| Activity/Work Task: Soil Sampling | | Overall Risk Assessment Code (RAC) (Use highest code) | | | M | | |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | | Risk Assessment Code (RAC) Matrix | | | | | |
| Contract Number: W912DY-17-D-0003 | | Severity | Probability | | | | |
| Date Prepared: 06/25/20, Revised 02/02/21 | | | Frequent | Likely | Occasional | Seldom | Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | | Catastrophic | E | E | H | H | M |
| | | Critical | E | H | H | M | L |
| Reviewed by: Doug Russell/HSE Manager | | Marginal | H | M | M | L | L |
| | | Negligible | M | L | L | L | L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | | | | |
| | | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | | RAC Chart | | |
| | | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | | E = Extremely High Risk | | |
| | | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | | H = High Risk | | |
| | | | | | M = Moderate Risk | | |
| | | | | | L = Low Risk | | |
| Job Steps | Hazards | Controls | | | EM 385-1-1 | RAC | |
| Arrival of new personnel at site. | Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | | | 01.B.03 01.E.01 28 | M | |
| Soil sampling | Poor planning. | Complete Job Safety Analysis for each task. Use Hazard Assessment Resolution Program frequently – for each task to be completed. | | | | M | |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | | | 14.A.01 | M | |
| | Intrusive activities and underground utilities. | Follow procedure for intrusive activities in the CMIP and SSHP prior to commencing activities. | | | 25.A.01 | M | |
| | Overhead hazards/utilities. | Overhead hazards shall be evaluated prior to moving equipment on the project site. Overhead power lines shall be shut-off and locked-out if minimum separation distances cannot be achieved in accordance with EM 385-1-1 Table 11-1. Areas with overhead hazards shall be barricaded with caution tape to warn personnel In areas where it is not feasible to use barricades, spotters shall be provided: however, the minimum distances from energized overhead electrical lines must be observed. | | | 11.F.04 | M | |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------|--|---|------------|-----|
| Soil sampling (continued) | Underground utilities and other underground hazards. | <p>Follow any additional procedures for intrusive activities identified in the CMIP prior to commencing intrusive activities.</p> <p>Utilities shall be located and marked prior to commencing intrusive activities. Contact utility one-call service (811) at least 48 hours but not more than 10 days prior to commencing intrusive activities, excluding weekends or any state or federal holidays. Retain a copy of mark-out ticket for documentation purposes and QC purposes. Follow requirements of AMS-710-02-PR-01600, <i>Excavation and Trenching</i>, and AMS-710-02-PR-01610, <i>Utility Contact Prevention</i>.</p> <p>Evaluate the work areas, ground conditions, and travel paths to identify any sensitive underground structures, unstable areas, dangerous slopes, and existing open excavations.</p> <p>Complete a Site Layout Plan prior to mobilizing the equipment. The plan shall identify all underground utilities and other underground hazards in the active work areas and travel routes.</p> | | M |
| | Underground utilities and other underground hazards. (continued) | <p>Cease work immediately if unknown utilities or utility markers are uncovered.</p> <p>Use manual excavation within 3 feet of known utilities. Once the line or cable is exposed, heavy equipment can be used but must remain at least 3 feet from the exposed line or cable.</p> <p>Each work crew member shall be trained in electrocution hazards, explosion/fire hazards, and emergency procedures associated with contacting energized power lines and pipelines.</p> <p>Immediately contact utility one-call service (811) if an underground utility is damaged, dislocated, or disturbed.</p> | | |
| | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain. | 14.C.01-10 | M |
| | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | 05.A.08 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|----------------------------|------------------------------------|--|------------------------------|-----|
| Soil sampling (continued). | Use of heavy equipment. | Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily. Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. Mechanical excavation equipment will only be used within one foot of suspected subsurface target anomalies. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment. | 18.A 18.G 18.B 05.F | M |
| | Insect bites/West Nile Virus. | Wear personal protective equipment (PPE) and tape joints to keep insects away from the skin. Check limbs/body for insects/insect bites before end of shift. Notify SS of flu-like symptoms. | 06.D.01 | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Remove clothing or Tyvek® coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy. Follow procedures outlined in the SSHP. | 06.D.03 | L |
| | Severe weather. | The Site Supervisor (SS) will monitor weather conditions each day in order to plan and prepare for hazardous conditions and will use lightning and severe weather detection devices to evaluate potential weather threats. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. When lightning is observed within a 10 mile radius or upon hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). A waiting period of at least 30 minutes from the last nearby lightning strike will be observed before resuming activities. Follow procedures outlined in the SSHP. | 06.I | L |
| | Hazardous atmospheres. | Personnel shall immediately notify the SS if odors are detected. | | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|----------------------------|------------------------------|--|-------------------------------|-----|
| Soil sampling (continued). | Heat stress and cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT TLV values. | 06.I | M |
| | Dust. | All visible dust shall be controlled. PPE use is required when working in contaminated areas. Water will be utilized to keep dust levels low. | 28 | L |
| | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available in work trucks. Site personnel shall complete annual fire extinguisher training. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents. Fire watch shall be stationed to monitor area at least one hour after hot work activities. | 09.E.01 09.A.06 09.B.08 | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|---|---|
| Personal Protective Equipment – Modified Level D: Hard Hat as applicable Safety Glasses Chemical Resistant Boots Work Gloves over Butyl Rubber Gloves Tyvek F ANSI Class 2 reflective warning vests Equipment: Fire Extinguishers Emergency Eyewash First Aid Kit Drinking water Weather radio or AM/FM radio Hand tools Heavy equipment Portacount fit tester Emergency Personnel Decontamination Station (EPDS) Personnel Decontamination Station (PDS) PID with 11.7 eV lamp Ambulance | Training Requirements: Competent Person (SSHO) Brian Rhodes Site safety orientation HAZWOPER 40-Hour MEC Awareness Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety Procedures Fit testing respiratory protection | Daily site safety inspection (SSHO) – Brian Rhodes Daily site safety inspection (UXOSO) – TBD Vehicle inspection daily Check Known Allergies Questionnaire Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Overhead and underground utilities Mechanized equipment initial inspection Mechanized equipment (daily) Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | | | |
|--|--|--|--------------------|------------|
| Activity/Work Task: Equipment Decontamination | Overall Risk Assessment Code (RAC) (Use highest code) | M | | |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | | |
| Date Prepared: 06/25/20, Revised 02/02/21 | | Frequent Likely Occasional Seldom Unlikely | | |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M | | |
| Reviewed by: Doug Russell/ HSE Manager | Critical | E H H M L | | |
| | Marginal | H M M L L | | |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Negligible | M L L L L | | |
| | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | | |
| "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | RAC Chart | | |
| "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | E = Extremely High Risk | | |
| Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | H = High Risk | | |
| | | M = Moderate Risk | | |
| | | L = Low Risk | | |
| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
| Clean equipment. | Failure to properly plan daily activities. | Complete Job Safety Analysis for each task, as specified in, "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed. | | M |
| | Exposure to contaminants. | Maintain work zones and decontamination areas. Level D - Modified personal protective equipment shall be worn as required in the Accident Prevention Plan or Site Safety and Health Plan. Personnel shall perform proper decontamination procedures each time when exiting the Exclusion Zone. | 28 05.A.01 | L |
| | Poor lighting. | Additional lighting shall be put in place as necessary. Temporary lighting shall be protected with ground fault circuit interrupters (GFCI). | 07.A.01 11.D.05 | L |
| | Slips, trips, and falls. | Work areas shall be kept organized during work activities. Housekeeping shall be maintained. Personnel shall use caution when walking/working on wet surfaces. | 14.C.01-10 | M |
| | Electrical. | GFCIs shall be used on all power tools and extension cords. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas. | 11.D.05 11.A.03 | M |
| | Heavy lifting. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | 14.A.01 | M |
| | Noise. | Personnel shall wear hearing protection when operating pressure washer. | 05.C | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|------------------------------|---|---|--|------------|
| Clean equipment (continued). | Liquid splash, eye, face injury | Full body PVC raingear or polyethylene coated coveralls shall be worn by pressure washer operators. Orifice operators shall use a full-face shield. Other crew members shall use a of ANSI Z87.1 compliant safety glasses with side shields, goggles or face shield. | | M |
| | Skin contact with contaminated wash-water | Remove PVC raingear polyethylene coated coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces. Dispose of polyethylene coated coveralls while turned inside-out. Manually decontaminate reusable PVC raingear using trisodium phosphate (TSP) or other approved decontamination solution. | | L |
| | Fire. | Fire extinguishers shall be placed in work areas. Smoking shall only be allowed in designated areas. Site personnel shall complete annual fire extinguisher training. | 09.E.01 09.A.06 | L |
| | Heat and Cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT TLV values. | 06.I 02.C | M |
| | Use of pressure or steam washer. | The pressure/steam washer shall be inspected before each use. The manufacturer's instruction manual shall be used to guide the inspection process. Personnel shall be trained in the use of the washing equipment. All personnel working in the equipment decontamination area shall be trained in the emergency shut-off procedures for the equipment being used. The minimum amount of steam/pressure that will complete the job should be used. Pressure washers exceeding 3000 psi shall not be used. The spray from such equipment shall only be directed at surfaces to be cleaned and never at body parts or other personnel. Personnel in the immediate area shall use face shields and metatarsal/shin guards. Personnel shall keep firm grip on wand and not point it at anything that is not being washed. Pressure washer operators must maintain good footing. The trigger on the wand shall never be wired/fixed open. Operators are to take adequate breaks to avoid fatigue. Hot surfaces shall be avoided. Units shall be shut off and allowed to cool prior to re-fueling (if gas-powered). Carbon monoxide shall be monitored if gas-powered pressure washers are used in areas with limited ventilation. Carbon monoxide concentrations shall not be allowed to exceed 25 parts per million within any work areas. | 13.A.02 13.A.02 09.B.21 13.A.12 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|------------------------------|----------------------------------|--|------------|-----|
| Clean equipment (continued). | Spills of decontamination water. | All waste handling activity shall be performed on visqueen (polyethylene sheeting) lined work surfaces. Waste liquids shall be stored with secondary containment. Lids and bungs shall be secured when drums are in storage or are being moved. Spill cleanup equipment shall be readily available when handling wastes. Drums containing waste shall be inspected on a daily basis. Spills shall be immediately reported to the Site Safety and Health Officer. | 09.B.18 | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|---|---|---|
| Personal Protective Equipment - Level D - Modified: Hard hat Safety glasses Safety-toed boots Face shield Metatarsal and leg protection Work gloves PVC rain-gear or Poly coated Tyvek Protective over-boots Hearing protection Equipment: GFCI Fire extinguishers Emergency eyewash First aid kit Drinking water Weather radio or AM/FM radio Spill control equipment | Competent Person (CP) / Qualified Person (QP): Brian Rhodes – QP/SSHO Brian Rhodes – QP/First Aid and CPR Training Requirements: Site safety orientation HAZWOPER 40-Hour Lifting/back safety Fire extinguisher use Emergency procedures National Lightning Safety Institute Lightning Safety procedures | Daily site safety inspection (SSHO) – Brian Rhodes Daily site safety inspection (UXOSO) – TBD Housekeeping (daily) Fire extinguisher (weekly) Equipment and tools inspection daily and before use Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | |
|---|---|--|
| Activity/Work Task: Pressure Washing | Overall Risk Assessment Code (RAC) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20, Revised 02/03/21 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by: Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| | Negligible | M L L L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment Equipment will be decontaminated by washing with pressurized water. | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely. | RAC Chart |
| | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | RAC |
|----------------------------------|--|--|----------|
| Preparation for Pressure Washing | Musculoskeletal injury from handling heavy objects | Observe proper lifting techniques Obey sensible lifting limits (50 lbs. Maximum per person manual lifting) Use mechanical lifting equipment (hand carts, trucks, forklift) to move large loads, awkward loads | M |
| | Unauthorized access to work area | The work areas shall be defined by barrier tape, rope or other suitable barriers and be marked with warning signs. The perimeter should be outside of the effective range of the water jet wherever possible. | M |
| | Equipment failure | Inspect equipment according to manufacturer's specifications Ensure all fittings and hoses have the correct pressure rating and in good condition Do not use damaged or defective equipment | M |
| | Lack of communication | Before starting, the team members shall agree on signals to be used during the operation of the equipment. | M |

| Job Steps | Hazards | Controls | RAC |
|--|--|---|------------|
| Preparation for Pressure Washing (continued) | Improper use of pressure washing equipment | <p>All equipment shall be operated consistent with the manufacturer's instructions.</p> <p>Water jetting equipment shall only be operated by persons who are trained and knowledgeable in the safe operation of the equipment to be used.</p> <p>The orifice operator must always be able to shut down the water jet by releasing pressure on the trigger, switch or foot valve pedal</p> <p>Control devices shall be kept in proper working order and shall not be altered or tampered with.</p> <p>Equipment shall not be repaired or connections tightened when the unit is in operation or the pump is running.</p> <p>All pressurized water cleaning operations shall comply with the Contractor's Pressurized Water Cleaning and Cutting Operations procedures.</p> | M |
| | Slips, trips, falls | <p>Use proper stance for sound footing while operating pressure washer</p> <p>Clear walkways, platforms, access steps and work areas of equipment, tools, and debris</p> <p>Mark, identify, or barricade tripping hazards</p> <p>Hose shall be arranged so that tripping hazards to not occur.</p> | L |
| Pressure Washing | Working alone | A minimum of two persons, one at the pump and one at the orifice or gun, shall be employed at all times. | M |
| | Foot injury from high pressure water jet | Jetting gun operators shall be protected with waterproof boots with steel toecaps, shanks, and metatarsal guards. | M |
| | Hand injury | Hand protection shall be used where there is a reasonable probability of injury and if required by the original equipment manufacturers' specifications. | M |
| | Liquid splash, eye, face injury | <p>Full body PVC raingear or polyethylene coated coveralls shall be worn by pressure washer operators.</p> <p>Orifice operators shall use a full face shield.</p> <p>Other crew members shall use a of ANSI Z87.1 compliant safety glasses with side shields, goggles or face shield.</p> | M |
| | Skin contact with contaminated wash-water | <p>Remove PVC raingear polyethylene coated coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces. Dispose of polyethylene coated coveralls while turned inside-out. Manually decontaminate reusable PVC raingear using trisodium phosphate (TSP) or other approved decontamination solution.</p> | L |
| Noise | Pressure water jetting operations may produce high noise levels. Use ear protection. | M | |

| Job Steps | Hazards | Controls | RAC |
|-------------------------------------|---|--|------------|
| Pressure Washing (continued) | Heat Stress and cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT monitoring and TLVs. | L |
| Changed or Unanticipated Conditions | Safety or health hazards that may be derived from changed or unanticipated conditions | Modify the AHA as often as necessary to address new or unanticipated hazards. Use "Job Safety Analysis" form to facilitate field documentation | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|---|---|
| Modified Level D: including poly-coated coveralls or PVC raingear, hard hats with attached face shield, Waterproof boots with steel toecaps and shanks and metatarsal guards, hearing protection Hand Tools Pressure Washer Unit | This AHA Site-specific orientation Workers must be trained in the safe operation of all assigned equipment TBD – CP/SSHO | Inspect all equipment daily prior to use and in accordance with manufacturer's requirements. Inspect the work area daily for unanticipated hazards. Inspect non-construction equipment and power tools per manufacturer requirements. |

Activity Hazard Analysis (AHA)

| | | |
|--|--|--|
| Activity/Work Task: Waste Management | Overall Risk Assessment Code (RAC) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by: Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Larry Verdier, CIH, CSP, HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Negligible | M L L L L |
| | <p>Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above)</p> <p>"Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom or Unlikely.</p> <p>"Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible</p> <p>Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA.</p> | |
| | | RAC Chart |
| | | E = Extremely High Risk |
| | | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | RAC |
|----------------|---|---|----------|
| Drums Handling | Handling heavy objects | Observe proper lifting techniques. Obey sensible lifting limits (50 lbs. maximum per person manual lifting). Use mechanical lifting equipment (handcarts, trucks, and forklift) to move large loads, awkward loads. Check and secure drum lids before moving. | M |
| | Caught in/between moving parts/pinch points | Identify and understand parts of equipment, which may cause crushing, pinching, rotating, or similar motions. Remove all jewelry, especially rings, bracelets, watches Watch hand placement and foot placement Assure guards are in place to protect from these parts of equipment during operations. Abrasion resistant work gloves when the possibility of pinching, or other injury may be caused by moving / handling large or heavy objects. Maintain all equipment in a safe condition. Keep all guards in place during use. De-energize and lock-out machinery before maintenance or service. | M |

| Job Steps | Hazards | Controls | RAC |
|-------------------------------|---|--|------------|
| Drums Handling (continued) | Slips, trips, falls | Clear walkways, platforms, access steps and work areas of equipment, tools, and debris. Mark, identify, or barricade other obstructions. Work areas, platforms, and walkways should be kept free of materials, debris, and obstructions such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous. Maintain three-point contact when mounting / dismounting heavy equipment. Maintain good housekeeping. | M |
| | Sharp objects | Wear abrasion resistant work gloves. Inspect hand tools before use. Keep guards in place during use. | M |
| | Vehicle traffic | Use spotter when backing. Survey route to work locations. Inform crew of hazards. Wear reflective vest when exposed to heavy equipment or traffic. | M |
| | Struck by/against heavy equipment, protruding objects | Isolate equipment swing area. Require backup alarms on all heavy equipment. Make eye contact with operators before approaching equipment. Understand and review hand signals. | L |
| | Inhalation and contact with hazardous substances | Review hazardous properties of site contaminants with workers before work begin. Monitor breathing zone pursuant to SSHP. Avoid skin contact with contaminated waste. Avoid inhalation of dust or vapors. | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|---|--|
| <ul style="list-style-type: none"> Level D: hard hat, safety glasses, safety boots, ear protection, abrasion resistant gloves Hand tools Drum dolly Forklift | <ul style="list-style-type: none"> Tailgate Safety Meeting Site-specific orientation HAZWOPER 40-hr. HAZWOPER 8-hour refresher 8-hr Supervisor training Forklift operator training TBD – CP/SSHO | <ul style="list-style-type: none"> Use this AHA as a checklist Inspect all equipment and tools prior to use per manufacturer requirements. |

Activity Hazard Analysis (AHA)

| | | |
|--|--|--|
| Activity/Work Task: Fueling Operations | Overall Risk Assessment Code (RAC) (Use highest code) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Larry Verdier, CIH, CSP, HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Negligible | M L L L L |
| | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | |
| "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | RAC Chart |
| "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | E = Extremely High Risk |
| Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------|----------------------------------|---|--|----------|
| Fueling operations. | Exposures to fuels. | <p>Personnel shall periodically review the Safety Data Sheets (SDS) for the fuels that are being used at the project.</p> <p>The handling and use of fuels shall be performed in well-ventilated areas – preferably outside of buildings.</p> <p>Personnel shall avoid skin and eye contact with fuels. Safety glasses and disposable nitrile gloves shall be worn while handling fuels. If personnel sustain skin contact with fuels, then the affected area shall be immediately washed with soap and water. If fuel contact with clothing is made, then clothing shall be removed and changed immediately.</p> | 06.B.01 09.B.07 05.B.01 09.B.05 | L |
| | Fire: extinguisher requirements. | 10 pound A:B:C fire extinguisher shall be readily available when fueling equipment at any location on site. Trucks with flammable/combustible fuels must be equipped with 20 pound A:B:C fire extinguisher. Personnel who intend to extinguish small fires shall be trained annually in the use of fire extinguishers. Equipment and property are of secondary concern in a fire situation - personnel shall never try to extinguish a fire if there is any doubt that it can be extinguished safely. | 09.E.03 09.B.03 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------------|--|--|--------------------|------------|
| Fueling operations (continued). | Fire: elimination of ignition sources – hot surfaces. | All vehicles and equipment shall be shut down prior to fueling. Small equipment, such as generators, mowers, pressure washers, etc. shall be allowed to cool prior to re-fueling. Heavy equipment with the fuel cap near the engine or near other hot surfaces shall also be allowed to cool prior to re-fueling. | 09.B.21 | M |
| | Fire: elimination of ignition sources – arcs/sparks/open flames. | Smoking shall not be allowed within 50 feet of fueling operations. Personnel shall visually survey the immediate area for open flames and other ignition sources prior to commencing fueling operations. Personnel are prohibited from using cell-phones or two-way radios during all fueling operations. | 09.B.02 | L |
| | Fire: elimination of ignition sources – static electricity. | Personnel shall never fill portable fuel cans that are in the bed of a pickup truck or in the trunk of an automobile. Filling fuel containers on plastic pickup truck bed-liners can cause static electric discharges, which may ignite the fuel. The fuel can(s) shall be removed from the truck bed or automobile trunk and placed on the ground before adding fuel. Electrical continuity shall be maintained between the portable fuel can and the tank being filled. A bonding cable shall be used to maintain continuity between the metal fuel container and the equipment fuel tank. Allowing free-fall of fuel into the tank is prohibited. Personnel shall not re-enter vehicles while fueling is underway due to the static electric charge generated between clothing and vehicle seats. If you absolutely have to get in your vehicle while the gas is pumping, make sure you get out, close the door touching the metal, before you pull the nozzle out. This way the static from your body will be discharged before you remove the nozzle. | 09.B.21 | L |
| | Storage and transportation: five-gallon cans in pick-up trucks. | Gasoline shall be stored and transported in properly marked/labeled five-gallon, or smaller-size safety cans (equipped with self-venting cap and flash arrestor). Gasoline cans shall be secured to prevent movement during transportation. No more than six - five gallon containers of gasoline may be transported in vehicles (back of pick-up trucks or trailers) at the same time unless all the Department of Transportation (DOT) Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding (as required), and the appropriate HM 126 Training (as well as having been provided emergency response information and training.) The total quantity of hazardous materials may never exceed 440 pounds total. Hazardous materials must be secured prior to transporting. | 09.B.08 09.B.11 | L |
| | Communication of hazards. | Drivers must be notified that they are transporting hazardous materials. Drivers shall review SDS for the fuels transported in their vehicle. | 01.B.01 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------------|---|---|--------------------|------------|
| Fueling operations (continued). | Storage of fuels on-site. | Portable safety gasoline cans must be stored within a flammable materials storage area, have appropriate warning signs, be posted as "No Smoking", and have a fire extinguisher available in the area. | 09.B.02 09.B.18 | M |
| | Spills. | All spills shall be immediately cleaned-up. Spill control equipment shall be readily available. All spills shall be reported to the Site supervisor (SS) and Site Safety and Health Officer (SSHO). | 09.B.19 | M |
| | Storage and transportation: safety containers and saddle tanks in pick-up trucks. | Gasoline shall not be transported in portable saddle tanks – only diesel fuel shall be transported in saddle tanks. All portable saddle tanks mounted in pick-up trucks shall be manufactured to meet DOT specifications. Portable saddle tanks shall be securely mounted to the pick-up truck, as recommended by the manufacturer. Saddle tanks shall be properly marked (see 49 Code of Federal Regulation 172.101) with the proper shipping name and labeled for "No Smoking." No more than 110 gallons of diesel fuel may be transported in a saddle tank unless all the DOT Hazardous Material Regulations are complied with, such as proper packaging, completing shipping papers, placarding, and the appropriate HM 126 Training (as well as having been provided emergency response information and training.) | 09.B.08 | L |
| | Bulk storage of diesel fuel on-site. | Caps on saddle tanks shall be securely closed. Saddle tanks shall be inspected weekly to check for leaks. Bulk storage tanks shall not be permitted on site without express permission from the Contractor's Project Manager and Health and Safety Manager. Containment measures shall be implemented. | | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|--|---|
| <p>Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Disposable nitrile gloves ANSI Class 2 reflective warning vests</p> <p>Equipment: Fire Extinguishers Saddle tanks Bonding cable Eye wash station Five-gallon safety cans (equipped with self-venting cap and flash arrestor) Basic spill kit (55-gallon open top drum, shovels, plastic sheeting, sorbent pads and granular material)</p> | <p>Training Requirements:</p> <p>Bonding techniques Materials of Trade Hazard communication - Review Material Safety Data Sheet for fuels Portable fire extinguisher use Lifting/back safety</p> | <p>Daily site safety inspection (SS) – TBD Daily site safety inspection (SSHO) – TBD</p> <p>Survey area for ignition sources (prior to commencing fueling operations) Verify SDSs for fuels are available in vehicles transporting fuels Saddle tanks (daily) Verify eye wash bottle is readily available Fire extinguisher (before fueling equipment)</p> |

Activity Hazard Analysis (AHA)

| | | |
|--|--|--|
| Activity/Work Task: Disposal of Remediation Derived Waste | Overall Risk Assessment Code (RAC) (Use highest code) | M |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M |
| | Critical | E H H M L |
| Reviewed by: Larry Verdier, CIH, CSP, HSE Manager | Marginal | H M M L L |
| | Negligible | M L L L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as certification of hazard assessment. | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart |
| | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | RAC |
|----------------------------|---|---|----------|
| Remediation waste disposal | Personnel injury, property damage, and/or equipment damage | Use qualified and trained forklift operators. The operator shall not exceed the load capacity rating for the forklift. The load capacity shall be clearly visible on the forklift. Forklift operators shall inform their supervisor of any prescribed medication that they are taking that would impair their judgment. | M |
| | Cross-contamination and contact with potentially contaminated materials | Loads to be transported shall be inspected for container integrity and secured prior to movement. Sampling technicians will wear proper protective clothing and equipment to safeguard against potential contamination. Only essential personnel will be in the work area. All personnel will follow good hygiene practices. Proper decontamination procedures will be followed. All liquids and materials used for decontamination will be contained and disposed of in accordance with federal, state, and local regulations. | L |
| | Heavy lifting | Use proper lifting techniques. Lifts greater than 50 pounds require assistance or mechanical equipment; size up the lift. Avoid sudden or awkward motion. Lift with legs. | L |
| | Slip, trip and falls | Housekeeping shall be a routine task throughout daily activities. | M |

| Job Steps | Hazards | Controls | RAC |
|----------------------------|--------------------------------------|---|-----|
| Remediation waste disposal | Drum handling | Stay upwind when filling a drum (with either soil or water), be careful not to make contact with the contained waste. Conduct air monitoring as specified in the SSHP. Wear appropriate gloves and or splash protection. Make sure lid or bung of drum is secure. If moving a drum unassisted, be sure to leverage properly, use proper lifting techniques, and wear safety glasses and steel-toed boots. When using a drum dolly, make sure straps and lid catch are securely attached. Leverage properly when tilting drum. Be sure toes stay away from drum. | M |
| | Tripping Hazards | Site Safety and Health Officer (SSHO) will ensure that workers are aware of potential slippery surfaces and tripping hazards. Personnel will inform Site Supervisor (SS) or SSHO of any observed potential slip, trip, or fall hazards. | L |
| | Manual lifting | Workers will be trained in proper lifting techniques and the potential for injuries due to lifting, to be discussed during site-specific training. No bulky item or items assessed at over 50 lbs will be lifted without assistance or use of a lift assist device (e.g., handcart). | M |
| | Improper labeling or shipping papers | All generated waste shall be labeled in accordance with Department of Transportation regulations based on waste stream profile and be accompanied by required documentation based on waste characterization criteria per Resource Conservation and Recovery Act and 40 Code of Federal Regulations (CFR). Only personnel with the required training shall characterize and profile waste. | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|---|--|---|
| Personal Protective Equipment Level D with Nitrile gloves Equipment: Air monitoring equipment Fire Extinguishers First Aid Kit Trucks Drums Packing materials Drum dolly | Competent Person (CP) / Qualified Person (QP): TBD HAZWOPER 40-Hour Site safety orientation Emergency procedures Hazard communication Hazardous materials shipping Applicable AHAs Fire extinguisher use | Daily site safety inspection (SSHO) – TBD Daily site safety inspection (SS) –TBD Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Inspect shipping containers and labeling |

Activity Hazard Analysis (AHA)

| | | | |
|---|---|--|------------|
| Activity/Work Task: MEC/MPPEH Handling and Certification | Overall Risk Assessment Code (RAC) (Use highest code) | L | |
| Project Location: RSA-014S Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | |
| Date Prepared: 6-4-21 | | Frequent Likely Occasional Seldom Unlikely | |
| Prepared by (Name/Title): Winston D Russell/HSE Manager | Catastrophic | E E H H M | |
| Reviewed by (Name/Title): | Critical | E H H M L | |
| | Marginal | H M M L L | |
| | Negligible | M L L L L | |
| Notes: (Field Notes, Review Comments, etc.) | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart | |
| | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk | |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | L = Low Risk | |
| Job Steps | Hazards | Controls | RAC |
| Arrival of new personnel at site. | Unfamiliarity with site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | L |
| MEC/MPPEH Handling and Certification | Poor planning. | Complete JSA for each task, as specified in AMS 710-05-FM-01708, Sample Job Safety Analysis Worksheet "Job Safety Analysis (JSA)." Use Hazard Assessment Resolution Program frequently – for each task to be completed. | L |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | L |
| | Struck-by/Against. | Wear reflective warning vests when exposed to vehicular traffic. Personnel working on or near roads and only remain on road long enough to complete work. Personnel walking along roadway shall stay off roadway as far as possible and walk on the side facing traffic. | L |

| Job Steps | Hazards | Controls | RAC |
|---|--|---|-----|
| MEC/MPPEH Handling and Certification (continued). | Munitions and Explosives of Concern (MEC) / Unexploded Ordnance (UXO) contact. | Use only UXO personnel qualified in accordance with Department of Defense Explosives Safety Board Technical Paper 18, Minimum Qualifications for UXO Technicians and Personnel. UXO Technicians shall be present during any activity occurring in a Munitions Response Areas. Perform all work in accordance with approved Work Plan and applicable SOPs. Excavate to the side of anomalies. Only use hand tools to expose anomaly. Follow all applicable SOPs and EM 385 1-97. | L |
| | Blast overpressure fragmentation blast. | The UXO Safety Officer (UXOSO) is responsible for maintaining the minimum safe distance arcs indicated in the Work Plan for the fragmentation data sheet of the Munition with the Greatest Fragmentation Distance (MGFD) for the Munitions Response Site. | L |
| | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, wooded or uneven terrain. | L |
| | Accidental detonation of MEC. | Observe the requirements of Explosives Safety and Health Manual EM 385-1-97. Only UXO technicians will excavate or handle MEC. Personnel in the immediate vicinity of MEC operations will be kept to the minimum necessary for safe operations but no less than two UXO technicians. Do not subject MEC to heat, shock, or friction. Only hand excavation permitted when within one feet of MEC. Use magnetometers frequently to pinpoint the location of MEC. | L |
| | Non-UXO personnel. | Establish minimum separation distance (MSD) and Public Access Exclusion Distance (PAED) based on the Hazardous Fragmentation Distance of the MGFD and maintain site control. Stop all MEC operations when non-UXO personnel are within the MSD/PAED arc. | L |
| | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | L |
| | Insect bites/West Nile Virus. | Wear personal protective equipment and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon or equivalent and clothing insecticide preparations containing permethrins (Repel Permanone or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms. | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls when necessary to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where body position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy. | L |

| Job Steps | Hazards | Controls | RAC |
|---|------------------------------|--|------------|
| MEC/MPPEH Handling and Certification (continued). | Severe weather. | The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). Follow procedures outlined in the APP. | L |
| | Adjacent Test Areas | Coordinate with OB/OD for site entry since RSA-014S is adjacent. | L |
| | Heat stress and cold stress. | Follow procedures outlined in the APP/ Site Safety and Health Plan. | L |
| | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 10 pound A:B:C fire extinguisher shall be available when refueling. | L |
| | MEC/MPPEH explosive hazard | A SUXOS and UXOSO shall inspect all MEC/MPPEH for potential explosive hazard. Fuze, cavities and components if present shall be thoroughly inspected and certified MDAS. Prior to disposal a third verification shall be performed by UXOQC. | L |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|--|---|---|
| Personal Protective Equipment - Level D: Hard Hat Safety Glasses Safety-Toed Boots Work Gloves ANSI Class 2 reflective warning vests Equipment: Roll-off box (lockable) Backhoe or mini excavator Fire Extinguishers Emergency Eyewash First Aid Kit Communication devices Deep-Woods Off or Ultrathon Repel Permanone Drinking water Weather radio or weather APP | Training Requirements: Site safety orientation UXO Technicians must be qualified IAW DDESB TP 18 HAZWOPER 40-Hour MEC Awareness Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety Procedures | Daily site safety inspection (UXOSO) – TBD Daily site safety inspection (SUXOS) – Instrument function checks in accordance with SOPs Housekeeping (daily) Fire extinguisher (monthly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms |

Activity Hazard Analysis (AHA)

| | | | | | | |
|--|--|---|----------|------------|--------------------------------|------------|
| Activity/Work Task: Vehicle Operations | Overall Risk Assessment Code (RAC) (Use highest code) | M | | | | |
| Project Location: RSA-014 Redstone Arsenal Huntsville AL | Risk Assessment Code (RAC) Matrix | | | | | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability | | | | |
| Date Prepared: 06/25/20, Revised 02/03/21 | | Frequent | Likely | Occasional | Seldom | Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E | E | H | H | M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E | H | H | M | L |
| | Marginal | H | M | M | L | L |
| | Negligible | M | L | L | L | L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Step 1: Review each "Hazard" with identified safety "Controls" and determine RAC (See above) | | | | | |
| | "Probability" is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | | | | RAC Chart | |
| | "Severity" is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | | | | E = Extremely High Risk | |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of AHA. | | | | H = High Risk | |
| | | | | | M = Moderate Risk | |
| | | | | | L = Low Risk | |
| Job Steps | Hazards | Controls | | | EM 385-1-1 | RAC |
| Project vehicle use. | Operation of motor vehicles and trucks-General. | All company owned, leased, or rented vehicle operations shall comply with the requirements of AMS-710-02-PR-02700, <i>Non-Commercial Motor Vehicle Safety</i> , and AMS-710-02-PR-05700 <i>Mechanized and Marine Equipment</i> . All company owned, leased, or rented commercial vehicle operations shall comply with the requirements of AMS-710-02-PR-03900, <i>Commercial Motor Vehicle Safety</i> . Subcontractors operating motor vehicles shall comply with all federal, state, and local traffic regulations. Subcontractors shall only use vehicles that are in good condition and safe to operate. All personnel shall drive defensively and wear seat belts while vehicles are in motion. | | | 18.A.01 18.A.02 18.A.03 | M |
| | Operation of motor vehicles and trucks-Accidents | In the event of an accident: Stop; call for medical assistance; notify police; complete Vehicle Accident Report and submit to your supervisor. If an APTIM employee is injured, the medical forms per Section 8.0 of the Installation-Wide APP (CEHNC, 2019). Attachment 3, must completed at the health clinic or Emergency Room. Refer to "Aptim Federal Services, LLC Incident Notification, Reporting, and Management Procedure" summary in Attachment 3 of the Site Safety and Health Plan (SSHP). | | | 18.C.02 18.C.03 | |
| | | | | | 01.D.01 | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|----------------------------------|--|---|---|-----|
| Project vehicle use (continued). | Operation of motor vehicles and trucks-Backing | <p>Back into parking spaces upon arrival, whenever possible.</p> <p>When preparing to move or back vehicles at the project site, walk around the vehicle before backing to identify any new conditions or obstructions.</p> <p>Use a spotter when backing whenever possible, and sound horn prior to backing.</p> <p>Determine and agree upon hand signals (between spotter and driver) before attempting to back vehicle.</p> <p>Check the rear-view and side mirrors prior to backing (Note: All vehicles, other than automobiles, must have small convex mirrors attached to the side mirrors.)</p> <p>Back slowly in areas of obstructed vision.</p> <p>Anticipate others who may be backing out into your pathway and adjust accordingly.</p> | <p>18.C.14 08.B.04</p> <p>08.B.06</p> | L |
| | Operation of motor vehicles and trucks - Unfamiliar with the vehicle | <p>Familiarize yourself with the vehicle before moving.</p> <p>Review the dashboard controls, steering radius, overhead, and side clearances. Locate windshield wipers and lights.</p> <p>Properly adjust mirrors and seat.</p> | | M |
| | Operation of motor vehicles and trucks-Speed | <p>Obey all posted speed limits.</p> <p>Radar detectors are prohibited in all company owned, leased, or rented vehicles.</p> <p>Reduce travel speed during hazardous conditions (i.e., rain, fog, snow).</p> | <p>08.B.06</p> <p>18.C.04 18.C.05</p> | M |
| | Operation of motor vehicles and trucks-Spacing/Distance | <p>Identify if your vehicle has Anti-Lock Brakes.</p> <p>Follow the 3-second rule. Increase the 3-second rule as necessary during hazardous travel conditions.</p> <p>Always "leave yourself an out" during travel – this applies to stoplights as well.</p> <p>When stopping, make sure that you leave enough distance between you and the car in front of you (you should be able to see the rear tires of the vehicle in front, when stopped).</p> <p>When at a red light, and it turns green, use the "delayed start" technique, by counting to three before you take your foot off the brake.</p> <p>DO NOT TAILGATE!</p> <p>Allow extra spacing and braking time for trucks and vehicles towing trailers. Trailers shall be equipped with brakes</p> | | M |
| | Operation of motor vehicles and trucks-Skids | <p>If the vehicle has begun to skid out of control, turn the steering wheel in the direction of the skid and re-adjust the wheel, as necessary.</p> <p>Slow travel speeds during hazardous travel conditions.</p> <p>Use 4-wheel drive, if available, when driving vehicles off road, on steep inclines, muddy conditions, etc.</p> <p>Do not take vehicles "off road" if they cannot be operated safely.</p> | 18.C.05 | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|----------------------------------|--|--|--------------------|------------|
| Project vehicle use (continued). | Operation of motor vehicles and trucks-Blind Spots | Become familiar with any blind spots associated with your vehicle. Adjust mirrors properly. Make sure you use your directional signals. Always look over your shoulder to assure the lane is clear when changing lanes. | | M |
| | Operation of motor vehicles and trucks-Cellular phones | Exercise caution when approaching other driver's blind spots. Do not use handheld cellular phones while driving. Pull over to the side of the road when making a call. | 18.C.01 | M |
| | Operation of motor vehicles and trucks-Equipment Failure | Perform daily inspections of your vehicle. Any vehicle with mechanical problems that may endanger the safety of the driver, passengers, or the public shall not be used. | 18.A.03 18.A.04 | M |
| | Operation of motor vehicles and trucks-Safety Equipment | Ensure safety equipment is in the vehicle. Safety equipment should include a spare tire, jack, first-aid kit, fire extinguisher, and flashlight. Flares and/or reflective triangles shall be available in larger trucks. Verify that the proper documentation is in the vehicle - documentation includes an operations manual for the vehicle, insurance card, vehicle registration, and APTIM Incident forms. | 18.A.03 | M |
| | Operation of motor vehicles and trucks- Influenced by drug and alcohol | Never drive under the influence of drugs or alcohol. Disciplinary action, including termination, will be taken against anyone who is convicted of or who pleads no-contest to the charges of driving under the influence in accordance with AMS. Project-assigned hourly employees are not permitted to operate company owned, leased, or rented vehicles after 10:00 p.m. without written authorization from their supervisor. | 01.C.02 | M |
| | Operation of motor vehicles and trucks-Driver Attitude/Fatigue | Do not operate any vehicle when abnormally tired, temporarily disabled, or under the influence of drugs or alcohol. Keep an even temper when driving. Do not let the actions of others affect your attitude. Avoid "highway-hypnosis" and "falling asleep at the wheel." Take plenty of breaks when driving long distances. Rotate driving responsibility with your partner. No employee is authorized to operate a company vehicle (including rentals) after having been on-duty for a period of 12-hours. No employee may drive for more than 10-hours in a single on-duty period. | 01.C.04 | M |
| | Operation of motor vehicles and trucks-Vehicle Loading | DO NOT OVERLOAD the vehicle. Secure all equipment within the body of the vehicle. Do not block side view mirrors with load. Do not transport Department of Transportation manifested hazardous materials without a commercial driver's license. Dispatch all equipment and personnel with proper forms and identification. | 18.C.13 18.C.16 | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel Name(s) | Inspection Requirements |
|---|--|--|
| Personal Protective Equipment – N/A: Equipment: Seatbelt Spare tire and jack First aid kit Fire extinguisher Flashlight Operations manual for the vehicle Insurance card Vehicle registration Accident report forms | Training Requirements: Site safety orientation Licensed vehicle operators Defensive driving (all APTIM personnel) | Daily site safety inspection (QCSM) – Brian Rhodes Daily site safety inspection (QCSM) – Vehicle inspections (daily) Vehicle inspections (prior to trips greater than 50 miles for APTIM provided vehicles) |

Activity Hazard Analysis (AHA)

| | | |
|--|---|--|
| Activity/Work Task: Site Restoration | Overall Risk Assessment Code (RAC) (Use highest code) | M |
| Project Location: RSA-014 Redstone Arsenal, Huntsville AL | Risk Assessment Code (RAC) Matrix | |
| Contract Number: W912DY-17-D-0003 | Severity | Probability |
| Date Prepared: 06/25/20, Revised 02/03/21 | | Frequent Likely Occasional Seldom Unlikely |
| Prepared by (Name/Title): Dennis Seymore, Scientist | Catastrophic | E E H H M |
| Reviewed by: Doug Russell/HSE Manager | Critical | E H H M L |
| | Marginal | H M M L L |
| Notes: (Field Notes, Review Comments, etc.) This AHA serves as the hazard assessment | Step 1: Review each “ Hazard ” with identified safety “ Controls ” and determine RAC (See above) | |
| | “ Probability ” is the likelihood to cause an incident, near miss, or accident and identified as: Frequent, Likely, Occasional, Seldom, or Unlikely. | RAC Chart |
| | “ Severity ” is the outcome/degree if an incident, near miss, or accident did occur and identified as: Catastrophic, Critical, Marginal, or Negligible | E = Extremely High Risk |
| | Step 2: Identify the RAC (Probability/Severity) as E, H, M, or L for each “Hazard” on AHA. Annotate the overall highest RAC at the top of AHA. | H = High Risk |
| | | M = Moderate Risk |
| | | L = Low Risk |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|-----------------------------------|---|--|--------------------------|----------|
| Arrival of new personnel at site. | Unfamiliarity with: site, general site hazards, project safety rules, chain of command, and emergency procedures. | All personnel shall attend the site orientation training. | 01.B.03 01.E.01 28 | M |
| Restore site. | Poor planning. | Complete Job Safety Analysis for each task. Use Hazard Assessment Resolution Program frequently – for each task to be completed. | | M |
| | Heavy lifting, strains, and sprains. | No individual employee is permitted to lift any object that weighs over 50 pounds. Proper lifting techniques shall be used. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 50-pound limit. | 14.A.01 | M |
| | Intrusive activities and underground utilities. | Follow procedure for Utility Contact Prevention in Accident Prevention Plan (APP) prior to commencing excavation activities. Utilities shall be located and marked prior to commencing intrusive activities. The Alabama One Call Law must be followed. Contact Digger’s Hotline of Alabama at least 10 days but not less than prior 48 hour to commencing intrusive activities off base, excluding weekends or any state or federal holidays. Retain a copy of mark-out ticket for documentation purposes and QC purposes. On base utilities shall be cleared by the RSA Public Works Department. | 25.A.01 | M |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------|-----------------------------|---|------------|----------|
| Restore site (continued). | | <p>Follow requirements of AMS-710-02-PR-01600, <i>Excavation and Trenching</i>, and AMS-710-02-PR-01610, <i>Utility Contact Prevention</i>.</p> <p>Evaluate the work areas, ground conditions, and travel paths to identify any sensitive underground structures, unstable areas, dangerous slopes, and existing open excavations.</p> <p>Use manual excavation within 3 feet of known utilities. Once the line or cable is exposed, heavy equipment can be used but must remain at least 3 feet from the exposed line or cable.</p> <p>Each work crew member shall be trained in electrocution hazards, explosion/fire hazards, and emergency procedures associated with contacting energized power lines and pipelines.</p> <p>Immediately contact utility one-call service (811) if an underground utility is damaged, dislocated, or disturbed.</p> | | |
| | Overhead hazards/utilities. | <p>Before equipment is moved, the travel route shall be surveyed for overhead and terrain hazards. The minimum distances from electrical lines must be observed in accordance with EM-385-1-1 Table 11-1.</p> <p>Power lines shall be assumed to be energized unless verified to be de-energized and visibly grounded. Operation beneath a power line that has not been verified as de-energized and grounded must maintain clearance distances stated above. A high-visibility elevated warning line or barricade shall be erected at the minimum approach distance.</p> <p>Each work crew member shall be trained in the electrocution hazards and emergency procedures associated with energized power lines.</p> <p>RSA public works personnel who may be required to deenergize overhead electric lines shall follow NFPA 70E requirements and be familiar with arc flash protection requirements.</p> | 11.F.04 | M |
| | Slips, trips, and falls. | Keep work areas clear and maintain housekeeping. Personnel shall not jump from elevated surfaces. Personnel shall use caution when walking on rocky, slippery, or uneven terrain. | 14.C.01-10 | M |
| | Hand injuries. | Items to be handled shall be inspected for sharp edges prior to being handled. Personnel shall wear leather gloves when handling sharp materials. Personnel shall be aware of and avoid pinch point hazards. | 05.A.08 | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------|------------------------------------|---|------------------------------|-----|
| Restore site (continued). | Use of heavy equipment. | Only qualified personnel shall be permitted to operate equipment. Heavy equipment shall be inspected daily after the initial U.S. Army Corps of Engineers inspection (and documented). Do not use unsafe equipment. All equipment shall have backing alarms. All equipment shall be operated at safe speeds and in a safe manner. Equipment operators shall wear safety belts. Personnel are only permitted to approach equipment after a signal from the operator. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not enter the swing radius of equipment. Ground personnel shall not position themselves between equipment and stationary objects. Personnel shall verify all mechanical guards are in place and functioning properly. Moving equipment shall be equipped with a back-up alarm. All equipment shall be shut down with energies dissipated prior to performing maintenance activities - lock out/tag out procedures may apply. Only qualified mechanics shall work on or repair heavy equipment. | 18.A 18.G 18.B 05.F | M |
| | Insect bites/West Nile Virus. | Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide, such as, 3M Ultrathon™ or equivalent and clothing insecticide preparations containing permethrins (Repel® Permanone® or equivalent) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify Site Safety and Health Officer (SSHO) of flu-like symptoms. | 06.D.01 | L |
| | Contact dermatitis and poison ivy. | Check around work areas to identify if poison ivy is present. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Learn to identify poisonous plants. Remove clothing or Tyvek® coveralls by inside-out method to avoid contact with potentially contaminated outer surfaces. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where sampling position raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to contract poison ivy. | 06.D.03 | L |
| | Severe weather. | Follow procedures outlined in the SSHP. | 06.I | L |
| | Hazardous atmospheres. | Personnel shall immediately notify the SSHO if odors are detected. | | L |
| | Heat stress and cold stress. | Follow procedures outlined in the SSHP. Use ACGIH guidelines for WBGT monitoring and TLVs. | 06.I | M |
| | Dust. | Dust shall be monitored and controlled. Respiratory protection may be required if dust cannot be adequately controlled. | | L |

| Job Steps | Hazards | Controls | EM 385-1-1 | RAC |
|---------------------------|------------------------|--|-------------------------------|------------|
| Restore site (continued). | Fire. | Smoking shall be permitted in designated areas. Vehicles shall not be parked in tall dry grass. Engines shall be shut off before refueling. A 40-B:C fire extinguisher shall be available when refueling. Site personnel shall complete annual fire extinguisher training. Smoking shall not be permitted near fueling areas. Gasoline shall be stored in safety cans with flash arrestors and spring-loaded vents. | 09.E.01 09.A.06 09.B.08 | L |
| | Dump truck operations. | Dump trucks shall be inspected and found to be in safe condition prior to being placed in service at site. Overhead hazards shall be re-evaluated prior to allowing dump trucks onto the project site. Areas with overhead hazards shall be barricaded with caution tape to prevent dump bed from contacting. In areas where it is not feasible to use barricades, then spotters shall be provided: however, the minimum distances from electrical lines must be observed (see SSHP). Operators shall wear seat belts while trucks are in motion at the project site. Spotters shall assist trucks when backing is necessary. Trucks shall be equipped with audible backup alarms. Cab shall be equipped with elevated bed indicator. Material shall not be loaded over cab of trucks. Personnel shall stay away from trucks when being loaded. Tires shall be inspected for accumulation of debris and cleaned as needed to avoid tracking on roadways. | 18.A.03 18.G.26 11.F | M |
| | Use of fertilizers. | The material safety data sheet for fertilizers shall be read and understood. Personnel shall avoid contact with fertilizer. | 06.B.01 | L |
| | Electrocution. | Only qualified electricians shall perform electrical disconnection activities. | 11.A | M |

| Equipment to be Used | Training Requirements/Competent or Qualified Personnel name(s) | Inspection Requirements |
|---|---|--|
| <p>Personal Protective Equipment - Level D:</p> <p>Hard hat Safety glasses Safety-toed boots Work gloves ANSI Class 2 reflective warning vests</p> <p>Equipment:</p> <p>Fire extinguishers Emergency eyewash First aid kit Deep-Woods Off or Ultrathon™ Repel® Permanone® Drinking water Weather radio or AM/FM radio</p> | <p>Competent Person (CP) / Qualified Person (QP):</p> <p>Brian Rhodes – CP/SSHO Brian Rhodes – CP/First Aid and CPR</p> <p>Training Requirements:</p> <p>Site safety orientation Applicable AHAs HAZWOPER 40-Hour Qualified equipment operators Lifting/back safety Fire extinguisher use Emergency procedures Biological hazard identification and control Tornado shelter locations National Lightning Safety Institute Lightning Safety procedures</p> | <p>Daily site safety inspection (SSHO) – Brian Rhodes Daily site safety inspection (UXOSO) – TBD</p> <p>Check Known Allergies Questionnaire, training, and medical certifications against personnel roster Mechanized equipment (U.S. Army Corps of Engineers form prior to use) Mechanized equipment (daily) Overhead and underground utilities Housekeeping (daily) Fire extinguisher (weekly) Vehicle inspection daily Equipment and tools inspection daily and before use Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available</p> |

Activity Hazard Analysis (AHA)

| | | | | | | |
|--|--|----------|--------|-----------------|--------|---------------------------------|
| Contractor Name (Performing the Work): APTIM | Overall Risk Assessment Code (RAC) (Use highest code) | | | | | L |
| Foreman Signature (Performing the Work): | | | | | | |
| AHA Prepared By (Name/Title): Pamela Moore/HSE Manager | | | | | | |
| Activity/Work Task: COVID-19 JOB SITE PRACTICES | Risk Assessment Code (RAC) Matrix | | | | | |
| AHA Signature Log #: | Probability | | | | | |
| Contract Number: W912DY-17-D-0003 | Severity | Frequent | Likely | Occasional | Seldom | Unlikely |
| Date Prepared: May 8, 2020 | Catastrophic | E | E | H | H | M |
| Project Location: Redstone Arsenal, Madison County, Alabama | Critical | E | H | H | M | L |
| PRIME CONTRACTOR SECTION: REVIEWED BY: SIGNATURE REQUIRED | Marginal | H | M | M | L | L |
| SSHO Signature: | Negligible | M | L | L | L | L |
| QC Manager Signature: | Step 1: Review each Hazard with identified "Controls". Determine RAC (see above). | | | | | |
| Prime Superintendent Signature: | | | | | | RAC CHART |
| Notes: | Probability: Likelihood the activity will cause a Mishap (Near Miss, Incident, or Accident). Identify as Frequent, Likely, Occasional, Seldom or Unlikely Identify as Catastrophic, Critical, Marginal, or Negligible | | | | | E -- Extremely High Risk |
| | | | | | | H -- High Risk |
| | Step 2: Identify the RAC (probability vs. severity) as E, H, M, or L for each "Hazard" on AHA. Annotate the overall highest RAC at the top of the AHA | | | | | M = Moderate Risk |
| | | | | | | L = Low Risk |
| Job Steps (Work Sequences) | Specific Anticipated Hazards | | | Controls | | RAC |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|-----------------------------|--|--|-----|
| Management Responsibilities | Lack of planning contributing to increased risk of Infection | <ul style="list-style-type: none"> - Management shall follow guidance in the APTIM project specific COVID-19 Virus Control Plan. - Management shall continually check the APTNet Corona Virus Webpage for the latest CDC's Interim Guidance and update recommendations and make adjustments to the AHA, as appropriate. - Management shall designate a representative to monitor for signs of illness in the workplace, and if someone is showing symptoms, management shall ask them to leave. - Management shall designate a representative to take employees' temperatures with a digital forehead thermometer that is disinfected appropriately between applications. This should be done PRIOR TO any individual entering the job site. Individuals' temperatures should also be taken when leaving or at the end of their shift. Management shall keep records of the temperatures taken. <p>Note that some people with COVID-19 may not have a fever, so this should not be the only means of detection.</p> <ul style="list-style-type: none"> - Management shall separate sick employees immediately. CDC recommends that employees who appear to have acute respiratory illness symptoms (i.e. cough, shortness of breath) upon arrival to work or become sick during the day should be separated from other employees and be sent home immediately. Individuals that have been asked to leave should NOT be allowed to enter any occupied area at any time prior to leaving. | L |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|--|---|---|----------|
| <p>Management Responsibilities (continued)</p> | <p>Lack of planning contributing to increased risk of infection</p> | <ul style="list-style-type: none"> - Management shall provide tissues and encourage employees to cover their noses and mouths with a tissue (or elbow or shoulder if a tissue is not available) when coughing or sneezing. - Management shall provide disposable hand towels and no-touch trash receptacles. - Limit the exchange/sharing of paper documents by encouraging use of electronic communication whenever possible. - Do not allow sharing of tools or any multi-user devices and accessories such as iPads, laptops, hand-held radios, computer stations, etc. - Provide soap and water and hand sanitizer with alcohol content between 60% and 90% in the workplace. Ensure that adequate supplies are maintained. Place hand sanitizers in multiple locations on the job site, in the office, in or around portable toilets, or in conference rooms to encourage hand hygiene. - Provide disposable gloves where appropriate; instruct workers to wash hands after removing gloves. - Communicate key CDC recommendations (and post signage where appropriate) to your staff and tradespeople: <ol style="list-style-type: none"> 1. How to Protect Yourself 2. If You are Sick 3. COVID-19 Frequently Asked Questions 4. Place posters that encourage staying home when sick, cough and sneeze etiquette, and hand hygiene at the entrance to your workplace and in other workplace areas where they are likely to be seen. - Management shall communicate with Human Resources for practices for managing sick time related to COVID-19. | <p>L</p> |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|-------------------------------|---------------------------------------|---|-----|
| Restricting Job Site Visitors | Possible Exposure by Unvetted Visitor | <ul style="list-style-type: none"> - Restrict the number of visitors to the job site, including the trailer or office. - All visitors should be screened in advance. If the visitor can answer "yes" to any of the following questions (without identifying which question applies), the visitor will not be permitted to access the facility. The questions are: <ul style="list-style-type: none"> o Have you been asked to self-quarantine since December 2019? o Have you been in close contact with any person(s) who has been asked to self-quarantine since December 2019? o Have you experienced a recent onset of any illness-related symptoms, such as fever, cough, or shortness of breath? o Have you traveled outside of North America in the past 14 days? o Have you been in close contact with any person(s) who have traveled outside of North America in the last 14 days? o Have you been in close contact with any person(s) who has been diagnosed with COVID-19? | L |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|---|--|--|-----|
| Workers Entering Occupied Job-Site Trailers | Exposing Others or Being Exposed to COVID-19 | <p>Many contractors and service technicians may perform construction and maintenance activities within occupied job-site trailers. These work locations present their own unique hazards with regards to COVID-19 exposures. Electricians, and heating, ventilation, and air conditioning (HVAC) technicians are examples of these types of workers. All such workers should evaluate the specific hazards when determining best practices related to COVID-19.</p> <ul style="list-style-type: none"> - Require the customer to clean and sanitize the work area prior to the workers' arrival on site. - Technicians should sanitize the work areas themselves upon arrival, throughout the workday, and immediately before departure. <p>Refer to CDC guideline: Clean & Disinfect.</p> <ul style="list-style-type: none"> - Require customers to keep household pets away from work area. - Ask that occupants keep a personal distance of 6 feet at minimum. - Do not accept payments on site (no cash or checks exchanged). Require electronic payments over the phone or online. - Workers should wash hands immediately before starting and after completing the work. <p>Refer to CDC guideline: When and How to Wash Your Hands.</p> | L |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|---|---|--|-----|
| Additional PPE Recommendations for COVID-19 | Lack of Protection from COVID-19 Exposure | <ul style="list-style-type: none"> - Gloves should be worn when practical while on site and during routine cleaning/disinfecting and/or while providing care to someone who is sick. If gloves are not typically required for the task, then a nitrile glove may be used as practical. - Remember: The type of glove worn should be appropriate to the task. - Eye protection should be worn all times while on site, or as practical. - Follow local jurisdiction (County and/or State) and federal guidance (CDC) for wearing face masks. <p>APTIM will continue to provide and recommend employees to wear face masks.</p> <ul style="list-style-type: none"> - Do not share personal protection equipment (PPE). - Utilize disposable gloves where appropriate; instruct workers to wash hands after removing gloves. - Ensure used PPE is disposed of properly. - Sanitize reusable PPE per manufacturer's recommendation prior to each use. | L |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|--|--|---|-----|
| Social Distancing on the Job Site or in the Office | Transmission of COVID-19 by Close Proximity | <ul style="list-style-type: none"> - Discourage hand-shaking and other contact greetings. - To limit the number of people on a job site, allow non-essential personnel to work from home when possible. - Keep a minimum of a 6 foot distance between individuals when possible. - Do not host large group meetings. CDC recommends that we avoid gatherings of 10+ people. Conduct meetings on-line or via conference call. - Do no stack trades on each other. - Do not share tools. Tools must be disinfected after each employee use. - If shuttling employees, ensure proper distancing. Encourage employees to provide their own transportation, when possible. - Employees should NEVER share personal protection equipment (PPE). - Do not use a common water cooler. Provide individual water bottles or instruct employees to bring their own. - Do not congregate in lunch areas. - Take breaks and lunch in shifts to reduce the size of the group in the break area at any one time to less than 10 people. - No communal food shall be permitted on the job site until further notice, i.e., donuts, pizza, buffets, etc. | L |
| Proper Hand Washing | <p>COVID-19 Spreads by improperly washed/unwashed hands</p> <p>Touching Face with contaminated hands</p> | <ul style="list-style-type: none"> - All job sites should have hand washing stations readily available to all workers on the project and should be well stocked and maintained. - Hand washing stations should be cleaned and sanitized regularly. - All workers should wash hands frequently and thoroughly using soap and water for at least 20 seconds, especially before and after eating, smoking, or drinking, and after blowing your nose, coughing, or sneezing. - Refer to the CDC guideline; "When and How to Wash Your Hands." - Do not touch your face, eyes, mouth, nose, or ears. | L |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|---|---|--|----------|
| <p>Routine Environmental Cleaning of Jobsite / Office</p> | <p>Virus transmitted on contaminated surfaces</p> | <ul style="list-style-type: none"> - Routine cleaning shall be performed on all frequently touched surfaces on the job site. This includes, however is not limited to, workstations, countertops, handles, doorknobs, gang boxes, shared tools and equipment. - The use of appropriate cleaning agents and directions shall be utilized to perform all cleaning. Ensure all exposed workers are trained on the hazards of the cleaning chemicals used in the workplace in accordance with OSHA Hazard Communication standard. Employers must comply with OSHA Bloodborne Pathogen standards, including the proper disposal of regulated waste and PPE. - Any trash from offices or job site should be emptied frequently by someone wearing gloves. <p>After changing the trash, the employee should throw the gloves away and wash their hands.</p> <ul style="list-style-type: none"> - Disinfectant spray will be provided for portable bathrooms and is to be used to disinfect common contact surfaces before and after each use. During summer months, the portable bathrooms shall be serviced by the supplier company twice per week. <ul style="list-style-type: none"> - All common break areas, lunch and break rooms will be cleaned once per workday. - Employees performing cleaning will be issued proper PPE, such as nitrile gloves and eye or face protection as needed. | <p>L</p> |

| Job Steps (Work Sequences) | Specific Anticipated Hazards | Controls | RAC |
|----------------------------|---------------------------------|---|-----|
| Managing Sick Employees | Sick Employees Infecting Others | <ul style="list-style-type: none"> - Management shall actively encourage sick employees to stay home. - Employees who have symptoms of acute respiratory illness are recommended to stay home and not return to work until they are free of fever (100.4° F [38.0° C] or greater using an oral thermometer), signs of a fever, and any other symptoms for at least 24 hours, without the use of fever-reducing or other symptom-altering medicines (e.g. cough suppressants). - Separate sick employees. CDC recommends that employees who appear to have acute respiratory illness symptoms (i.e. cough, shortness of breath) upon arrival to work or become sick during the day should be separated from other employees and be sent home immediately. - If an employee is well but has a family member at home with COVID-19, they should notify their supervisor. Refer to CDC guidance for how to conduct a risk assessment. - If an employee is confirmed to have COVID-19, inform fellow employees of possible exposure to COVID-19 in the workplace, but maintain confidentiality as required by the Americans with Disabilities Act (ADA). Ask the affected employee to identify those other employees whom he/she came into contact with before the employee departs. Employees who worked in close proximity (3- to 6-feet) to a coworker with confirmed COVID-19 should also be sent home and referred to CDC guidance for how to conduct a risk assessment. - Communicate your company's Human Resources practices for managing sick time related to COVID-19. | L |

| Equipment to be Used | Training Requirements & Competent or Qualified Personnel Names | Inspection Requirements |
|--|---|--|
| Soap and Water (Any Kind/Brand) | Scrub surface diligently for at least 30 seconds. Interferes with fats in virus shell. | Rinse off with water. Properly discard of towels. |
| Bleach (Active ingredient - sodium hypochlorite) | Wipe over surfaces. Leave on surface for 10-15 minutes. Wipe with clean cloth. | Use as directed on bottle. Discard of towels properly. |
| Isopropyl Alcohol/Rubbing Alcohol (at least 70% denatured alcohol) | Clean surface with soap and water. Dry. Wipe Alcohol on. (do not dilute) Let evaporate. | Use and store per manufacturer's recommendations. Flammable. Use in well-ventilated areas. Poisonous. For topical use only. Do not ingest. |

ATTACHMENT 2

AMS HEALTH AND SAFETY PROCEDURES

AMS-710-02-PR-02700, Non-Commercial Motor Vehicle Safety
AMS-710-02-PR-05700, Mechanized and Marine Equipment
AMS-710-02-PR-03900, Commercial Motor Vehicle Safety
AMS-710-02-PR-01610, Utility Contact Prevention
AMS-710-02-PR-01500, Control of Hazardous Energy
AMS-710-01-PR-00300, Bloodborne Pathogens
AMS-710-05-PR-00400, Stop Work Authority
AMS-710-04-PR-00300, Hazardous Waste Operations
AMS-710-05-PR-01700, Work Area Hazard Assessment
AMS-710-02-PR-03000, Personal Protective Equipment
AMS-710-02-PR-03500, Respiratory Protection Program
AMS-710-02-PR-06400, Permit to Work
AMS-710-01-PR-05000, Medical Surveillance Program
AMS-710-01-PR-01000, Sanitation and Potable Water
AMS-710-02-PR-01600, Excavation and Trenching
AMS-710-01-FM-04201, COVID-19 Control Plan
AMS-710-01-PR-00400, Hazard Communication

PROCEDURE

Procedure Number:

AMS-710-02-PR-02700

Revision:

1

Procedure Owner:

HSE

Issuing Authority:

VP HSE & Security

Approval Date:

3/4/2019



NON-COMMERCIAL MOTOR VEHICLE SAFETY

| | | | |
|------------|--|-----------------|-------------|
| 1 | Clarification regarding the use of the point system for existing employees, sections 4.2.3, 4.2.5-4.2.7. | M. Hetzler | 3/4/2019 |
| 0 | Initial Issue | M. Hetzler | 2/22/2019 |
| Rev | Changes | Approved | Date |

Parent Document:

N/A

NON-COMMERCIAL MOTOR VEHICLE SAFETY

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for using non-commercial motor vehicles on APTIM sites and driving on company business. More stringent regulatory agency or client procedures may supersede these requirements. Each project is responsible for identifying the most stringent procedure and including those requirements in the site-specific safety plan. The most stringent of the requirements shall be adhered to.

The following deliverables are defined within this procedure:

| Deliverable | Producer | Customer |
|---|---|--|
| Vehicle Inspection Form AMS-710-02-FM-02701 | Driver | Site Files / Equipment Services Group |
| Motor Vehicle Procedure Acknowledgement Form AMS-710-02-FM-02702 | Driver / Supervisor | HR Personnel Files |
| Notice of Citation Form AMS-710-02-FM-02704 | Driver | HSE Rep and HR Personnel Files |
| Request for Check of Driving Record Form AMS-710-02-FM-02705 | Driver / Site Manager /HR Representative / Hiring Manager | Supervisor, HSE Rep, and MVR Coordinator |
| Training | Drivers | Site Files / Learning Management System |

2.0 SCOPE

This procedure addresses the operation of non-regulated over-the-road vehicles (e.g., cars, trucks, and vans with gross weight of 10,000 lbs or less) by Company authorized drivers. On-site mobile equipment, rough terrain vehicles, golf carts, and similar utility vehicles are not covered in this procedure.

This procedure applies to all APTIM employees, contractors, and subcontractors associated with an APTIM site who operate a motor vehicle on behalf of APTIM (e.g. company- owned, rented, or leased by APTIM or its clients – hereafter referred to as “company vehicle”). In addition, this procedure applies to the use of personal vehicles on company business.

The requirements for operating Commercial Motor Vehicles (i.e. those which typically require a Commercial Driver’s License and/or are regulated by DOT) can be found in the Commercial Motor Vehicle Safety Procedure (AMS-710-02-PR-03900).

- It should be noted that the requirements of AMS-710-02-PR-03900 apply to non-commercial vehicles when the combined Gross Vehicle Weight Rating (GVWR) or Gross Combination Weight Rating (GCWR) of the vehicle and its load/attachments exceed 10,000 pounds.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

- Any vehicle, no matter how small, hauling hazardous materials in quantities requiring placards is defined as a Commercial Motor Vehicle, and the driver requires a Commercial Driver's License with proper endorsements.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Human Resources
- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Equipment Services Group
- APTIM Contractors
- APTIM Subcontractors

4.0 PROCEDURE

- 4.1.1 All personnel who operate a company vehicle and those operating a personal vehicle for business purposes (all hereby referred to as "driver(s)") shall be familiar with this procedure and certify acceptance of the requirements by completing Motor Vehicle Procedure Acknowledgement Form (AMS-710-02-FM-02702).
- 4.1.2 Company vehicles are to be utilized exclusively for business purposes and occupied by authorized passengers as defined in this procedure.
- 4.1.3 Drivers shall have a valid driver's license for the area in which they are operating a vehicle. Any person with a suspended license is prohibited from driving any company vehicle.
- 4.1.4 Drivers shall comply with all local, state, and federal traffic regulations.
- 4.1.5 Drivers are personally responsible for any and all citations incurred by violating traffic regulations. Citations issued while driving a company vehicle or a personal vehicle while on company business shall be reported using the Notice of Citation Form (AMS-710-02-FM-02704).
- 4.1.6 Drivers shall be familiar with and abide by all laws and regulations applicable to the operation of their vehicle and should not drive motor vehicles in areas (i.e. other countries) where they are unsure of or inexperienced in local driving rules and regulations.
- 4.1.7 Drivers shall use cell phones/cellular devices in accordance with Cellular Device Use Procedure (AMS-710-02-PR-05600).

NON-COMMERCIAL MOTOR VEHICLE SAFETY

- 4.1.8 Drivers shall notify their supervisor immediately of any event that might alter their driver's license status, to include suspension or revocation of driver's license.
- 4.1.9 Where applicable, requests for reinstatement of denied or revoked driving privileges can be made to the appropriate SBU HSE Lead.
- 4.1.10 Smoking in company-owned, leased, or rented vehicles is prohibited.
- 4.1.11 No pets are allowed in company-owned, leased, or rented vehicles.
- 4.1.12 Failure to comply with this procedure may result in disciplinary action up to and including termination.

4.2 Driver Qualification and Status

- 4.2.1 New hire candidates (including non-APTIM personnel) may be subject to a Motor Vehicle Record background check (MVR), based on the position for which he/she is applying, prior to driving for APTIM business purposes.
- 4.2.2 The applicable hiring manager, HR Rep, or other APTIM personnel shall complete a Request for Check of Driving Record Form (AMS-710-02-FM-02705) and provide a copy to an MVR Coordinator.
 - 4.2.2.1 MVR Coordinators shall perform the following steps:
 - 4.2.2.2 Generate an MVR.
 - 4.2.2.3 Evaluate results and render a decision based on the Driving Record Point System shown in section 4.2.3.
 - 4.2.2.4 Communicate results back to the MVR requestor.
- 4.2.3 Drivers shall be evaluated in accordance with the Driving Record Point System shown in the table below.

| Description of Violation | Assigned Point Value |
|---|----------------------|
| Non-Moving: vehicular equipment deficiency, no seatbelt use, failure to secure load. | 1 |
| Moving: speeding (less than 15 miles per hour over limit, disobey traffic control signal, failure to signal, tailgating, use of cell phone while driving. | 2 |
| At-fault accident | 3 |

NON-COMMERCIAL MOTOR VEHICLE SAFETY

| | | |
|--|--------------------------|-----------------------|
| Major citations: speeding (15 mph or more over limit, reckless driving, suspended license for driving violation, speed contest, open alcohol container (Non-Work Related). | 6 | |
| Driving under the influence (Non-Work Related), Hit and run (leaving the scene of an accident), Refusal to submit to testing. | 8 | |
| Driving under the influence (DWI/DUI) Work Related, Work Related Open Alcohol Container | Ineligible / Termination | |
| | | |
| Driving Privilege Status Description | Past 12 Months | Past 24 Months |
| Can drive without restriction. | 0-3 points | 0-5 points |
| Can drive with understanding of probationary status. | 4-6 points | 6-8 points |
| Not eligible for company driving privileges for 12 months. | 7-11 points | 9-15 points |
| Not eligible for company driving privileges. | 12 points or more | 16 points or more |

4.2.4 Pre-Employment Driving Record Point System

4.2.4.1 If a new hire candidate has accumulated three points or less in the last 12 months or five points or less in the last 24 months per date of MVR, they shall be given the privilege to drive motor vehicles on company business without restrictions.

4.2.4.2 If a new hire has accumulated four to six points in the last 12 months or six to eight points in the last 24 months, they shall be placed on probation for a period of 12 months. They shall be afforded the privilege to drive motor vehicles on company business during this probationary period. Any driving infractions (e.g., speeding tickets, at-fault accidents, and any other citations) accumulated during this probationary period shall result in termination of the privilege to drive a motor vehicle on company business.

4.2.4.3 If the new hire candidate has accumulated seven to eleven points in the last 12 months or nine to fifteen points in the last 24 months, they shall not be eligible for company driving privileges. Employment can only be offered with the strict understanding of denial of the privilege to drive motor vehicles on company business. After the first 12 months of employment, the employee can petition the appropriate SBU President and SBU HSE Lead for reconsideration of driving privileges. An MVR will be generated at this time.

4.2.4.4 If a new hire candidate is expected to drive a vehicle to fulfill the responsibilities of his/her role and there has been an accumulation of twelve points or more in the last 12 months or sixteen points or more in the last 24 months, the candidate shall not be hired.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

4.2.5 Existing Drivers

4.2.5.1 Requiring drivers to maintain an acceptable driving record is a risk mitigation measure utilized by the company for continued driving privileges. Accordingly, each affected driver's MVR traffic record may be subject to periodic review to ensure compliance with state and federal regulations, as well as company policy.

4.2.5.2 The applicable APTIM Manager/Supervisor or HSE Representative may initiate the MVR process by completing a Request for Check of Driving Record Form (AMS-710-02-FM-02705) and submitting the form to the HSE Representative.

4.2.5.3 Drivers shall provide verbal and written notice to their supervisor of traffic or vehicular citations in accordance with 4.2.6 - 4.2.7.

4.2.6 Work Related Traffic Violations

4.2.6.1 Drivers shall provide verbal and written notice to their supervisor of citations involving company vehicles within 24 hours of the event. This applies to citations occurring during business hours and non-business hours.

4.2.6.2 This verbal notice shall be followed by the driver completing a Notice of Citation Form (AMS-710-02-FM-02704), which shall be forwarded to the respective SBU HSE Lead or designee.

4.2.7 Non-Work Related Traffic Violations

4.2.7.1 It is not necessary for drivers to report non-work related citations to their supervisor as they occur, with the exception of Driving Under the Influence (DWI/DUI).

4.2.7.2 However, drivers have the responsibility to keep track of their non-work related vehicular citations and utilize established evaluation criteria, as described in the table shown in section 4.2.3, to determine if their overall traffic citations exceed acceptable company limits.

4.2.7.3 Additionally, if a driver's overall MVR record (work related or not) exceeds the company's established points system criteria, the driver shall verbally inform their supervisor as soon as practical, but no longer than the following business day after the occurrence.

4.2.7.4 Continued employment may only be extended with the strict understanding of denial/revocation of the privilege to drive company vehicles, or personal vehicles on company business. After the first 12 months following driving privilege revocation, the driver can petition their respective SBU President and SBU HSE Lead for reconsideration of driving privileges.

4.2.8 Drivers assigned a company vehicle are responsible to ensure that other drivers are qualified in accordance with this procedure before operating the vehicle. Failure to do so may result in disciplinary action up to and including termination.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

4.3 Incident Reporting

- 4.3.1 Drivers shall report all vehicle citations and incidents while driving a company vehicle or personal vehicle incurred while on company business to their supervisor, or responsible APTIM personnel, as soon as possible, but not later than 24 hours after the occurrence.
- 4.3.2 Incidents involving company vehicles or personal vehicles being used for business purposes shall be reported in accordance with the Incident Reporting Procedure (AMS-710-05-PR-02300).

4.4 Use of Personal Vehicles for Business Purposes

- 4.4.1 Personal vehicles shall only be used for company business on APTIM sites if approved by the Site Manager or his designee.
- 4.4.2 Drivers using personal vehicles for Company business, other than on project sites, shall not be reimbursed for any damage sustained by or to their vehicle. The Company also assumes no liability for any incident while operating personal vehicles.
- 4.4.3 Drivers using personal vehicles on Company business shall maintain liability coverage that meets or exceeds statutory minimum limits. Drivers are recommended to maintain the following limits: \$100,000 per person, \$300,000 per occurrence, and \$25,000 property damage.

4.5 Vehicle Inspection & Maintenance

- 4.5.1 All drivers shall perform a visual 360 degree walk around prior to each use.
- 4.5.2 All company vehicles shall be inspected, at a minimum, on a weekly basis by using the Vehicle Inspection Form (AMS-710-02-FM-02701). Completed Inspection forms shall be sent to the Equipment Services Group.
- 4.5.3 Drivers that have been assigned a company vehicle shall ensure that the vehicle is maintained in accordance with manufacturer specifications. The Driver Responsibility sheet in each vehicle outlines the services to be rendered at prescribed mileage intervals.
- 4.5.4 Drivers using a personal vehicle are responsible to ensure that the vehicle is maintained in accordance with manufacturer specifications and applicable federal, state, and local requirements.

4.6 Impaired Driving

- 4.6.1 Personnel shall not operate a vehicle for company business when mental or physical impairment might interfere with their ability to operate the vehicle in a safe manner.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

- 4.6.2 Personnel shall not operate a vehicle for company business while impaired, intoxicated or under the influence of alcohol or illegal drugs as outlined in the Substance Abuse Program Procedure (AMS-710-01-PR-03600).
- 4.6.3 Personnel shall not operate a vehicle for company business while under the influence of medication that may interfere with motor vehicle operation.
- 4.6.4 Personnel shall not operate a vehicle for company business when under conditions of extreme stress, fatigue, or any other physical or mental impairment that may hinder safe vehicle operation.
- 4.7 Driver Safety Notification Sticker**
- 4.7.1 A safety notification bumper sticker shall be applied to all US/Canada based company vehicles in an effort to ensure continued compliance with driving safety regulations.
- 4.7.2 The notification service shall be managed by a third party fleet safety management company and shall serve as the recipient of all calls that are placed concerning unsafe driving behavior. The Equipment Services Group shall serve as the first point of contact as it pertains to notifications that are received from the third party company who administers the bumper sticker safety call in service.
- 4.7.3 Upon receiving a report from the third party administrator, the Equipment Services Group shall contact the respective SBU HSE Lead or designee. The SBU HSE Lead or designee shall then contact the affected driver's supervisor concerning the complaint and provide an Employee Counselling Record (AMS-710-05-FM-00201), where applicable. All third party reports should be closed out by the driver's supervisor as instructed on the report.
- 4.7.4 Upon verification that the report was made in error or the caller statement was verified to be unsubstantiated, the SBU HSE Lead or designee should request the report be removed from the system. Reports can only be removed from the system with final authorization from the SBU HSE Lead or designee.
- 4.7.5 Deemed the primary/responsible operator of the vehicle, it is the responsibility of the driver to ensure that the sticker remains on the vehicle and is legible at all times. If the vehicle is project or program assigned and there is no designated primary operator, then the Project/Site Manager shall be considered the primary/responsible party.
- 4.7.6 The primary/responsible party shall contact the Equipment Services Group immediately upon recognizing that the sticker is defaced or removed so a new one can be applied. Failure on the part of the primary operator to ensure that a legible sticker remains on the vehicle shall result in disciplinary action up to and including revocation of vehicle usage or possible termination of employment.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

4.8 Global Positioning System

- 4.8.1 Global Positioning System (GPS) speed and location gathering devices may be installed in company vehicles. The company utilizes data generated by these devices to track vehicle use, substantiate reports of unsafe driving, and monitor driving behavior.
- 4.8.2 Unsafe and unlawful driving behavior (i.e. excessive speeding), reported by GPS devices shall be investigated to evaluate the circumstances. Where applicable, the driver may be subject to disciplinary action up to and including termination of employment per the HSE Disciplinary Action Procedure (AMS-710-05-PR-00200).
- 4.8.3 Drivers caught disabling, tampering, or refusing to drive Company vehicles equipped with GPS shall be subject to disciplinary action up to and including immediate termination.

4.9 Transporting Personnel and Materials

- 4.9.1 Personnel shall not be used to support or steady loads while a vehicle is in motion.
- 4.9.2 Truck running boards shall not be ridden by personnel.
- 4.9.3 Drivers and passengers shall be seated with arms and legs inside the vehicle.
- 4.9.4 Personnel shall mount and dismount vehicles only when stopped and the gear in park. For manual transmissions, the gear shall be set based on manufacturer's recommendations with the parking brake engaged.
- 4.9.5 Personnel shall vacate all vehicles that are being loaded by a crane, backhoe, shovel, loader, or other equipment and shall move away from the vehicle during loading.
- 4.9.6 Loads extending beyond the bed of a truck or wagon shall be flagged and marked appropriately.
- 4.9.7 If left overnight, loads extending beyond the bed of a truck or wagon shall be flagged and marked appropriately (i.e. cones, reflective tape, etc.).
- 4.9.8 Drivers are responsible for safe loading, unloading, and securing of cargo.
- 4.9.9 Load shall not exceed manufacturer's specifications.
- 4.9.10 Where passengers are permitted to ride in the bed of trucks, the following requirements shall be met:
- Seats shall be firmly attached or passengers shall sit flat on the bed of the truck and shall not lean against the tailgate. Passengers shall keep their arms and legs inside the boundaries of the truck.
 - The maximum speed at which the vehicle may travel on site is 10 mph, unless posted signage dictates a lower speed.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

- At a minimum, passengers shall wear safety glasses unless the bed of the truck is enclosed.
- The weight of the people and their materials/tools shall not exceed the weight capacity of the vehicle.
- Passengers shall not be transported on the back of flatbed trucks.

4.9.11 Vehicles shall not be left running while unattended.

4.9.12 If a vehicle is parked on an incline or grade, the parking brake shall be engaged and wheels properly chocked.

4.9.13 When repair work or maintenance of any sort is performed on any vehicle, the parking brake shall be engaged.

4.10 Safety Features and Supplies

All company vehicles used on site shall be equipped in accordance with state and local laws and regulations. The Company also requires the following equipment:

4.10.1 First-aid Kit (when necessary due to the set-up of the site)

4.10.2 Snow tires and chains where conditions warrant

4.10.3 A minimum 2 1/2 pound ABC-rated fire extinguisher

4.11 Training

To help equip employees with the knowledge and skills of defensive driving, the following has been established:

4.11.1 New Hire Training - personnel expected to be driving a company vehicle or driving a personal vehicle on company business shall be required to complete a standard/initial defensive driver training program. This typically will apply to professional employees and certain craft employees, based upon roles and responsibilities.

4.11.2 Refresher Training – APTIM drivers will be required to complete a “refresher” defensive driver training program once every 2 years.

4.11.3 Post-Incident Training – Employees involved in an incident while driving on company business may be required to take post-incident training.

4.11.4 In the event one of APTIM’s clients has an established Driver Qualification program that meets or exceeds the company approved defensive driver training as approved by Corporate HSE, then the employee is only required to complete one training.

4.11.5 Recordkeeping - All training forms and supporting documentation shall be retained in the company’s learning management system.

NON-COMMERCIAL MOTOR VEHICLE SAFETY

5.0 TERMINOLOGY

Key terms within the context of the procedure. Terminology is to be listed in a table as shown below:

| Term | Definition |
|------------------------------|---|
| Authorized Passengers | <p>Authorized passengers in APTIM Company Vehicles are limited to:</p> <ul style="list-style-type: none"> • Company employees or employees of all subsidiaries • Consultants or subcontractors to the Company when on Company business • Company clients or potential clients, Company vendors, and other on legitimate Company business |
| Company Vehicle | Any motor vehicle that is owned, leased, rented, provided by a Client or otherwise provided by or through Company |
| Company | APTIM and its subsidiaries and affiliates |
| Driver | Individuals who are assigned a company vehicle or drive a company- owned/leased/rented vehicle, or personal vehicle, on Company business. |
| Motor Vehicle | Motor vehicle means motorized over-the-road vehicles to include: any passenger vehicle, cars, trucks used upon the highway for transporting passengers and/or property, as well as driving of company vehicles on site locations. This includes personal vehicles operated on company business. |
| Motor Vehicle Operator (MVO) | Individuals who are assigned a company vehicle or drive a company- owned/leased/rented vehicle, or personal vehicle, on Company business. |
| Motor Vehicle Report (MVR) | Motor Vehicle Report or MVR is a report from a driver's license agency that shows a list of violations and accident history. |
| Project Assigned Employees | Any employee that is assigned to a field operations project position. This designation includes: Project Managers, Site Managers/Supervisors, Foremen, Technicians, Scientists, Geologists, and Project Business Accountants. This does not include employees that are typically assigned to an office but are visiting a site for brief periods of time, such as to provide technical assistance, perform audits, and perform program reviews. |
| Site | Any location, facility, or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities, and/or project sites. |

NON-COMMERCIAL MOTOR VEHICLE SAFETY

6.0 REFERENCES

6.1 Required Forms/Checklists

| | |
|---------------------|--|
| AMS-710-02-FM-02701 | Vehicle Inspection Form |
| AMS-710-02-FM-02702 | Motor Vehicle Procedure Acknowledgement Form |
| AMS-710-02-FM-02704 | Notice of Citation |
| AMS-710-02-FM-02705 | Request for Check of Driving Record |

6.2 Other Internal References

| | |
|---------------------|---------------------------------|
| AMS-710-05-PR-02300 | Incident Reporting |
| AMS-710-02-PR-05600 | Cellular Device Use |
| AMS-710-02-PR-03900 | Commercial Motor Vehicle Safety |
| AMS-710-01-PR-03600 | Substance Abuse Program |

6.3 Other External References

| |
|------|
| None |
|------|

7.0 ATTACHMENTS

| Attachment | Attachment Title |
|----------------|--|
| Attachment 7.1 | Vehicle Inspection Form |
| Attachment 7.2 | Motor Vehicle Procedure Acknowledgement Form |
| Attachment 7.3 | Notice of Citation |
| Attachment 7.4 | Request for Check of Driving Record |
| Attachment 7.5 | Driver Qualification Process Flow |
| Attachment 7.6 | Vehicle Inspection Process Flow |



Procedure Number: **AMS-710-02-PR-02700**

Revision: **1**

Approval Date: **3/4/2019**

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.1
VEHICLE INSPECTION FORM**



NON-COMMERCIAL MOTOR VEHICLE SAFETY

| | | | | |
|---|--------------------------|------------------------|----------------------|-------------------------|
| Make | | Model | | |
| Unit # | | Inspection Date | | Odometer Reading |
| <i>The items below are to be inspected on a weekly basis. Report ALL items in need of repair to the mechanics at the time of inspection. Return the completed sheet to the Equipment Superintendent and Safety Department at the end of the week.</i> | | | | |
| Inspection | Notes | | | |
| Lubrication | <input type="checkbox"/> | | | |
| Starting System | <input type="checkbox"/> | | | |
| Instruments (speedometer & temperature gauge) | <input type="checkbox"/> | | | |
| Cooling System (Radiator) | <input type="checkbox"/> | | | |
| Air System | <input type="checkbox"/> | | | |
| Glass | <input type="checkbox"/> | | | |
| Mirrors (Rear-view & left outside) | <input type="checkbox"/> | | | |
| Defroster | <input type="checkbox"/> | | | |
| Brakes | <input type="checkbox"/> | | | |
| Steering System | <input type="checkbox"/> | | | |
| Tires | <input type="checkbox"/> | | | |
| Headlights | <input type="checkbox"/> | | | |
| Tail lights | <input type="checkbox"/> | | | |
| Brake lights | <input type="checkbox"/> | | | |
| Horn | <input type="checkbox"/> | | | |
| Windshield Wipers | <input type="checkbox"/> | | | |
| Fire Extinguisher | <input type="checkbox"/> | | | |
| Seat belts | <input type="checkbox"/> | | | |
| Back-up alarm | <input type="checkbox"/> | | | |
| Condition of vehicle body | <input type="checkbox"/> | | | |
| Initials & badge # of inspector | <input type="checkbox"/> | | | |
| Driver Notification Sticker present and legible | <input type="checkbox"/> | | | |
| Other | <input type="checkbox"/> | | | |
| | | | | |
| To be completed by Mechanic / Equipment Services Group: | | | | |
| Date Reported | Repairs Made | | Date Repaired | |
| | | | | |
| | | | | |
| This form must be sent to ESGdocs@aptim.com | | | | |
| Signature of Mechanic / ESG Representative | | | | |



Procedure Number: AMS-710-02-PR-02700

Revision: 0

Approval Date: 2/22/2019

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.2
MOTOR VEHICLE PROCEDURE ACKNOWLEDGEMENT FORM**



NON-COMMERCIAL MOTOR VEHICLE SAFETY

I, the undersigned, acknowledge that I have been provided with the Company’s Non-Commercial Motor Vehicle Safety Procedure and/or the Commercial Motor Vehicle Safety Procedure (if a CDL driver). I was afforded an opportunity to ask questions about these procedures, acknowledge that they apply to me, and understand that I may speak with my supervisor about any parts of the policy or procedures that I may not understand. Key elements of APTIM’s Motor Safety Policy and Procedures include:

As an APTIM employee, or a Non-APTIM employee operating an APTIM vehicle or personal vehicle on company business, I understand that these driving activities are privileges and not rights of employment. My driving status and possibly my employment are conditioned upon the policy, procedures, and my adherence to them.

I further understand and acknowledge that I am required to follow federal, state, and local laws, including laws relating to licensing and the operation of motor vehicles, as well as the applicable procedures, rules, and regulations of APTIM clients relating to my operation of a motor vehicle. When such procedures, rules, or regulations conflict, I will follow the most conservative and safest practice and promptly speak with my supervisor for clarification.

Printed Name: _____ Date: _____

Employee ID Number (if applicable): _____

Signature: _____

Supervisor Printed Name: _____ Date: _____

Project / Location: _____

Signature: _____

Please send a copy of this form to the designated HR Representative to be kept in the personnel file.



Procedure Number: AMS-710-02-PR-02700

Revision: 0

Approval Date: 2/22/2019

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.3
NOTICE OF CITATION FORM**



NON-COMMERCIAL MOTOR VEHICLE SAFETY

This form is to be completed each time an APTIM approved driver is issued a citation while driving a company vehicle or a personal vehicle for business purposes. Once complete, it is to be signed by the driver's supervisor and forwarded to the appropriate Human Resources Representative and the Corporate HSE Fleet Safety Department.

Driver Name _____ Employee No. (If applicable) _____

Nature of Citation _____

Date Citation Received: _____ Time Citation Received: _____

Location of Citation (City, State) _____

Law Enforcement or entity Issuing Citation: _____

Is Citation Being Contested? No Yes Details _____

Court Location and Court Date from Citation: _____

Driver Signature _____ Date _____

Corrective Action Being Taken _____

Supervisor Signature _____ Date _____

PLEASE PROVIDE A COPY OF THIS FORM TO SBU HSE LEAD AND YOUR HUMAN RESOURCES REPRESENTATIVE.

CORPORATE HSE USE ONLY

MVR Check ran on Employee ___Y ___N Date: _____

Total Point Count: _____

New Driving Status: _____ Change in Driving Status: ___Y ___N



Procedure Number: AMS-710-02-PR-02700

Revision: 0

Approval Date: 2/22/2019

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.4
REQUEST FOR CHECK OF DRIVING RECORD**



NON-COMMERCIAL MOTOR VEHICLE SAFETY

Fair Credit Reporting Act Disclosure Statement

In accordance with the provisions of Section 604 (b) (2) (A) of the Fair Credit Reporting Act, 15 U.S.C. 1681 et seq, as amended by the Consumer Credit Reporting Reform Act of 1996 (title II, Subtitle D, Chapter I, of Public Law 104-208, 110 Stat. 3009-426) and other applicable consumer credit legislation, you are being informed that reports verifying your driving record may be obtained for employment purposes. These reports are required by Sections 382.413, 391.23 and 391.25 of Federal Motor Carrier Safety Administration Regulations. You have the right to receive a copy of the reports and have the prescribed allotment of time by law to have any errors corrected and the reports obtained after corrections have been posted.

| Violation | Assigned Point Value |
|---|----------------------|
| Overweight, loss of load, vehicular equipment infraction, etc. | 1 |
| Moving violation: speeding, failure to stop, failure to signal turn, etc. | 2 |
| At-fault accident | 3 |
| Major citation: reckless driving (including speeding 15 or more miles per hour over the limit), tailgating, suspended license, speed contest, improper lane usage, open container, etc. | 6 |
| Driving under the influence or Hit and Run (Leaving the Scene) | 8 |

In the space provided below, please list all violations and accidents (regardless of fault) currently listed on your driving record by the state issuing your driver's license (include all states for which you have held a driver's license during the last two (2) years). Determine the number of points assigned from the table above, and write in column labelled Points. Finally, write the sum total of all points where indicated. If you are unsure if a violation is on your record, write it down.

| Violations | Driver's License Number | State of Issue | Date of Violation (M/Y) | Points as Determined from Above |
|--|-------------------------|----------------|-------------------------|---------------------------------|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Attach a blank sheet of paper if additional space is needed. DO NOT WRITE ON THE BACK OF THIS FORM. | | | | |
| Total Points | | | | |

I hereby certify that the information provided is a complete and accurate statement of my driving record for the previous twenty-four (24) months. I authorize the company to obtain a copy of my driving record from the state of issuance of my license(s) prior to my hire, post-accident, annually, and/or as determined necessary to ensure compliance with Federal, state, and local law, and with APTIM policies and/or procedures. Any driving record check that is conducted on me will fall under the Fair Credit Reporting Act as explained above. I also understand that falsification of data may disqualify me from being hired or result in revocation of my company driving privileges or other disciplinary action as provided by company policies and procedures.

Signature _____ Date _____ Position/Applied For _____

Driver License No. _____ State of Issue _____ Expiration Date _____

Do You Have a CDL? Y N List all Endorsements on CDL: _____

Printed Name _____ SSN _____ DOB _____ Employee # _____

Current Address _____ City _____ State _____ Zip _____

Requesting Authority (printed name) _____ Site / Location _____

--- Send completed form to your respective MVR Coordinator ---



Procedure Number: AMS-710-02-PR-02700

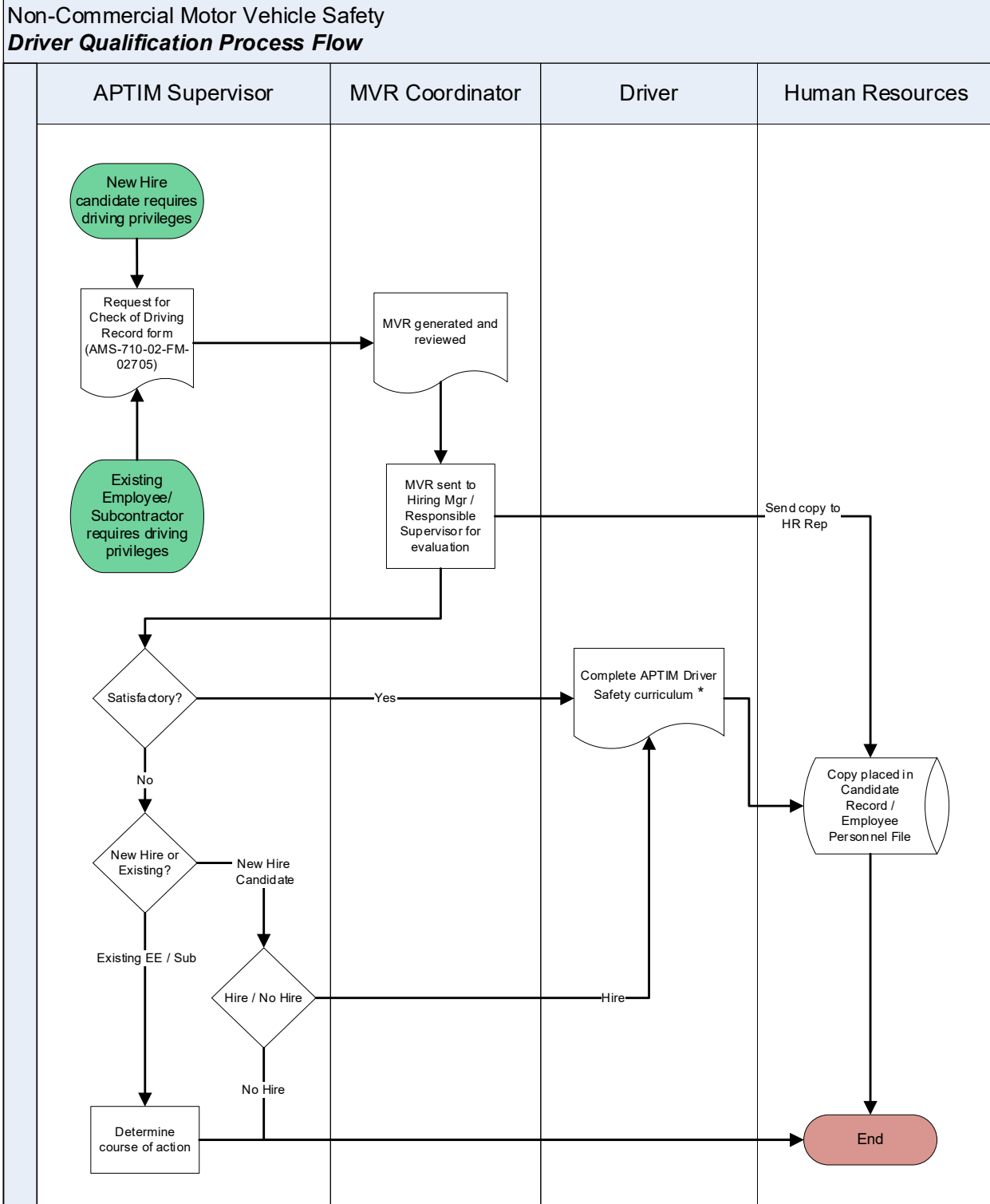
Revision: 0

Approval Date: 2/22/2019

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.5
DRIVER QUALIFICATION PROCESS FLOW**

NON-COMMERCIAL MOTOR VEHICLE SAFETY





Procedure Number: AMS-710-02-PR-02700

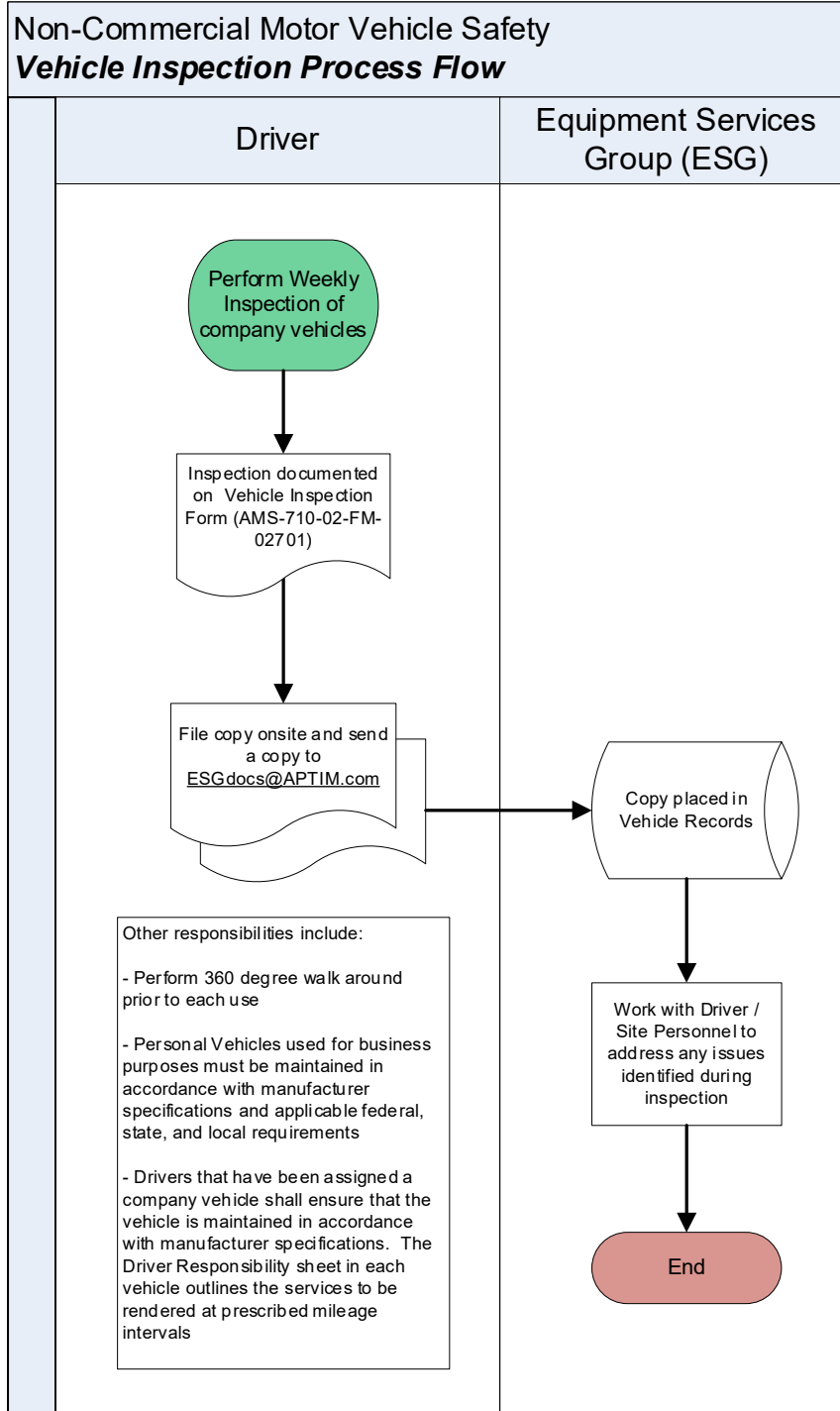
Revision: 0

Approval Date: 2/22/2019

NON-COMMERCIAL MOTOR VEHICLE SAFETY

**ATTACHMENT 7.6
VEHICLE INSPECTION PROCESS FLOW**

NON-COMMERCIAL MOTOR VEHICLE SAFETY





PROCEDURE

| | | | |
|------------------|--|--------------------|---------------------------------|
| Procedure Title: | Mechanized and Marine Equipment | AMS Number: | AMS-710-02-PR-05700 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

MECHANIZED AND MARINE EQUIPMENT

| | | | |
|------------|------------------------|----------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Mechanized and Marine Equipment used on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors, and visitors associated with a APTIM site.

3.0 RESPONSIBILITIES

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

Each site shall make every attempt to prevent the possibility of incidents to employees or damage to the equipment or facilities when performing work activities with Mechanized and Marine Equipment through compliance with safety regulations, training of employees to properly perform their job activities and through employee involvement in safe work activities.

4.1 Mechanized and Marine Equipment

- 4.1.1 Mechanized and marine equipment covered by this procedure are those that operate within an off-highway project/facility, not open to public traffic.
- 4.1.2 These rules apply to the following types of mechanized and marine equipment: scrapers, loaders, crawler or wheel tractors, bulldozers, off-highway trucks, graders, compactors, backhoes, excavators, pile driving, agricultural and industrial tractors, and similar equipment.
- 4.1.3 The safety requirements, ratios, or limitations applicable to machines or attachment usage covered in Construction Manual 300, shall be complied with, and shall apply to cranes, machines, and attachments.
- 4.1.4 All mechanized and marine equipment covered by this procedure shall comply with the requirements of AMS-710-02-PR-06600 Working Around Overhead Power Lines when working or being moved in the vicinity of power lines or energized transmitters.

4.2 General Requirements

- 4.2.1 Do not use equipment that is not in proper operating condition. Attach a "Danger – Do Not Use" tag to inoperable equipment, remove key from equipment, and give key to the supervisor when notifying him/her of the inoperable equipment.
- 4.2.2 No modifications or additions which affect the capacity or safe operation of the equipment shall be made without the manufacturer's written approval.
 - 4.2.2.1 If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly.
 - 4.2.2.2 In no case shall the original safety factor of the equipment be reduced.
- 4.2.3 All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, shall have appropriate lights or



Mechanized and Marine Equipment

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of the equipment.

- 4.2.4 A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.
- 4.2.5 Heavy machinery, equipment, or parts thereof, which are suspended or held aloft by use of slings, hoists, or jacks shall be substantially blocked or cribbed to prevent falling or shifting before employees are permitted to work under or between them. Bulldozer and scraper blades, skid steer loader buckets, dump bodies, and similar equipment, shall be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the motors stopped and brakes set, unless work being performed requires otherwise.
- 4.2.6 All equipment shall have a service brake system, an emergency brake system, and a parking brake system. These systems may use common components, and shall be maintained in operable condition.
- 4.2.7 Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set.
- 4.2.8 The use, care and charging of all batteries shall conform to the applicable requirements which include the following;
 - 4.2.8.1 Face shields, aprons, and rubber gloves shall be provided for workers handling acids or batteries.
 - 4.2.8.2 Facilities for quick drenching of the eyes and body shall be provided within 25 ft. (7.62 m) of battery handling areas.
 - 4.2.8.3 When batteries are being charged, the vent caps shall be kept in place to avoid electrolyte spray. Vent caps shall be maintained in functioning condition.
- 4.2.9 Whenever visibility conditions warrant additional light, all equipment/vehicles, or combinations of equipment/vehicles, in use shall be equipped with at least two headlights and two taillights in operable condition.
- 4.2.10 All equipment/vehicles, or combination of equipment/vehicles, shall have brake lights in operable condition regardless of light conditions.
- 4.2.11 All equipment with cabs shall be equipped with windshields and powered wipers. Cracked and broken glass shall be replaced.
 - All cab glass shall be safety glass, or equivalent, that introduces no visible distortion affecting the safe operation of the equipment.
- 4.2.12 Equipment operating in areas or under conditions that cause fogging or frosting of the windshields shall be equipped with operable defogging or defrosting devices.
- 4.2.13 All equipment with enclosed cabs operated in hot weather environments should be outfitted with cooling units, and personnel should be monitored for heat stress.
- 4.2.14 Equipment/vehicles used to transport employees shall have seats firmly secured and adequate for the number of employees to be transported.
- 4.2.15 Tools and material shall be secured to prevent movement when transported in the same compartment with employees.
- 4.2.16 Equipment shall not be loaded beyond its established load limit and the load shall be secured for safe transport
- 4.2.17 Passengers shall not be allowed on equipment unless seated in a manufacturer's installed seat and with the seat belt fastened.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.2.18 All equipment/vehicles, whose pay load is loaded by means of cranes, power shovels, skid steer loaders, or similar equipment, shall have a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.
- 4.2.19 All equipment/vehicles with dump bodies shall be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done.
- 4.2.20 Operating levers controlling hoisting or dumping devices on haulage bodies shall be equipped with a latch or other device which will prevent accidental starting or tripping of the mechanism.
- 4.2.21 Trip handles for tailgates of dump trucks shall be so arranged that, in dumping, the operator will be in the clear.
- 4.2.22 Pneumatic-tired earth-moving equipment (trucks, scrapers, tractors, and trailing units) whose maximum speed exceeds 15 mph (24 kph), shall be equipped with fenders on all wheels.
 - Mud flaps may be used in lieu of fenders whenever motor equipment/vehicle is not designed for fenders.
- 4.2.23 Scissor points on skid steer loaders and similar equipment, which constitute a hazard to the operator during normal operation, shall be guarded.
- 4.2.24 Mobile equipment shall be equipped with a fire extinguisher with a minimum rating of 10BC.
- 4.2.25 Never use buckets, forks, or attachments as a work platform or personnel carrier.
- 4.2.26 All rubber-tired, self-propelled scrapers, rubber-tired skid steer loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler tractors, crawler-type skid steer loaders, and motor graders, with or without attachments that are used in construction work shall be equipped with rollover protective structures (ROPS) and seat belts. This requirement does not apply to side boom pipe laying tractors.
- 4.2.27 When a signal person is used, the equipment shall not be moved unless the designated signal person giving signals is in full view of the operator.
- 4.2.28 For movement of mobile equipment in congested areas, a designated signal person shall be in full view of the operator and shall direct the movement. In some cases, multiple signal persons may be required.
- 4.2.29 No one shall be allowed within the boom, bucket, or counterweight swing radius, when it is in operation. Barricades shall be erected to keep workers from entering, as appropriate.
- 4.2.30 Walk behind compactors (or similar) shall be equipped with a continuous pressure (dead man type) control to stop the equipment if released.
- 4.2.31 Personnel such as surveyors, who are required to work around heavy earthworking equipment, shall wear a high visibility vest or clothing.
- 4.2.32 The operator must place marker guides, lighting or other effective signs to indicate to the driver the limit of safe approach to the tipping area when dumping operations are being carried out (whether by day or night).
- 4.2.33 Drivers of trucks delivering materials to site in multi-stage tippers or side un-loaders must take into account the gradient of the ground on which they are tipping, the nature of the material being discharged and to watch out for "hang up" of material during discharge. If necessary, a spotter must be used to direct discharge via radio communication or hand signals.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

4.2.34 When it is necessary (e.g., maintenance/refueling) to approach closer than 20 meters (65 feet) to a heavy vehicle, this shall only be done with the verbal permission of the driver/operator of the heavy vehicle. The following rules shall apply to parking of heavy equipment:

- Only park in designated areas;
- Lower all attachments on equipment fitted with moveable attachments (i.e., forks, buckets, blades, ripper's) when parking;
- If on an incline chock the wheels;
- Turn wheels into the side of the bank or road; and
- Apply the park brake and slew brake where applicable.

4.2.35 Vehicles used for the primary purpose of transporting fuel, explosives, oils etc. shall not haul passengers.

4.2.36 Smoking is not allowed in or within 50' of vehicles transporting fuel, explosives, oils, etc.

4.3 General Requirements for Operators

4.3.1 It is the responsibility of the operator to read and understand the operator's manual and the manufacturers' recommendations for each type and model of equipment to be operated and the requirements of this procedure.

4.3.2 The equipment must be inspected by the operator (designated person) prior to each use. Do not use equipment that is not in proper operating condition or is not within the last monthly inspection period. Attach a "Danger — Do Not Use" tag to inoperable equipment and notify the supervisor. Remove key from the equipment.

4.3.3 When so equipped, check the "operator presence/seat interlock" prior to starting equipment. Do not operate the equipment if the system is not functioning properly.

4.3.4 Operators must know the capacity and operating characteristics of the equipment to be operated.

4.3.5 The equipment must be attended at all times or attachments must be placed in the "transport lock position" or lowered to the ground.

4.3.6 The operator must check the work area for slopes, obstructions, potholes, etc. prior to beginning work. Check for overhead obstructions such as power lines, pipe racks, etc. and ensure proper clearances. See AMS-710-02-PR-06600 Working Around Overhead Power Lines.

4.3.7 When mounting or dismounting equipment, clean shoes and hands before climbing. Always use handrails, grab rails, and steps. Maintain a three-point contact with steps and handholds. Never jump on or off equipment. Never attempt to mount or dismount a moving machine. Do not use steering wheel or control levers as a handhold.

4.3.8 Loads must be carried as low as possible to maintain stability of the equipment and operator visibility.

4.3.9 Operations are to be performed only from the operators control station.

4.3.10 When equipped with "roll over protective structures" (ROPS), the operator must wear seat belt at all times and keep their body (hands, arms, legs, head) inside the protected area.

4.3.11 Never lift loads over people, occupied buildings, or operating equipment.

4.3.12 Use caution when handling objects such as round bales, poles, stumps, cylinders, sheets of plywood, etc. with skid steer loaders. Lifting too high or rolling the bucket too far back could result in objects sliding down the loader arms and falling onto the operator's control station.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.3.13 Obey posted speed limits. When operating on the project/facility, take it slow and easy. Give right of way to loaded machines and maintain a safe distance from other machines.
- 4.3.14 Avoid steep slopes or unstable surfaces. When operating on a slope, keep the load low and use extreme caution. Avoid sudden starts, stops, and turns when operating on inclines.
- 4.3.15 When moving mobile equipment, plan the move by evaluating road or ground conditions, overhead obstacles, traffic and congestion, and work adjacent to the travel path.
- 4.3.16 When driving on a sloped area, always drive up or down the slope and not across the slope. . Avoid making turns on inclines. If it is necessary, make turns wide and slowly with load carried low. When traveling up or down inclines, do so with loaded buckets facing uphill and empty buckets facing downhill.
- 4.3.17 When parking, select a place out of the traffic areas. Select a level area whenever possible. When it is necessary to park on an incline, position the machine at right angles to the incline. Secure or lower buckets, blades, and attachments and set the parking brake. Shut down the machine and chock wheels. Cycle the controls to ensure all attachments are secure.
- 4.3.18 The driver of a haul or dump truck shall not enter or leave the cab while the truck is being loaded.
- 4.3.19 The driver of a shovel or loader shall not cause the bucket of the shovel or loader to be traversed over the driver's cab of a truck or other motor vehicle during loading operations.
- 4.4 Transporting or Driving Equipment on Public Highways
 - 4.4.1 When traveling on public roads, lock dual brake pedals together. Make sure all clearance flags, lights, and warning signs are in place and visible. Make sure the "Slow Moving Vehicle" emblem is visible to traffic approaching from the rear. Use escort vehicles, as required.
 - 4.4.2 When loading or unloading equipment, select a level surface. Chock the transport vehicle to prevent movement. Keep trailer bed and ramps free of oils, mud, snow, ice, and debris. On articulated machines, attach the steering frame lock after loading and remove it before unloading. Chain and block the machine securely. Secure all attachments in the transport mode and lower buckets or blades. Cover or remove "Slow Moving Vehicle" emblems before transporting.
 - 4.4.3 Only the equipment operator and personnel trained and qualified to load equipment shall be allowed in the area during equipment loading or unloading.
 - 4.4.4 Unless qualified as an operator of the specific type of equipment to be transported, the truck driver shall not be allowed to drive the equipment onto or off of the trailer.
- 4.5 General Requirements for Excavations
 - 4.5.1 The location of underground utilities, i.e., electric, gas lines, water lines shall be identified prior to beginning excavation.
 - 4.5.2 Check with the supervisor or the facility owner for permit requirements. If unidentified encumbrances or utilities are struck, stop all work and notify the supervisor.
 - 4.5.3 Precautions must be implemented to keep personnel out of excavations and at least 10 ft. (3 m) away from the equipment and its maximum boom and/or counterweight swing radius when operating. Accessible areas within the swing radius of the equipment are to be barricaded to prevent personnel from being struck or crushed.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.5.4 Vehicles/equipment shall not approach an excavation while employees are in the excavation.
- 4.5.5 When excavating, extreme caution should be utilized to avoid hazards caused by cave in, i.e., roll over, tipping, or objects falling from overhead. If equipped with such, use the machine stabilizers. Avoid dangers such as rock or earth slides, when working at the base of excavations, overhangs, or stockpiles. See AMS-710-02-PR-01600 Excavation and Trenching for additional requirements.
- 4.5.6 The supervisor must confirm that the design, layout, construction and maintenance of any dumping or stockpiling operations take the following into account:
 - The nature of the material being dumped;
 - The size and weight of the equipment being used;
 - The site conditions, including stability of the area on which the dump is built; and
 - The weather conditions.
- 4.5.7 The operator must not dump rock or other material from a haul or dump truck over a bank or into a bin unless there is an effective backstop provided or a person (spotter) suitably stationed to guide and direct the driver to a safe dumping position, via radio communications or hand signals.
- 4.6 Equipment Specific Precautions
 - 4.6.1 Trencher
 - 4.6.1.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.
 - 4.6.1.2 When operating a trencher, ensure the equipment is ready for the job it must do.
 - Use a digging boom of the right length with a tooth pattern appropriate to soil conditions.
 - Keep guards, personnel restraints and trench cleaner in proper adjustment in relation to the digging chain.
 - 4.6.1.3 If the trencher is a riding model, operate the machine only from the operator's seat. The digging chain, auger, or wheel of the trencher can throw rock or debris a considerable distance. Use proper face and eye protection.
 - 4.6.1.4 Never allow anyone in the trench while digging.
 - 4.6.1.5 When beginning a new trench, set the digging boom down carefully with the chain moving slowly. The chain will tend to pull the machine. Be prepared to counteract the pull. Dropping a rapidly moving digging chain to the ground can cause the trencher to move quickly and unexpectedly.
 - 4.6.1.6 Use caution when trenching on hillsides. Avoid the potential for roll over or tipping. Always try to dig with the trencher in a level position. Vibration will tend to make the trencher slip sideways down a slope. Thoroughly evaluate the potential hazards and design the job such that equipment will remain stable throughout the course of the job.
 - 4.6.1.7 Avoid fences, walls, or other obstructions. If the tip of the digging boom makes contact with an obstacle, the machine can climb up and tip backwards onto the operator.
 - 4.6.1.8 During digging, if the machine strikes an unforeseen encumbrance and begins to labor, or jams, shut down the machine and inspect the worksite



Mechanized and Marine Equipment

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

and the chain. Never attempt to free a stuck chain while the trencher is running.

4.6.1.9 Stop the engine before attempting to service the chain.

4.6.2 Backhoes and Excavators (Trackhoes)

4.6.2.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.

4.6.2.2 Never operate the controls from the ground. Always operate from the operators control station.

4.6.2.3 Use stabilizers if equipped. Apply enough pressure to the stabilizers to support and level the machine. Do not elevate the tires off the ground higher than required.

4.6.2.4 Never enter, or allow anyone to enter the backhoe's pivot-point area or the swing radius of the boom. Maintain a clear zone of at least 10 ft. (9 m) beyond the maximum reach of the boom or counterweight.

4.6.2.5 Do not dig under the equipment or stabilizers.

4.6.2.6 When operating on a slope, swing to the uphill side to dump the load, if possible. If downhill dumping is necessary, swing only as far as required to dump the load. Use extreme caution. If equipped, use stabilizers to support the machine.

4.6.2.7 When using the backhoe/excavator bucket for hoisting:

- Consult the manufacturer's manual for lifting capacity.
- Position the machine so that load lowering is done over the front or back of the machine, not the side.
- For backhoes, always use stabilizers, and in soft soil place pads under each stabilizer.
- Ensure that the load is balanced and move slowly to maintain control of the load. Use tag lines when needed.
- Never lift the load higher than necessary to clear obstacles.
- Lower the load as soon as the obstacle is cleared and never hoist loads over people.

4.6.3 Skid Steer Loaders

4.6.3.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.

4.6.3.2 All skid-steer style loaders with cabs shall be fitted with a manufacturer-approved safety glass front door, front cage cover of equivalent effectiveness.

4.6.3.3 Skid steer loaders can tip quickly due to their short wheelbase and operating characteristics if the operator does not stay within the manufacturer operational limits.

4.6.3.4 Operators must maintain complete control at all times and operate at a speed suitable to site conditions.

4.6.3.5 Operate the skid steer loader from the operator's compartment—never from the outside.

4.6.3.6 Stay seated when operating the skid steer loader controls.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.6.3.7 The operator must keep hands, arms, legs, and head inside the cab while operating the skid steer loader.
- 4.6.3.8 Travel and turn with the bucket in the lowest position possible. Come to a complete stop before raising the bucket to dump.
- 4.6.3.9 When changing direction, look both ways to ensure adequate clearance from personnel and equipment.
- 4.6.3.10 Use extreme caution when operating in and around excavations to avoid tipping.
- 4.6.3.11 Always travel up and down slopes with the loaded bucket facing up the hill or the empty bucket facing down the hill.
- 4.6.3.12 Avoid sudden starts, stops, and turns to prevent tipping or striking other equipment or people.
- 4.6.3.13 Attachments used with skid steer loaders must be approved by the manufacturer and used in accordance with manufacturer instructions. Equipment capacities must be adjusted to accommodate such attachments.
- 4.6.3.14 On skid steer loaders where the operator's seat and controls are between the lift arms and in front of the lift arm pivot points, and where the operators must enter and exit from the loader through the front of the machine and over the bucket, operators must use great care to avoid contact of foot or hand controls that may be activated and cause movement of the lift arms, bucket, or other attachment.
- 4.6.4 Compactors
 - 4.6.4.1 Prior to using compaction equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.
 - 4.6.4.2 Operators are required to wear safety toe shoes and metatarsal guards while operating hand held compaction equipment. Other types of personal protective equipment may be required, e.g., hearing protection, respiratory protection.
 - 4.6.4.3 Caution must be exercised when working in or around excavations to avoid tipping or cave in. When in excavations 4 ft. (1.2 m) deep and greater, sides must be sloped or shored to prevent cave in. Shoring evaluation must consider the additional load, which may be imposed due to the compaction activity.
 - 4.6.4.4 To minimize personnel exposure on steep slopes and exposures to excavation hazards in areas such as washouts or in excavations that are not shored or sloped, a remotely-controlled compactor should be used. Personnel shall stay clear of the equipment when in operation.
- 4.6.5 Burial Plow Attachment
 - 4.6.5.1 When transporting a burial plow attachment, raise the plow to its fully elevated position and engage the transport lock. For parking, the plow should be either locked in the transport position or lowered to the ground.
 - 4.6.5.2 Know the location of underground utilities and clear the area of all obstructions or bystanders before operating the machine.
 - 4.6.5.3 When plowing on slopes, the machine's stability is increased due to the blade in the ground. Always enter or exit the ground slowly. Rapid entry or exit may cause the machine to tip.
- 4.6.6 Horizontal Boring Attachment



Mechanized and Marine Equipment

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.6.6.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.
- 4.6.6.2 Do not guide drill rod or pipe with hands, arms, feet, or other bodily contact. Use only guide tools as recommended by the manufacturer.
- 4.6.6.3 Keep bystanders and unauthorized personnel out of the work area and away from exposed drill rod or pipe.
- 4.6.6.4 Do not use excessive crowd (pushing) force on drill rod or pipe. Whipping action may result increasing the potential for incidents or injury.
- 4.6.6.5 Never use fasteners or hardware other than that supplied by the manufacturer to retain drill rod or pipe connectors
- 4.6.6.6 Do not service drill rod or pipe while engine is running.
- 4.6.7 Rock Cutting Attachment
 - 4.6.7.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.
 - 4.6.7.2 Read and understand the danger, caution, and warning signs on the equipment prior to beginning work.
 - 4.6.7.3 Rock cutting may require hearing and/or respiratory protection. Check with your supervisor to determine the proper personal protective equipment.
 - 4.6.7.4 Keep all unauthorized personnel away from the work area.
- 4.6.8 Industrial/Agricultural Mower
 - 4.6.8.1 Prior to operating this equipment, the operator shall receive proper training and study the operator's manual to ensure a comprehensive understanding of the machine operation and controls.
 - 4.6.8.2 Ensure that chain, flexible, or solid deflector shields are in place on the front and rear of the mower deck and are in good repair. Do not operate with damaged or missing shields.
 - 4.6.8.3 Check for broken, missing, bent, or severely worn blades.
 - 4.6.8.4 Check work area for debris and foreign objects to avoid them being picked up and thrown out by the mower. Inspect for rough terrain, drop-offs, ditches, potholes, steep slopes, stumps, standing water, mud, soft soil, or slippery conditions.
 - 4.6.8.5 Keep unauthorized personnel out of the work area. The mower may throw objects up to 300 ft. (91 m).
 - 4.6.8.6 Do not operate mower in transport position.
 - 4.6.8.7 Avoid excessive ground speed for terrain conditions and sudden starts, stops, or turns.
 - 4.6.8.8 Plan to mow downhill on steep slopes. Avoid over-speed of the power take off.
 - 4.6.8.9 Ensure all required guards are in place.
 - 4.6.8.10 Keep clear of rotating blades, parts, and drivelines.
- 4.7 Seat Belts
 - 4.7.1 Seat belts shall be provided on all equipment covered by this procedure.



Mechanized and Marine Equipment

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.7.1.1 Seat belts need not be provided for equipment that is designed only for stand-up operation.
- 4.7.1.2 Seat belts need not be provided for equipment that does not have rollover protective structure (ROPS) or adequate canopy protection
- 4.7.2 Tractors shall have seat belts as required for the operators when seated in the normal seating arrangement for tractor operation, even though backhoes, breakers, or other similar attachments are used on these machines for excavating or other work.
- 4.8 Audible Alarms
 - 4.8.1 All bi-directional equipment shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.
 - 4.8.2 All bi-directional equipment that has an obstructed view to the rear to be used in reverse gear shall be equipped an operational reverse signal alarm distinguishable from the surrounding noise level.
- 4.9 Access Roads and Grades
 - 4.9.1 No earthmoving and hauling equipment shall move upon any access roadway or grade unless the access roadway or grade is constructed and maintained to accommodate safely the movement of the equipment.
 - 4.9.2 Every emergency access ramp and berm shall be constructed to restrain and control runaway equipment.
- 4.10 Pile Driving Equipment General Requirements
 - 4.10.1 Boilers and piping systems which are a part of, or used with, pile driving equipment shall meet the applicable requirements of the ASME, Power Boilers (Section I).
 - 4.10.2 All pressure vessels which are a part of, or used with, pile driving equipment shall meet the applicable requirements of the ASME, Pressure Vessels (Section VIII).
 - 4.10.3 Overhead protection, which will not obscure the vision of the operator, shall be provided. Protection shall be the equivalent of 2-inch (50 mm) planking or other solid material of equivalent strength.
 - 4.10.4 Stop blocks shall be provided for the leads to prevent the hammer from being raised against the head block.
 - 4.10.5 Boom stops will be provided to prevent the leads from being pulled past "Top Dead Center" towards the operators cab.
 - 4.10.6 Any work that would require an employee to work down line from an energy source, will fall into the lockout, tagout and try safety procedure.
 - 4.10.7 A blocking device, capable of safely supporting the weight of the hammer, shall be provided for placement in the leads under the hammer at all times while employees are working under the hammer.
 - 4.10.8 Guards shall be provided across the top of the head block to prevent the cable from jumping out of the sheaves.
 - 4.10.9 When the leads must be inclined in the driving of batter piles, provisions shall be made to stabilize the leads.
 - 4.10.10 Fixed leads shall be provided with ladder, and adequate rings, or similar attachment points, so that the loft worker (pile buck) may engage his safety lanyard to the leads. If the leads are provided with loft platforms(s), such platform(s) shall be protected by standard guardrails.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.10.11 Air and steam hose leading to the hammer or jet pipe shall be securely attached to the hammer with an adequate length of at least 1/4-inch (9 mm) diameter chain or cable to prevent whipping in the event the joint at the hammer is broken. Safety chains, or equivalent means, shall be provided for each hose connection to prevent the line from thrashing around in case the coupling becomes disconnected.
 - 4.10.12 Steam line controls shall consist of two shutoff valves, one of which shall be a quick-acting lever type within easy reach of the hammer operator.
 - 4.10.13 The use of steam as a testing medium for equipment is prohibited without prior approval of the Senior Site Manager / Supervisor and the Site EHS Manager / Supervisor / Representative (or the Construction Business Line Management representative in the absence of the Site EHS Manager / Supervisor / Representative).
 - 4.10.14 Guys, outriggers, thrust-outs, or counterbalances shall be provided as necessary to maintain stability of pile driver rigs.
 - 4.10.15 Vibrations of pile driving rigs may cause loosening of bolts and other connections. Daily inspections at the beginning of the shift, and as necessary thereafter, shall be made to control these hazards.
 - 4.10.16 Piles are usually delivered to the jobsite in railroad flatcars or trailer trucks. Upon arrival at the jobsite, an inspection shall be made of each load. Spacers, binders or dunnage may shift while in transit causing problems such that piles could fall, roll, or slip during unloading. Stanchions shall remain in place until all piles have been removed from the trailer or flatcar. Tag lines will provide proper control during movement of the pile by crane to the storage area. Workers shall not be allowed on top of the load if all stakes and reinforcing wire have been removed. Piling tongs shall not be permitted.
- 4.11 Pile Driving
- 4.11.1 Setting up the Pile Driving Rig
 - 4.11.1.1 A coordinated effort is needed by each worker in setting up the pile driving rig. All equipment shall be inspected prior to assembly. The rig shall be assembled on solid ground, firmly supported by heavy timber sills or substantial cribbing. In some cases, heavy mats may be needed due to soil conditions. Steel blocks and wire rope shall be used for hoisting and pulling. All pile driving leads should be assembled separately and erected with power equipment. The crane shall be set level to enable the swing brake to hold and to maintain the boom angle consistent with the boom angle indicator. The jib shall be removed from boom for pile driving operations.
 - 4.11.2 Operation
 - 4.11.2.1 All employees shall be kept clear when piling is being hoisted into the leads.
 - 4.11.2.2 Piles shall be properly placed for handling by the driving rig as close to the hoisting center as possible. Proper spacing with dunnage is necessary for the rig to safely hook onto the next desired pile. Tag lines are essential for the proper placement of the pile by the rig. Workers shall not guide the pile directly by hand until the pile is close to the driving lead.
 - 4.11.2.3 When lifting a pile into the driving leads, all personnel not actually engaged in this operation shall be kept at least 2 pile lengths distance from the area.
 - 4.11.2.4 Dogs on pile-driven hoist drums that automatically disengage either by relieving the load or rotating the drum shall be prohibited.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.11.2.5 Pulling piles with hammer or pile line rigged through the head block is prohibited, unless driver and rigging are designed to safely withstand the imposed strain.
- 4.11.2.6 Stirrups shall be provided for worker's use on sheet piles or a mechanical device shall be used to guide the pile into place. If it is required to go aloft on sheet piling, the worker shall use a ladder or aerial lift.
- 4.11.2.7 There shall be head room at least twice the length of the individual sheet when interlocking sheet piling from the top of a driven sheet pile.
- 4.11.2.8 When piles are being driven in an excavated pit, the walls of the pit shall be sloped to the angle of repose or sheet-piled and braced. See AMS-710-02-PR-01600 Excavation and Trenching.
- 4.11.2.9 When steel tube piles are being "blown out", employees shall be kept well beyond the range of falling materials.
- 4.11.2.10 When it is necessary to cut off the tops of driven piles, pile driving operations shall be suspended except where the cutting operations are located at least twice the length of the longest pile from the driver.
- 4.11.2.11 When driving jacked piles, all access pits shall be provided with ladders and bulkheaded curbs to prevent material from falling into the pit.
- 4.11.3 Barges or floats supporting pile driving operations shall meet the applicable requirements for marine operation as outlined in 4.14 of this procedure.
 - 4.11.3.1 All hose connections supplying power or that has material passing through them shall be secured at the connections with 1/4" diameter chain or cable to prevent whipping.
 - 4.11.3.2 Lines supplying power to the hammer or other high pressure equipment shall be equipped with quick-acting, single action shut-off valves.
 - 4.11.3.3 Work areas shall be kept clear of obstructions such as extra hose footage, piling cutoffs or materials spoils.
 - 4.11.3.4 A safe work area of 1 1/2 times the height of the leads shall be "Red" barricaded and maintained free of all personnel not directly involved in the pile driving operations.
- 4.11.4 Inspection and Maintenance
 - 4.11.4.1 All equipment shall be maintained in accordance with established guidelines and/or the manufacture's guidelines, which ever depicts the most stringent application for achieving optimum safety results.
 - 4.11.4.2 Monthly inspection records shall be maintained. Crane inspection documents will be supplied before any crane operation begins.
 - 4.11.4.3 Provisions shall be installed to allow for a general maintenance of the leads top sheaves to be accomplished from ground level.
 - 4.11.4.4 Equipment will only be operated in a manner as it was designed to do. Alterations shall require site management approval at minimum.
 - 4.11.4.5 Any piece of equipment that will not or does not operate in the manner designed by the manufacture shall be tagged "Defective" and taken out of service until properly repaired.
- 4.11.5 Pile Driving Equipment Operators
 - 4.11.5.1 Only qualified and designated employees shall operate any piece of equipment.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.11.5.2 Operators shall operate their assigned equipment only and shall only operate it in a safe and responsible manner.
- 4.11.6 Pile Driving Equipment Signaling
 - 4.11.6.1 Equipment and winch operators shall accept signals only from the designated signal person. See AMS-710-02-PR-05900 General Crane and Derrick Safety
 - 4.11.6.2 One person shall be the designated signal person.
 - 4.11.6.3 When assigned to signal a piece of equipment, this employee accepts the shared responsibility for the safe operation of that piece of equipment.
- 4.11.7 Pile Driving Operations on, Over, or Adjacent to Water
 - 4.11.7.1 The width of hulls for floating pile drivers shall not be less than 45% of the height of lead above the water.
 - 4.11.7.2 Pile driver and dredge fairlead sheaves and spudline sheaves shall be guarded to prevent workers or tools from being drawn into them.
 - 4.11.7.3 All walkways over water shall be a minimum of 20-inch wide with standard handrails along both sides on structures and gang planks.
- 4.11.8 Pile Extraction
 - 4.11.8.1 Extreme stress on equipment can develop during pile extraction especially in water where the current is strong. Normal extraction is done with an extracting hammer designed for this purpose. The vibratory and sonic hammers designed for extraction have proved to be very satisfactory. For pile extraction, the following shall be executed:
 - 4.11.8.2 If piling cannot be pulled without exceeding the load rating of equipment, a pile extractor shall be used.
 - 4.11.8.3 When pulling piling, crane booms shall not be raised in excess of the crane manufacturer's written specifications for such operations and the crane shall not be allowed to tip. Remove jib from boom for extraction operations.
 - 4.11.8.4 Extractor hooks shall be carefully inspected daily for signs of failure.
 - 4.11.8.5 The screwbolt should be locked in the extractor pin with a spring clip or the vibration may loosen the bolt.
- 4.11.9 Personnel Protective Equipment
 - 4.11.9.1 Guidelines shall be followed per the project Dress code which identifies the personnel protective equipment required.
 - 4.11.9.2 Appropriate gloves shall be worn at all times.
 - 4.11.9.3 Hearing protection areas shall be established and maintained.
 - 4.11.9.4 Employees working where a fall exposure exist, shall be protected by Fall Protection Procedure.
- 4.11.10 Material Handling
 - 4.11.10.1 The loading, unloading or moving of material shall be done in a safe manner that will not expose personnel to inherent dangers and as being under loads or pinch points.
 - 4.11.10.2 All load hooks will have operable safety latches.
 - 4.11.10.3 When possible, loads shall be lifted in a flat and controlled manner.



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

4.11.10.4 Piling lifted by one end shall be attached in a positive manner to prevent slippage. Examples not all inclusive would be: Place a full wrap on round material and pre-cut a hole in I-beam material to secure the shackle.

4.12 Site Clearing General Requirements

4.12.1 Employees engaged in site clearing shall be protected from hazards of irritant and toxic plants and suitably instructed in the first aid treatment available.

4.12.2 All equipment used in site clearing operations shall be equipped with rollover guards (ROPS). In addition, rider-operated equipment shall be equipped with an overhead and rear canopy guard meeting the following requirements:

4.12.2.1 The overhead covering on this canopy structure shall be of not less than 1/8-inch (3 mm) steel plate or 1/4-inch (9 mm) woven wire mesh with openings no greater than 1 inch (25 mm), or equivalent.

4.12.2.2 The opening in the rear of the canopy structure shall be covered with not less than 1/4-inch woven wire mesh with openings no greater than 1 inch (25 mm).

4.13 Industrial Trucks

4.13.1 Industrial trucks shall meet the requirements of AMS-710-02-PR-00800 Forklifts and Powered Industrial Trucks.

4.14 Marine Material Handling Operations

4.14.1 Access to Barges

4.14.1.1 Ramps for access of equipment/vehicles to or between barges shall be of adequate strength, provided with side boards, well maintained, and properly secured.

4.14.1.2 Unless employees can step safely to or from the wharf, float, barge, or river towboat, either a ramp, meeting the requirements of paragraph 4.15.1.1 of this procedure, or a safe walkway, shall be provided.

4.14.1.3 Jacob's ladders shall be of the double rung or flat tread type. They shall be well maintained and properly secured.

4.14.1.4 A Jacob's ladder shall either hang without slack from its lashings or be pulled up entirely.

4.14.1.5 When the upper end of the means of access rests on or is flush with the top of the bulwark, substantial steps properly secured and equipped with at least one substantial hand rail approximately 33 inches (838 mm) in height, shall be provided between the top of the bulwark and the deck.

4.14.1.6 Obstructions shall not be laid on or across the gangway.

4.14.1.7 The means of access shall be adequately illuminated for its full length.

4.14.1.8 Unless the structure makes it impossible, the means of access shall be so located that the load will not pass over employees.

4.14.2 Working Surfaces of Barges

4.14.2.1 Employees shall not be permitted to walk along the sides of covered lighters or barges with coamings more than 5 ft. (1.5 m) high, unless there is a 3 ft. (1 m) clear walkway, or a grab rail, or a taut handline is provided.

4.14.2.2 Decks and other working surfaces shall be maintained in a safe condition.

4.14.2.3 Employees shall not be permitted to pass fore and aft, over, or around deckloads, unless there is a safe passage.



Mechanized and Marine Equipment

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

4.14.2.4 Employees shall not be permitted to walk over deckloads from rail to coaming unless there is a safe passage. If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches (610 mm) of bulwark, rail, coaming, or other protection exists, all employees shall be provided with a suitable means of protection against falling from the deckload.

4.14.3 First-Aid and Lifesaving Equipment.

4.14.3.1 Provisions for rendering first aid and medical assistance shall be provided.

4.14.3.2 The employer shall ensure that there is in the vicinity of each barge in use at least one U.S. Coast Guard-approved 30-inch (762 mm) lifering with not less than 90 feet (28 m) of line attached, and at least one portable or permanent ladder which will reach the top of the apron to the surface of the water. If the above equipment is not available at the pier, the employer shall furnish it during the time that he is working the barge.

4.14.3.3 Employees walking or working on the unguarded decks of barges shall be protected with U.S. Coast Guard-approved work vests or buoyant vests.

4.15 Inspection and Maintenance

4.15.1 Frequent Inspection

4.15.1.1 All equipment shall have as a minimum a Frequent Inspection conducted by a designated person(s) upon its arrival on the project/facility and monthly intervals thereafter.

4.15.1.2 The initial and monthly frequent inspections shall be documented using the Mechanized and Marine Equipment Inspection Form AMS-710-02-FM-05701.

4.15.1.3 A designated person(s) shall inspect each piece of equipment covered by this procedure for defects. All equipment in use shall be visually checked at the beginning of each shift to assure the equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use.

4.15.1.4 All defects shall be corrected before the equipment is placed in service.

4.15.1.5 For rental equipment, it is recommended that

- The rental company be required to conduct the initial inspection, along with a APTIM designated person, upon initial delivery to the site and
- Conduct the monthly inspection of their equipment along with a APTIM designated person.

4.15.2 Preventive Maintenance

4.15.2.1 A preventive maintenance schedule shall be established per manufacturer's requirements.

4.15.2.2 Do not service or repair moving parts on equipment while it is running.

4.15.2.3 Bleed pressure, hot liquid, etc. before performing maintenance or repairs. Lotto (Lock Out, Tag Out, Try Out). See AMS-710-02-PR-01500 Control of Hazardous Energy.

4.15.2.4 Properly block equipment or loads before repairing or maintaining equipment.

4.15.2.5 Preventive maintenance records. See 4.17 of this procedure.

4.15.3 General Requirements for Fueling and Maintenance



Mechanized and Marine Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

- 4.15.3.1 Refueling and/or battery charging shall be done in well-ventilated and designated areas.
- 4.15.3.2 Shut down equipment before refueling. Sufficient time should be allowed for the engine to cool before refueling.
- 4.15.3.3 Use approved fuel hose with embedded grounding and approved connections. If not available, attach a static ground from equipment to fuel transfer equipment to avoid fuel ignition due to static discharge.
- 4.15.3.4 Always ensure the availability of safety shower or eyewash facilities near fueling areas. Fire protection equipment must be readily available.
- 4.15.3.5 Starting aids, such as jumper cables or ether, may only be used with extreme caution and according to manufacturer's instructions. Always connect the ground cable last. The ground cable should be attached to the engine at a point away from the battery.
- 4.15.3.6 Only trained and authorized personnel are permitted to perform equipment maintenance. This includes inflating or changing tires and "jump starting." Control of the sudden release of hazardous energy must be implemented during service or maintenance.
- 4.15.3.7 Equipment towing should be avoided. If it is necessary, use a rigid tow bar and consult the manufacturer's requirements.

- 4.16 Document Retention
 - 4.16.1 Inspection documents shall be kept in the Project/Facility HSE Mgr. file.
 - 4.16.2 The qualification and training records shall be kept in the Project/Facility HSE Mgr. file readily available for review.
 - 4.16.3 Preventive maintenance records shall be completed and retained in the project/facility maintenance files.

- 4.17 Equipment Operator Qualification Procedure
 - 4.17.1 The project/facility manager or his designated Competent Person shall:
 - Prior to skills testing, train the operators using the manufacturer's manual for the equipment on which they are to be qualified.
 - Evaluate the skills of each prospective operator to ensure that they have the physical abilities and knowledge to safely operate the equipment they are being qualified on.
 - After fulfilling these requirements, complete the Mechanized and Marine Operators Qualification Form AMS-710-02-FM-05702.
 - Issue each operator a AMS-710-02-FM-02803 Type C Wallet Card.
 - 4.17.2 Operators of dump trucks, tractor/trailer trucks, buses, and any equipment that can be driven on a public roadway must also be licensed by the government/state to operate the vehicles on public roads or property.
 - 4.17.3 Operators of mobile equipment covered in this procedure with the exception of crane operators and drivers of equipment driven on public roadways shall complete a Medical Questionnaire AMS-710-02-FM-05202 prior to being assigned work requiring the use of such equipment.
 - The completed form shall be reviewed by the project/facility manager and the project/facility HSE manager.
 - Occupational Health Services or a medical doctor shall resolve any concerns that might affect the ability of the prospective operator to safely operate the equipment.



Mechanized and Marine Equipment

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

5.0 REFERENCES

| | |
|-------------------------|---|
| AMS-710-02-PR-00800 | Forklifts and Powered Industrial Trucks |
| AMS-710-02-PR-01400 | Electrical Safety |
| AMS-710-02-PR-01500 | Control of Hazardous Energy |
| AMS-710-02-PR-01600 | Excavation and Trenching |
| AMS-710-02-FM-02803 | Type C Wallet Card |
| AMS-710-02-FM-05202 | Medical Questionnaire |
| AMS-710-02-PR-05900 | General Crane and Derrick Safety |
| AMS-720-01-FM-00020 | Business Glossary |
| AMS-720-01-FM-00021 | Technical Glossary |
| Construction Manual 300 | Mobile Crane Safety |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|--------------------------|--|
| ASME | American Society of Mechanical Engineers |
| Backhoe | A tractor mounted attachment for digging trenches and excavations. |
| Bulldozer | A track mounted machine with a front mounted blade designed for moving materials by pushing it from one place to another. |
| Coaming | A raised edge around a hatch or opening in a deck of a ship or roof to prevent water from running down below. |
| Designated Person | A person selected or assigned by the employer or employer's representative as being competent to perform specific duties. |
| Dump Trucks | A vehicle with a tilting body to facilitate unloading itself. |
| Frequent Inspection | Daily or monthly intervals, by a designated person. |
| Loft Worker | A craft employee sometime referred to as a "pile buck" that assists with the placement and alignment of piles. |
| Skid Steer Loader | A machine with a bucket attachment designed for loading loose materials for transport. |
| ROPS | Roll Over Protective Structures mounted on equipment to protect the operator. |
| Scraper | Vehicles designed for removing soil by simultaneously scraping, loading, and transporting excavated materials. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| Excavator | A track-mounted backhoe with a revolving superstructure. |
| Tractor/Trailer Dump Bed | A trailer type vehicle, which has a tilting body to facilitate unloading itself and which is moved by an independent tractor or truck. |



Mechanized and Marine Equipment

| AMS Number: | Revision: | Approval Date: |
|----------------------------|------------|------------------|
| AMS-710-02-PR-05700 | INT | 7/30/2017 |

7.0 EXHIBITS

- Exhibit 7.1 AMS-710-02-FM-05701 – Mechanized and Marine Equipment Inspection Form
- Exhibit 7.2 AMS-710-02-FM-05702 – Mechanized and Marine Equipment Operators Qualification Form
- Exhibit 7.3 AMS-720-01-FM-00020 – Business Glossary
- Exhibit 7.4 AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|--|--------------------|---------------------------------|
| Procedure Title: | Commercial Motor Vehicle Safety | AMS Number: | AMS-710-02-PR-03900 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

COMMERCIAL MOTOR VEHICLE SAFETY

| | | | |
|------------|------------------------|----------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

1.0 PURPOSE

This procedure covers the minimum requirements for operation and maintenance of commercial motor vehicles. This procedure establishes the minimum standards for compliance of regulated carriers within APTIM..

2.0 SCOPE

This procedure applies to all APTIM operators of Commercial Motor Vehicles (CMV). This procedure does not supersede any Federal, State, or Local laws.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Human Resources
- APTIM Risk Management
- APTIM Managers
- APTIM Supervisors
- APTIM Employees

4.0 PROCEDURE

4.1 Sites wishing to establish one or more commercial drivers shall contact the applicable Transportation Administrator within their Operating Group for enrollment in the random drug testing pool and validation of compliance procedures.

4.2 All questions related to Drug and Alcohol testing will be referred to the Corporate HSE and the Substance Abuse Program procedure (AMS-710-01-PR-03600).

4.3 All Commercial Motor Vehicle Operators shall adhere to requirements listed in Non-Commercial Motor Vehicle Safety procedure (AMS-710-02-PR-02700).

4.4 Required Manuals (only applies to U.S.A. locations)

4.4.1 All U.S. sites operating CMVs shall maintain a current copy of the Federal Motor Carrier Safety Regulations (FMCSR) and the Hazardous Materials Regulations (HMR).

4.4.2 All U.S. regulated drivers will receive the latest version of the FMCSR pocketbook at time of hire. The driver will sign and return an acknowledgement statement showing receipt. This receipt is maintained in the Driver Qualification (DQ) file.

4.5 Training Requirements

4.5.1 Training requirements for all drivers include the following minimum courses:

4.5.1.1 Defensive Driver Training (DDT)

4.5.1.2 Entry Level Driver Training (when applicable)

4.5.1.3 Hazardous Materials Training (when applicable) at least every three years which may include:

- Cargo Tank Training
- Asbestos Training
- Materials of Trade Training
- Basic Hazmat Shipper Training (includes General Awareness, Function-Specific, Safety, Security Awareness, Emergency Response, and HazMat Incident Reporting Training)
- Compressed Gas Cylinder Training
- Written Security Plan Training



Commercial Motor Vehicle Safety

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

- 4.5.1.4 Corporate HSE Designated Training (conducted by either Operating Group, Business Line, or Corporate) required of all CMV drivers at hire and annually will include:
 - Log Books/Pre and Post Trip Inspections (U.S.A. only)
 - Load Securement
 - Hours of Service (U.S.A. only)
 - Drug and alcohol awareness
 - CSA 2010 training (U.S.A. only)
 - Other training directed by the Operating Group, Business Unit, or Training Department
- 4.5.1.5 Supervisors of regulated vehicles and drivers will also receive:
 - Reasonable Suspicion Training
 - Required Maintenance Awareness
 - Dispatcher Training
 - Required Documentation for Drivers
- 4.5.1.6 Drivers with less than 1 year experience will undergo Corporate HSE Designated Entry Level Driver Training.
- 4.5.1.7 Refresher training is required for all CMV drivers at least once per year.

4.6 Compliance

Each site shall monitor overall compliance as required by this procedure.

4.7 Auditing

One targeted in-house transportation compliance audit will be conducted on each Business Unit per year by the Fleet Safety Manager or designee.

4.8 Minimum Requirements

A person is qualified to operate a CMV if he or she is:

- 4.8.1 At least 21 years old;
- 4.8.2 Can read and speak the English language sufficiently to converse with the general public, to understand highway traffic signs and signals in the English language, to respond to official inquiries, and make entries on reports and records;
- 4.8.3 Can by reason of experience, training, or both, safely operate the type of motor vehicle he or she drives;
- 4.8.4 Is physically qualified to drive a CMV in accordance with applicable federal regulations.
- 4.8.5 Can by reason of experience, training, or both, determine whether the cargo to be transported has been properly located, distributed, and secured in or on the motor vehicle;
- 4.8.6 Is familiar with methods and procedures for securing cargo in or on the motor vehicle; and
- 4.8.7 Has a complete and current Driver Qualification File in the possession of the appropriate Transportation Administrator.

4.9 Financial Responsibility for Motor Carriers

CMV drivers shall meet financial responsibility requirements dictated in AMS-710-02-WI-03092 (Financial Responsibility for Motor Carriers).

4.10 Notification and reporting of accidents



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

Motor Vehicle Accident notifications and reporting shall be conducted in accordance with AMS-710-02-WI-03903 (Notification and Reporting Motor Vehicle Accidents).

4.11 Qualifications of Drivers

CMV drivers shall meet the qualification requirements detailed in AMS-710-02-WI-03904 (Qualification of Commercial Motor Vehicle Drivers).

4.12 Driving of Commercial Motor Vehicles

Authorized passengers are limited to employees of APTIM and those subcontractor, client, or regulatory personnel who are integral to a task being performed.

4.13 Driving Practices

4.13.1 The operator of the vehicle will wear a seat belt and is responsible for ensuring that all passengers in the vehicle wear applicable restraints.

4.13.2 Cell phone use shall be in accordance with AMS-710-02-PR-05600 (Cellular Device Use).

4.13.3 In accordance with Federal, State, Local, and company regulations, a radar detector shall not be used in a CMV.

4.13.4 All applicable rules and regulations outlined in the Non-Commercial Motor Vehicle Safety procedure (AMS-710-02-PR-02700) will also apply.

4.13.5 Negative Transportation Reports/Roadside Inspections/CMV Driver Violations

4.13.5.1 Transportation reports that are generated as a result of a scale-side, road-side, or other inspection will be handled in a manner consistent with the negative public (Driver Check) report, as defined in AMS-710-02-PR-02700 (Non-Commercial Motor Vehicle Safety).

4.13.5.2 All roadside inspections and citations will be reported to the driver's manager and the appropriate Transportation Administrator within 72 hours of the inspection. This includes any inspection regardless if no violations were found or if said inspection included violations.

4.13.5.3 Any violation during a roadside inspection or accident will stay on the driver's CMV record for a period of 24 months. Any driver receiving points will be subject to the following:

- Can drive without restriction. Past 24 months point total 0-20 points. Verbal counselling and violation training reviewed.
- Can drive with understanding of probationary status. Past 24 months point total 21-39 points. Driver receives Written Warning and will operate under Probationary Status.
- Company driving privileges revoked for 12 months. Past 24 months point total 40 or more. Driver revocation for 12 months.
- Points incurred by a driver that is reasonably beyond their control (i.e., mismatched brake chambers) will be reviewed by a committee and if found to be reasonably beyond the driver's control, may be removed from the driver's score.

4.13.5.4 Repeat offenses within 12 months will be reviewed by committee and subject to receive written warning, placed on probationary status, and subject to disciplinary action.

4.13.5.5 A driver's manager or site manager will also be held responsible and subject to disciplinary actions for any violation or citation resulting from improper or unauthorized operations of a CMV if said driver was directed to operate the CMV by their manager without proper qualifications and / or



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

training. Disciplinary actions up to and including termination shall be based on severity of violation for the manager.

4.14 Inspection, Repair, and Maintenance

4.14.1 Applicability

All CMVs shall be included in a scheduled preventive maintenance program. Service intervals shall be in terms of miles or hours of operation. Service intervals and service requirements shall be, at a minimum, per the manufacturer's recommendations with manufacturer recommendations documented in the Vehicle Maintenance File with the appropriate maintenance department.

4.14.2 Manufacturer Recommended Service

Whenever manufacturer service recommendations either fail to cover company's utilization of the equipment or are unavailable, preventative maintenance shall be done in accordance with AMS-855-01-WI-00400 (Repair and Maintenance for Equipment Services Fleet).

4.14.3 Pre Trip

4.14.3.1 All drivers shall conduct a pre-trip inspection (including tow bars, aerial devices, and saddle mounts as applicable) before operating a CMV and a documented post-trip inspection at the end of each shift. No CMV shall be operated unless the following parts and accessories are in good working order:

- Service brakes (including trailer brake connections)
- Parking brake
- Steering mechanism
- Lighting devices and reflectors
- Tires
- Horn
- Windshield wiper(s)
- Rear-vision mirror(s)
- Coupling devices
- Wheels & Rims
- Emergency Equipment

4.14.3.2 The Driver's Inspection Report Form (AMS-710-02-FM-02701) shall be used. A copy is to be submitted to the Maintenance Supervisor and the original is to remain with the CMV. When repairs are complete, the mechanic is to make the appropriate entry in the Vehicle Maintenance File and sign the original Driver's Inspection Report in the CMV. The on-coming driver shall verify that repairs have been made, sign the Driver's Inspection Report and turn in the final copy. Final (original) copy shall be forwarded to the local Transportation Representative for comparison with Driver's Daily Logs and retention.

4.14.4 Drivers' Vehicle Inspection Report

All Drivers' Vehicle Inspection Report forms shall be forwarded to the local Transportation Representative or other assigned representative and remain on file for three months.

4.14.5 Annual Inspection

All CMVs shall be subject to an annual safety inspection. A copy of this inspection shall be forwarded to the Maintenance Supervisor for inclusion into the CMVs maintenance file. Note that the vehicle shall either carry a copy of the inspection or be marked with a sticker/decal displaying the information.



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

4.14.6 Limited Inspection

A limited safety inspection is required to be performed in accordance with scheduled preventative maintenance guidelines for the specific CMV and is to be noted in the home terminal Vehicle Maintenance File.

4.14.7 Inspectors

4.14.7.1 Inspectors shall meet the qualification requirements.

4.14.7.2 Have a combination of training or experience totalling at least 1 year

4.14.7.3 Are knowledgeable of and have mastered the methods, procedures, tools, and equipment used when performing vehicle inspections.

4.14.8 Brake Inspectors

Brake inspectors shall meet the qualification which generally includes completion of an approved training program or one year of documented experience. (Use forms provided in DOT Manual.) Any driver making brake adjustments shall also have certification of qualifications on file with the Transportation Administrator and the local shop or maintenance facility performing the maintenance.

4.14.9 Driver Inspections

Where APTIM employees perform inspections and repairs, documentation of qualifications shall be on file with the local Transportation Representative and the local shop or maintenance facility

4.14.10 Outside Vendor Repair

Where an outside vendor is used for inspection and repair, APTIM management shall verify that the vendor understands and will comply with inspector qualification requirements.

4.14.11 Maintenance File

The Maintenance/Inspection Check list (see FMCSR) shall be used to check completeness of Vehicle Maintenance Files.

4.14.12 Out of Service

The current version of the North American Uniform Out-of-Service criteria shall be followed in determining the service status of all CMVs.

4.14.13 Cargo Tankers

All cargo tanks shall have a copy of the manufacturer's data report and required recertification in the maintenance file. Qualifications for recertification vendors shall be on file with the local Transportation Representative

4.14.14 Exemption Vehicles

All exemption vehicles or trailers are required to carry a copy of the exemption on the vehicle.

4.15 Hours of Service of Drivers (only applies to U.S.A. locations)

4.15.1 Hours of Service Applicability

No motor carrier shall permit or require any driver used by it to drive a property-carrying CMV, nor shall any such driver drive a property-carrying CMV:

- More than 11 cumulative hours following 10 consecutive hours off duty; or
- For any period after the end of the 14th hour after coming on duty following 10 consecutive hours off duty, No motor carrier shall permit or require a driver of a property-carrying CMV to drive, nor shall any driver drive a



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

property-carrying commercial motor vehicle, regardless of the number of motor carriers using the driver's services for any period after-

- Having been on duty 60 hours in any period of 7 consecutive days if the employing motor carrier does not operate CMVs every day of the week; or
- Having been on duty 70 hours in any period of 8 consecutive days if the employing motor carrier operates commercial motor vehicles every day of the week.
- Any period of 7 consecutive days may end with the beginning of any off-duty period of 34 or more consecutive hours; or
- Any period of 8 consecutive days may end with the beginning of any off-duty period of 34 or more consecutive hours.

4.15.2 Utility Service Vehicles

As noted above, Utility Service Vehicles are exempt from the Hours-of-Service, but not any other portion of the regulation outlined by the FMCSR including but not limited to the proper maintenance of the record of duty status.

4.15.3 Log Submissions (only applies to U.S.A. locations)

All required drivers shall record their duty status on the Driver's Daily Log (see DOT Manual), including recap. Logs shall be completely filled out and submitted to home terminal management daily, or no less often than every 13 days for extended trips. Note that a driver's daily log cannot be used as a time card only.

4.15.4 Log Violations (only applies to U.S.A. locations)

Local management shall carefully review all Drivers' Daily Logs. They shall require the driver to correct any errors and take follow-up action (training or progressive discipline) where regulations or company procedures have been violated.

4.15.5 Log Auditing (only applies to U.S.A. locations)

The Driver Management Online Log Checker System or manual verification shall be used by management to review Driver's Daily Logs.

4.15.6 Log Books

All original Drivers' Daily Logs shall be forwarded to the Transportation Administrator or locally appointed representative or supervisor by the thirteenth day following completion of the log and remain there for six months. Copies shall also be retained at the local office for six months.

4.16 Load Securement

- 4.16.1 Drivers shall not operate a CMV unless the vehicle's cargo is properly distributed and adequately secured
- 4.16.2 Driver shall ensure the CMV's cargo or any other objects does not obscure the driver's view ahead or to the right or left sides.

4.17 Transportation of Hazardous Materials

4.17.1 Driving and Parking Rules

- 4.17.1.1 APTIM shall maintain a Certificate of Hazardous Materials Registration for elements registered to transport Hazmat so that certain hazardous materials defined in that section can be transported. APTIM's current U.S. Registration can be obtained by contacting the Corporate HSE Fleet Department. A copy of this Registration or other country equivalent that shows the Certificate number shall be kept in trucks.
- 4.17.1.2 APTIM shall have a written Security Plan that shall be implemented whenever the hazardous materials defined in that section are being



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

shipped from a jobsite. Implementation shall include training those hazmat employees to the elements of the security plan.

- 4.17.1.3 APTIM shall obtain a Hazardous Materials Safety Permit if any of the materials listed in that section are to be transported.
- 4.17.1.4 If APTIM determines that the fleet will function as a transporter of hazardous waste, APTIM shall comply with requirements for hazardous waste transporters as well as all applicable transportation regulations. These requirements will include obtaining a federal and/or state environmental agency identification number and potentially additional training for drivers.
- 4.17.2 Additional Driver Requirements
 - 4.17.2.1 A driver of a commercial motor vehicle that will haul a quantity of hazardous materials that requires placarding shall obtain a hazardous materials endorsement.
 - 4.17.2.2 A driver of a commercial motor vehicle that will haul a quantity of hazardous materials that requires placarding shall have a means of contact, such as a cellular telephone, radio, or an electronic tracking or monitoring system.
- 4.17.3 Pre-, En route, and Post-Shipment Vehicle Requirements
 - 4.17.3.1 Pre-Shipment Requirements: When loading hazardous materials onto a truck, loading personnel shall strictly adhere to the separation/segregation requirements.
 - 4.17.3.2 The driver shall complete a Daily Vehicle Inspection Report (AMS-710-02-FM-02701).
 - 4.17.3.3 The driver shall ensure the following documents are in the truck: Emergency Response Guidebook, Certificate of Hazardous Materials Registration copy or the Registration number, a current vehicle inspection (annual), hazardous materials shipping papers if applicable, current license tags, current liability insurance certificate, Hazardous Materials Safety Permit copy or the Permit number.
 - 4.17.3.4 En route Shipping Requirements: All movement of hazardous materials in commerce will be performed per regulatory requirements.
 - 4.17.3.5 Post-Shipping Requirements: transporters shall keep a copy or electronic image of hazardous materials shipping papers for 375 days.
- 4.17.4 Carriage by public highway
 - 4.17.4.1 All loads of hazardous materials or hazardous wastes shall be accompanied by shipping papers or hazardous waste manifest, respectively. All documents shall be retained for at least 3 years by site. Shipping documents using any generic descriptions shall also contain the technical name of the hazardous substance in parentheses following the basic description.
 - 4.17.4.2 Shipping documents shall be within the drivers reach and readily visible. When the driver is out of the cab, they shall be in the driver's door pocket or on the driver's seat.
 - 4.17.4.3 All hazardous materials/waste loads shall be marked, labeled, and placarded.
 - 4.17.4.4 All hazardous materials/waste loads shall be reported and segregated.



Commercial Motor Vehicle Safety

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

4.17.4.5 In the event of a spill of reportable quantity, the jurisdictional chemical response hotline should be contacted. In the United States, CHEMTREC should be notified.

4.18 Drug and Alcohol Policy

Employees shall adhere to the requirements detailed in AMS-710-01-PR-03600 (Substance Abuse Program).

4.19 Transportation of Explosives

Transportation of explosives shall be conducted in accordance with AMS-710-02-PR-03900 and AMS-710-02-WI-07012 (Transportation of Explosives).

5.0 REFERENCES

| | |
|--|---|
| AMS-710-01-PR-03600 | Substance Abuse Program |
| AMS-710-02-PR-02700 | Non-Commercial Motor Vehicle Safety |
| AMS-855-01-WI-00500 | Commercial Motor Vehicle (CMV) Driver Vehicle Inspection Reports (DVIR) |
| AMS-710-02-PR-05600 | Cellular Device Use |
| AMS-710-02-WI-07012 (Transportation of Explosives). | Transportation of Explosives |
| AMS-710-02-WI-03902 | Financial Responsibility for Motor Carriers |
| AMS-710-02-WI-03903 | Notification and Reporting Motor Vehicle Accidents |
| AMS-710-02-WI-03904 | Qualification of Commercial Motor Vehicle Drivers |
| AMS-855-01-WI-00400 | Repair and Maintenance for Equipment Services Fleet |



Commercial Motor Vehicle Safety

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03900 | INT | 7/30/2017 |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|--|--|
| Commercial Motor Vehicle (CMV) Requiring CDL Drivers | In accordance with Federal Motor Carrier Safety Regulations (FMCSR) 383.91, there are three vehicle groups which require a fully qualified, documented DOT driver holding a Commercial Driver's License. These classes are as follows: Group A, Group B and Group C. |
| Company | APTIM and its majority owned entities, subsidiaries, and affiliates. |
| DOT | United States Department of Transportation |
| Transportation Administrator | The Transportation Administrator for Capital Services is located in Findley, OH. The Transportation Administrator for other DOT sites is the Fleet Safety Manager in The Woodlands, TX. |
| FMCSA | Federal Motor Carrier Safety Administration |
| FMCSR | Federal Motor Carrier Safety Regulations |
| MCS-150 | Document to register and file with the DOT/FMSCA for operations that will perform Interstate/Intrastate commerce in the U.S.A. |
| Commercial Motor Vehicles NOT Requiring CDL Drivers | "Commercial Motor Vehicle means any self-propelled or towed vehicle used on public highways in interstate commerce to transport passengers or property when...the vehicle has a gross weight rating or gross combination weight rating of 10,001 or more pounds." |

7.0 EXHIBITS

- Exhibit 7.1 AMS-720-01-FM-00020 – Business Glossary
- Exhibit 7.2 AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

None

PROCEDURE

Procedure Number:

AMS-710-02-PR-01610

Revision:

0

Procedure Owner:

HSE

Issuing Authority:

VP HSE

Approval Date:

9/3/2019



UTILITY CONTACT PREVENTION

| Rev | Changes | Approved | Date |
|-----|---------------|----------|----------|
| 0 | Initial Issue | M, Karr | 9/3/2019 |

Parent Document:

N/A

UTILITY CONTACT PREVENTION

1.0 PURPOSE

The purpose of this document is to provide the minimum requirements to ensure that all utilities are properly identified, to prevent personal injury, property damage and/or causing negative impact to the surrounding community and environment.

The following deliverables are defined within this procedure:

| Deliverable | Producer | Customer |
|--|--|--|
| Authorization to Drill Permit Form (AMS-710-02-FM-01611) | Competent Person – Utility Contact Prevention | Project Manager HSE Employees External Client |
| Utility Mark-Out Documentation Form (AMS-710-02-FM-01612) | Competent Person – Utility Contact Prevention | Project Manager HSE Employees External Client |
| Intrusive Activities Checklist (AMS-710-02-CK-01613) | Competent Person – Utility Contact Prevention | Project Manager HSE Employees External Client |

2.0 SCOPE

This procedure applies to all APTIM sites planning above ground or intrusive activities, where the utility locations and clearances are not positively identified.

Work conducted around overhead power lines with mobile equipment is addressed in AMS-710-02-PR-06600, Equipment Operation Around Overhead Power Lines.

This procedure authorizes implementation of local, or client required procedures, when those procedures are more protective. Applicable local and/or client specific procedures shall be documented in the project-specific Health and Safety Plan (HASP), Work Plan, or Accident Prevention Plan.

2.1 Exceptions

Exceptions must be approved per the requirements of AMS-710-05-PR-01300, HSE Request for Variances.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Project Managers

UTILITY CONTACT PREVENTION

- APTIM Utility Contact Prevention – Competent Person
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors

3.1 APTIM Managers

APTIM Managers are to ensure their Project Managers are adhering to these expectations.

3.2 APTIM Project Managers

Project Managers have to designate their Competent Persons and ensure they're implementing these expectations.

3.3 APTIM Utility Contact Prevention – Competent Person

See detailed responsibilities in section 4.1.1.

3.4 APTIM Supervisors, Employees, Contractors and Subcontractors

Supervisors, employees, contractors and subcontractors are required to not proceed or act outside of the expectation.

4.0 PROCEDURE

4.1 Underground Utility Contact Avoidance during Intrusive Activities

4.1.1 Preliminary Requirements

4.1.1.1 The Project Manager - Designates a Competent Person – Utility Contact Prevention (UCP), to manage the aspects of work associated with the intrusive activities, supervise the employees who have the potential to contact any utilities, and fulfill the requirements of this procedure.

4.1.1.2 The Competent Person - UCP is responsible for the following:

- Determining location-specific regulations and client requirements for the notification, identification, locating, marking, contact prevention, and protection of utilities.
- Ensuring boundaries of intrusive activities have been clearly marked, prior to contacting utility locating services.
- Ensuring National One-call center and/or other utility locating services have been contacted, and formal notification of the pending intrusive activities has been completed.

UTILITY CONTACT PREVENTION

- Ensuring that utility owners are contacted to mark the location of their facilities in the area of the intrusive activities. They shall obtain and document the utility mark-out confirmation number or ticket number provided by the One Call Center. Generally, this notification for a mark-out request must be made from at least two (2) business days (48 hours) to three (3) business days (72 hours) before beginning intrusive activities.
- Ensuring private utility locating services have been contacted and have completed mark-outs, in areas not covered by a One-call center.
- Ascertaining the requirements for maintaining the open ticket with the One Call Center (or local equivalent), client, and/or property owner after the initial formal notification and taking action required to maintain the open ticket, until intrusive activities are completed.
- Ensure time requirements for allowing utility owners to mark locations are met, and authorizing intrusive activities, after satisfaction that all utilities have been located and marked.
- Ensuring all above ground utilities are marked, flagged, or otherwise protected, in areas where equipment could come into contact with them.
- Photograph all utility markings.
- Ensure markings are protected and preserved as feasible.

4.1.1.3 Due to the sensitivity and costs associated with damage to fiber optic cables, the Competent Person - UCP must ensure and document verbal contact and an agreement with the fiber optic cable owner, for all work within 50 feet of fiber optic cables. Additional protective measures for intrusive activities near fiber optic cables shall be specified in site specific HASP, Site Safety Plan, etc.

4.1.1.4 The Competent Person - UCP must verify that the necessary emergency procedures to be taken if underground utilities become damaged are provided in the HASP, work plan, Job Safety Analysis, or Activity Hazard Analysis. These emergency procedures must be conveyed to employees as specified in Section 4.2.3, Field Crew Training (below).

4.1.2 General Requirements

4.1.2.1 A designated Competent Person - UCP shall be onsite at all times when intrusive activities are conducted.

4.1.2.2 Overhead utility locations must be marked where heavy equipment or other equipment has the potential for contacting overhead or adjacent utilities. Where required by law, advanced notification to the utility company may be required for any work where potential exists for incidental contact with utility lines. Daily site inspections are required to determine where activities will take place and to ensure all adjacent above ground utilities are identified, marked, and/or protected, to prevent contact. Provide updated information to employees in daily tailgate meetings.

UTILITY CONTACT PREVENTION

- 4.1.2.3 Maintain a minimum of 10 feet from overhead power lines, up to 50 kV. Adjust distances based on voltages over 50 kV by adding 0.4 inches per kV to the minimum 10 foot clearance. 20 feet of separation from lines, is required if voltage is unknown. Spotters are required to ensure safe clearance is maintained.
- 4.1.2.4 Prior to conducting any intrusive activities, the Competent Person - UCP must verify the Intrusive Activities Checklist (AMS-710-02-CK-01613) and the Utility Mark-out Documentation form (AMS-710-02-FM-01612) have been completed. No intrusive activities work is to be performed until all utility mark-outs are verified and until the facility owner-members have all provided the appropriate positive response.
- 4.1.2.5 Location specific procedures may not always be conveyed to contractors. The property owner, client, and/or facility operator must be consulted on the issue of underground utilities. All knowledge of past and present utilities must be evaluated prior to conducting work.
- 4.1.2.6 Only hand digging is permitted within 3 feet of underground high voltage lines, product lines, gas lines, or fiber optic cables. Once the line or cable is exposed, heavy equipment can be used but must remain at least 3 feet from the exposed line or cable.
- 4.1.2.7 If possible, shoveling/digging should be conducted parallel to the expected utility run.

4.1.3 Operating Requirements Specific to Excavation Activities

- 4.1.3.1 Refer to Section 5.0, Terminology to determine the applicable activities considered to be included as excavation.
- 4.1.3.2 The requirements of AMS-710-02-PR-01600, Excavation and Trenching must be followed.
- 4.1.3.3 After all mark outs have been completed, and the excavation locations have been accepted by the Competent Person - UCP prior to mechanical excavation, each utility identified inside the excavation location must be hand dug or vacuum excavated to a verify the utility location. The utility locations must be exposed in enough locations to verify its path of travel. If possible, the excavation location should be moved away from any utilities.
- 4.1.3.4 All utilities exposed during an excavation will be protected from accidental damage.
- 4.1.3.5 Utilities which are found to change elevation (shallower or deeper) or direction of run (curve) require UCP approval prior to soil removal/excavation operations.
- 4.1.3.6 When excavating close to a utility, outside the required 3 foot radius, the excavator should have a spotter to assist and guide the excavation equipment operator.
- 4.1.3.7 While the excavation is open, underground installations shall be protected, supported, or removed as necessary to safeguard employees.

UTILITY CONTACT PREVENTION

4.1.3.8 The utility owner should be contacted for guidance on protecting the utility from damage when backfilling excavations. When excavation is complete, as practical, 6 inches of soil may be placed over the utility to shield/protect during backfilling operations

4.1.3.9 Areas of refusal (tree roots, large rocks, concrete structures) which prevent either digging to depth or exposing utilities require UCP approval prior to beginning soil removal operations.

4.1.4 Operating Requirements Specific to Drilling Activities

4.1.4.1 Refer to Section 5.0, Terminology to determine the applicable activities considered to be drilling activities.

4.1.4.2 Follow all requirements in Section 4.1.1. & 4.1.2

4.1.4.3 After all mark outs have been completed, prior to drilling, each individual location must be hand dug or vacuum excavated to a minimum of 5 feet below ground surface (bgs).

4.1.4.4 Should the local geology be prone to refusal or should there be any other reason the drilling location cannot be cleared to a minimum of 5 feet bgs by hand digging or vacuum extraction, then the appropriate geophysical techniques should be utilized to verify the drilling location is clear of utilities to 5 feet bgs.

4.1.4.5 At any drilling location that cannot be cleared by hand digging or vacuum extraction, then an Authorization to Drill Permit (AMS-710-02-FM-01611) must be approved by the Director of Operations (or designee, which may be delegated to the business line manager for each area) in addition to the project/program manager/director. The SBU HSE lead may be consulted, but signature is not required.

4.1.5 Operating Requirements for Boring & Trenching Activities at Retail Fuel Dispensing Stations

4.1.5.1 Work in and around known retail fuel systems (lines and tanks) may be best performed by a licensed, APTIM approved tank subcontractor.

4.1.5.2 Gauge tank pit observation wells prior to beginning drilling activities.

4.1.5.3 Locate emergency shut off system prior to drilling activities.

4.1.5.4 Look for any visual indications that product lines or utilities have been installed in boring location (cracked concrete, sagging concrete, patched concrete, trench cuts, etc.)

4.1.5.5 Establish "No Drill Zones" if possible. No Drill Zones are areas around UST's, gas dispensers, lines or the canopy of retail fuel dispensing stations.

4.1.5.6 Boring and trenching activities at retail fuel dispensing systems should be moved to a pea gravel free area of the site when possible.

UTILITY CONTACT PREVENTION

- 4.1.5.7 If relocation is not possible, an air knife or vacuum extraction approach will be used for pre-clearance of underground utilities.
- 4.1.5.8 If pea gravel is encountered, stop work and either move the bore hole location or install with vacuum extraction techniques to a depth of 5 feet, if possible.
- 4.1.5.9 Standard pre-clearance tools (i.e. hand augurs, post hole diggers, spud bars, etc.) are prohibited when working in and around pea-gravel due to the possibility of damage to fiberglass tanks and lines from tool strikes.

4.1.6 Operating Requirements Specific to Sheet Piling Activities

- 4.1.6.1 Follow Section 4.1.4, Operating Requirements Specific to Drilling Activities.
- 4.1.6.2 After all mark outs have been completed, prior to installation of piling, each utility identified inside the sheet piling location must be hand dug or vacuum excavated to a verify the utility location. Additional planning may be necessary to change the location of the sheet piling location or the location of the utilities.

4.2 Training Requirements

4.2.1 Competent Person – Utility Contact Prevention

The Competent Person UCP must have successfully completed APTIM's internal Underground and Overhead Utility Contact Prevention training. It is the Project Manager's responsibility to verify that the Competent Person –UCP has completed training prior to overseeing activities.

4.2.2 Competent Person - Excavation Training

The Competent Person - Excavation shall have documented training or documented experience in excavation activities.

4.2.3 Field Crew Training

- 4.2.3.1 Prior to assignment of work, the Competent Person - UCP will provide the above and underground utilities information obtained to affected field crew personnel via the job safety analysis (JSA). Information will include:
- The utilities identified in work areas that may be affected by operations.
 - The location and depth of the utilities associated with the affected essential services
 - Any conditions on the proposed intrusive activities work and clearance requirements.
- 4.2.3.2 Prior to assignment of work, the Competent Person - UCP will also provide the following information to affected field crew personnel:
- The requirements of this procedure.

UTILITY CONTACT PREVENTION

- The required work practices and controls to prevent contacting utilities.
- The emergency procedures necessary if utilities are damaged.
- The roles and responsibilities of each worker within the work crew.

4.3 Incident Reporting Requirements

- 4.3.1 Employees are required to immediately report to their direct supervisor any utility contact incident or near miss incident.
- 4.3.2 All incidents involving utility contact shall be reported by the Competent Person – UCP and site supervisor as required by AMS-710-05-PR-02200, Incident Reporting.
- 4.3.3 Any damage caused or discovered to natural gas, liquid petroleum, or any hazardous liquid utilities, underground utilities must be immediately reported by the Competent Person – UCP, to emergency services, to the facility owner, and utility owner.
- 4.3.4 All other utilities contact, and damages are to be reported to the facility operator and the One Call Center (or local equivalent) by the Competent Person - UCP.
- 4.3.5 The Competent Person - UCP shall verify that all other local reporting requirements are met, e.g., reporting underground pipeline damages involving excavation in Texas to the Railroad Commission of Texas.

5.0 TERMINOLOGY

Key terms within the context of the procedure. Terminology is to be listed in a table as shown below:

| Term | Definition |
|---|--|
| As-Built Drawings | As-built drawings are blueprints that are usually obtained from the facility owner or client. They show original buried utilities and any modifications that have been made. |
| Company | APTIM |
| Competent Person – Utility Contact Prevention | Assigned by the Project Manager: An APTIM employee who is capable of identifying existing and predictable hazards presented by utilities located at an APTIM site that may be, hazardous, or dangerous to employees, could result in property damage, or negatively impact the community or environment. The Competent Person Utility Contact Prevention has successfully completed APTIM's in-house 'Underground/Overhead Utility Contact Prevention' training course, possesses an appropriate educational background, field experience, and has the authority to correct deficiencies or take prompt corrective measures to eliminate them. The required identification and documentation procedure for competent persons is specified in AMS-710-02-PR-04200, Competent/Qualified Person Procedure. |

UTILITY CONTACT PREVENTION

| | |
|----------------------------------|---|
| Drilling Activities | Any mechanical or manual penetration of the earth's surface using drilling, boring, auguring, or similar type of equipment. For the purposes of this procedure, drilling activities include the use of direct-push equipment and driving equipment such as hammers, impact hammers, vibratory drivers, or similar types of equipment. |
| Driving Activities | Any mechanical or manual penetration of the earth's surface using driving equipment. Driving activities include the installation of piles, sheet piles, poles, stakes, and fence posts. |
| Excavation | Any operation in which earth, rock, or other material in or on the ground is moved, removed, or otherwise displaced by means of any tools, power equipment or explosives, and includes, without limitation, grading, trenching, digging, ditching, drilling, auguring, boring, tunneling, scraping, cable or pipe plowing, piling, and driving. Any manmade cut, cavity, trench, or depression in an earth surface formed by earth removal. |
| Excavation Activities | Any mechanical or manual penetration of the earth's surface using heavy equipment such as excavators, backhoes, dozers, etc. Excavation activities also include manual use of hand shovels, pick-axes, etc. The use of 3-foot or larger diameter augers is also considered excavation activity. |
| Fiber Optic Cables | Optical communication cables that are buried underground. |
| Intrusive Activities | Any mechanical or manual penetration of the earth's surface, including drilling activities, driving activities, and/or excavation activities using drilling equipment, driving equipment, or excavating equipment. |
| No Drill Zones | No Drill Zones are areas located on retail petroleum sites where drilling is not permitted due to the presence of Underground Storage Tanks's (UST's), gas dispensers, lines or the canopy of retail fuel dispensing stations. |
| One Call Center | 811-One Call, Dig Safe, Miss Dig, etc. dial-in telephone number for requesting the location and mark-out of buried utilities, such as gas lines, electrical lines, telephone/cable lines, sewer lines, and water lines |
| Private Utility Locating Service | A private utility locating service is a firm established to locate underground utilities using specialized locating equipment, such as ground penetrating radar location devices or radio transmitter type utility locating equipment. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities, and/or project sites. |
| Site Survey | Inspection of the site to look for signs of buried utilities that may not be indicated through as-built drawings or through utility locating services. The survey typically involves inspection of overhead electrical services, basements, utility rooms, garages, |

UTILITY CONTACT PREVENTION

| | |
|------------------|---|
| | etc., for signs of old electrical conduits or fuel/water/septic lines. |
| Utility | <p>Any active or inactive above ground or subsurface structure that is or was designed to service a public or private facility. These may include, but are not limited, to the following:</p> <ul style="list-style-type: none"> • Electric power lines • Propane lines • Natural gas lines • Telephone lines • Telephone cables • Fiber optic lines • Fiber optic cables • Water lines • Steam and pneumatic lines • Sewer/sewage lines • Drain lines • Underground storage tanks • Septic tanks • Process or product lines • Reclaimed water lines |
| Vacuum Excavator | Equipment that excavates underground utilities with a combination of alternating water-and-air or air-and air pulsations (e.g., air knife, water knife, etc.) |

6.0 REFERENCES

Forms/checklists and other supporting policies, work processes, and procedures, included in the body of the procedure.

6.1 Required Forms/Checklists

Forms and checklists that are required for use by the procedure should be listed in Section 6.1.

| | |
|---------------------|-------------------------------------|
| AMS-710-02-FM-01611 | Authorization to Drill Permit Form |
| AMS-710-02-FM-01612 | Utility Mark-Out Documentation Form |
| AMS-710-02-CK-01613 | Intrusive Activities Checklist |

6.2 Other Internal References

| | |
|---------------------|---|
| AMS-710-02-PR-04200 | Competent/Qualified Person Procedure |
| AMS-710-02-PR-06600 | Working Around Overhead Power Lines with Mobile Equipment |
| AMS-710-02-PR-01600 | Excavation and Trenching |
| AMS-710-05-PR-01300 | HSE Request for Variances |



UTILITY CONTACT PREVENTION

| | |
|---------------------|--------------------|
| AMS-710-05-PR-02200 | Incident Reporting |
|---------------------|--------------------|

6.3 Other External References

| |
|------|
| None |
|------|

7.0 ATTACHMENTS

| Attachment | Attachment Title |
|------------|------------------|
| None | |



PROCEDURE

| | | | |
|------------------|-----------------------------|--------------------|--------------------------|
| Procedure Title: | Control of Hazardous Energy | AMS Number: | AMS-710-02-PR-01500 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

CONTROL OF HAZARDOUS ENERGY

| | | | |
|-----|------------------------|----------------------------|-----------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Control of Hazardous Energy on APTIM sites.

The following deliverables are defined within this procedure:

- Written site specific control of hazardous energy sources (lock-out/tag-out) plan
- Annual inspections of control of hazardous energy procedures and controls
- Control of Hazardous Energy training for affected and authorized employees

2.0 SCOPE

This procedure is to be utilized when creating a site specific plan for control of hazardous energy, inspections of procedures and controls, and training of authorized employees.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Electrical Superintendent
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

Upon commencement of site activities, the Site Manager and Site HSE Manager shall develop a written plan for the control of hazardous energy sources (Lock-out/Tag-out) to prevent the possibility of incidents to employees when performing work activities on or around hazardous energy sources. The plan shall be maintained in the site electronic data management system. This procedure applies to all equipment, vehicles, processes or systems that are powered by Electrical, Mechanical, Hydrostatic, or Pneumatic energy. When APTIM shares a site with client personnel, the APTIM Plan shall compliment the Client program. If APTIM is required to work to the client program, the plan must address the program interfaces and verify the minimum requirements set forth in this Procedure shall be met. Employees shall not be allowed to work on energized systems or equipment without written authorization from the Site Manager and consultation of the HSE Manager.

4.1 General

- 4.1.1 This Procedure specifies methods of controlling hazardous energy sources during construction and maintenance activities involving work on electrical services, facilities, shop equipment, engine-driven equipment, pressurized pipelines, and systems used as service lines for construction. This Procedure also covers activities to be used during start-up phases.
- 4.1.2 APTIM employees, contractors, subcontractors, and visitors shall adhere to requirements listed in this procedure.
- 4.1.3 If an energy isolating device is not capable of being locked out, the Tag-out procedure will be used.
- 4.1.4 If an energy isolation device is capable of being locked out, then the Lock-out procedures shall be used.
- 4.1.5 Whenever replacement or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed,



Control of Hazardous Energy

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

energy isolating devices for such a machine shall be designed to accept a lock-out device.

4.1.6 Affected workers, where Lock-out/Tag-out and/or Blinding/Blanking are performed, shall be made aware of systems that are being worked on in their areas.

4.2 Energy Control Procedures

4.2.1 Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in activities where Lock-out is required.

4.2.2 The procedures shall clearly outline the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including but not limited to the following:

- A specific statement of the intended purpose of the procedure.
- Specific procedural steps for the shutting down, isolating, blocking and securing machines or equipment to control hazardous energy.
- Specific procedural steps for the placement, removal and transfer of lockout and tagout devices and the responsibility for them and;
- Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout/tagout devices and other energy control measures.

4.3 Protective Materials and Hardware

4.3.1 A standard "DANGER - DO NOT OPERATE" tag (AMS-710-05-FM-01503) and individually keyed locks shall be used by each site.

4.3.2 Tags used shall be dated, signed, a description of the work being performed shown on the tag, and securely attached to the equipment/lock.

4.3.3 Tags shall not be reused, but destroyed immediately upon removal. No alterations to a tag are permitted.

4.3.4 No device shall be operated with a tag or lock attached regardless of circumstances.

4.3.5 No person shall remove another person's tag or lock unless it is deemed an emergency situation and the requirements of 4.9 are adhered to.

4.3.6 It is the discipline Supervisor's responsibility to ensure that no work is performed beyond the protection of blinds, blanks, locks, and tags.

4.3.7 Tags required beyond one shift shall be replaced by the oncoming shift. In no case will locks and tags be permitted to remain for more than 30 days without another inspection and redating with signatures.

4.3.8 Each authorized worker performing work on a system is required to affix a lock and tag on the system even though the equipment or system is already locked out. In these situations, a multiple locking device shall be used.

4.3.9 Lockout devices and tagout devices shall be singularly identifiable; shall be only devices used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

4.3.9.1 Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum amount of time the exposure is expected.

4.3.9.2 Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.



Control of Hazardous Energy

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

- 4.3.9.3 Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: color, shape, or size; and additionally, in the case of tagout devices, print and format shall be standardized.
- 4.3.10 Lockout and tagout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters.
- 4.3.11 Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be
 - non-reusable.
 - attachable by hand.
 - self-locking.
 - non-releasable with a minimum unlocking strength of 50 lbs.
- 4.3.12 At least equivalent to a one-piece, all-environment nylon cable tie. Lockout devices and tagout devices shall indicate the identity of the employee applying the device.
- 4.4 Types of Systems Requiring Lock-out/Tag-out and/or Blinding/Blanking
 - 4.4.1 Examples of types of energy sources requiring lock-out/tag-out and/or blinding/blanking are as follows:
 - 4.4.1.1 Electrical systems prior to being connected to a power source and energized will be locked out until they are released for service. Any time repairs or modifications are made to electrical systems, either temporary or permanent, they shall be locked out. Locks/Tags shall be applied to the main disconnect whenever possible.
 - 4.4.1.2 Lines, valves, and similar systems that are being tested pneumatically with gases shall be tagged and/or locked out in accordance with 4.3, to prevent accidental discharge of the pressure within the line. In addition, areas affected by the pneumatic test shall be barricaded against entry and the Site HSE Manager notified before commencement of the test. For safe test distance requirements for personnel see 4.8.2.
 - 4.4.1.3 Sources of energy such as pipelines, valves, and pumps shall be locked, blanked off, and otherwise secured to prevent charging, energizing, or creating any type of hazard to persons working on systems or inside a confined space.
 - 4.4.2 Electrical Operated Systems
 - 4.4.2.1 Whenever work on electrical equipment or services are scheduled, the power source (disconnects, circuit breakers, switches) controlling electrical equipment or systems shall be de-energized.
 - 4.4.2.2 The Electrical Superintendent or their designee shall assure that any power panel(s), distribution panel(s), or equipment controller(s) have been de-energized. Control circuit devices, such as push buttons, selector switches, and interlocks, may not be used as the sole means of de-energizing circuits or equipment.
 - 4.4.2.3 Stored electrical energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electrical energy might endanger personnel.
 - 4.4.2.4 Completed Danger – Do Not Operate Tag(s) and locks shall be attached to the controlling device by:
 - The person responsible for de-energizing the system, and
 - The craft supervisor responsible for this operation.



Control of Hazardous Energy

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

- 4.4.2.5 Each authorized worker required to work on the de-energized equipment or systems shall ascertain that the craft supervisor's and/or their foreman's completed Danger Tag and lock is attached to the controlling device or devices and place their lock and tag on the device before they begin work.
- 4.4.2.6 The de-energized equipment or system shall be tested using a voltmeter on the downstream side of the tagged-out controlling device. If the equipment is wired directly to a power panel box and is energized by turning on a push button or butterfly switch on the equipment, the power panel box on the downstream side shall be tested using a voltmeter.
- 4.4.2.7 The Electrical Superintendent or their designee will establish and maintain a lockout log. (See AMS-710-02-FM-01501).
- 4.4.2.8 The lockout log shall list craft workers or personnel applying a lock and tag on any power panel, distribution panel, or equipment-controlling device.
- 4.4.2.9 Each employee shall detail in the lockout log the time of day the lock was applied, the necessity for the lockout, the area or machine where the work is being performed and the approximate length of time that the power panel, distribution panel, or equipment controller will be de-energized.
- 4.4.2.10 When the work is completed, the employees shall report this information to the Electrical Superintendent before removing their lock. The employees shall log the time the work was completed in the lockout log and the time the lock was removed.
- 4.4.2.11 The last lock on the lockout device shall not be removed until the Electrical Superintendent inspects the power panel, distribution panel, or the equipment controller that was de-energized.
- 4.4.2.12 Faceplates, doors, and covers shall be installed and in place before the panels are re-energized.
- 4.4.2.13 The Electrical Superintendent shall notify craft workers in the area that the power panel, distribution panel, or controller is about to be re-energized. The Electrical Superintendent or his designee may then remove that last lock.
- 4.4.2.14 The Electrical Superintendent or their designee shall check the re-energized power panel, distribution panel or equipment controller for proper operation.
- 4.4.2.15 The date and time of day when these panels or equipment controllers were restored to service shall be entered in the lockout log.
- 4.4.2.16 To lock out electrically powered shop equipment to ensure maximum employee safety, a power disconnect switch shall be installed between the main power supply panel and each piece of electrically driven equipment which is directly connected to the power panel box. (This does not apply to equipment, which is equipped with a plug connection, including welding equipment.) This disconnect switch shall be located close to the equipment and properly identified. Pushbuttons or butterfly controls of equipment shall not be locked out. A short circuit can occur between a locked out pushbutton and relay causing the equipment to be energized with full power. Since some equipment is wired with dual controls and locking out one pushbutton does not render that equipment inoperable, after tag and lockout try start buttons to be certain disconnect is complete.

4.4.3 Construction Equipment or Facilities



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

- 4.4.3.1 The Electrical Superintendent, or their designee, shall open the switch, pull fuses and place his lock and tag on the equipment and then shall try the system.
- 4.4.3.2 Other employees shall place their locks and tags on the lockout device.
- 4.4.3.3 Employees shall complete lockout log information.
- 4.4.3.4 Upon completion of the work the employees shall remove their locks and tags. The Electrical Superintendent shall be that last person to remove their locks.
- 4.4.4 Operating Facilities and Equipment
 - 4.4.4.1 Operating unit electrician shall de-energize the system or equipment and demonstrate accuracy to the Electrical Superintendent or their designee.
 - 4.4.4.2 Electrical Superintendent or their designee shall ascertain that the system is de-energized and place their lock and tag on the lockout device.
 - 4.4.4.3 Other employees working on the system shall place their locks and tags on the device and complete the lockout log.
 - 4.4.4.4 Upon completion of the work, the Electrical Superintendent or their designee is the last construction personnel to remove their lock and tag in the presence of the Operating Unit Electrician.
 - 4.4.4.5 The Operating Unit Electrician then assumes control of the system.
- 4.4.5 Mechanical Work
 - 4.4.5.1 Whenever work is scheduled on mechanical equipment or pressurized systems, controlling devices such as circuit breakers, switches, valve handles, and other operating mechanisms shall be locked and tagged out to prevent their manipulation or operation.
 - 4.4.5.2 Affected workers required to work on mechanical equipment or pressurized systems shall determine that the craft supervisor's and their foreman's completed Lock/Danger Tag is attached to the controlling device or devices before they begin work.
 - 4.4.5.3 Where controlling devices permit, a lock shall be placed on the device by each employee to ensure that the controlling device is not inadvertently energized.
 - 4.4.5.4 De-energized equipment or systems shall be checked or tested to verify that the equipment is inoperable or that the pressurized system has been drained of its contents on the downstream side. To prevent harmful exposures, pressurized systems shall then be flushed out with water if liquids are involved or with inert gas if compressed gases are involved.
 - 4.4.5.5 Appropriate air tests shall be conducted whenever pressurized systems have previously contained hazardous gases or liquids, especially if welding and burning operations are involved when the system has been shut down. When isolating a pressurized system, slip-blind or blanks are required.
 - 4.4.5.6 All work that may involve pressurized vessels, pipes, or systems shall be done in accordance with 4.3.
- 4.5 Isolation of Structures and Pipelines
 - 4.5.1 Safety Rule
 - 4.5.1.1 All structures and pipelines, on which hot work is to be performed, shall be physically isolated from sources of contamination, be clean, and gas free.



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

The only exception to this rule is USA municipal potable water tanks and hot taps approved by Corporate HSE.

- Flange class designation is not the design pressure of the flange.
- Sample for lower flammable limit (LFL) and oxygen on all municipal potable water tanks before entry or any hot or cold work.

4.5.1.2 The isolation, emptying, cleaning, and gas freeing are to be performed by the customer unless special arrangements have been agreed upon beforehand with Business Unit/Operating Group HSE Director. Blanks can be sized for the design pressure of the pipeline when known or the flange class when the design pressure is unknown. All blinds shall be per the current edition of ASME B16.5 or B16.47, matching the mating flange Class (150, 300) and diameter.

4.5.2 Isolation Method

4.5.2.1 The preferred methods of isolation for structures and pipelines are illustrated in AMS-710-02-FM-05302 Isolation of Structures and Pipelines New/Repair Work/Maintenance, Figure 1.0. These methods use a “free air space” between the source of contamination and the structure or pipeline. These methods are applicable for new construction, repairs and maintenance work, but if the pipeline contains an expansion joint, Engineering-Assigned shall approve the method of isolation before the disconnect is made.

4.5.2.2 The isolation methods in AMS-710-02-FM-05302 Figure 2 shall only be used when the methods in Figure 1.0 are not physically possible. To use Figure 2 isolation methods requires:

- Authorization by the local Operation or Construction Manager after site inspection to assure this method of isolation is necessary.

4.5.2.3 Prior to installation of the isolation blank, the blank is examined by a qualified APTIM employee for correctness; identified (steel stencil) such that after installation, it can be confirmed to be installed at the correct location.

- A qualified APTIM employee confirms the blank is installed at the correct location with gaskets on either side and a tag is attached.

4.5.3 Isolation Exception

4.5.3.1 Exceptions to isolation illustrated in AMS-710-02-FM-05302 Figure 1.0 and Figure 2.0 can only be approved by Corporate Risk Analysis. Exceptions will only be considered after a written safety plan is submitted to Corporate HSE.

4.5.3.2 The safety plan must provide adequate HSE Supervision to control potential hazards. A minimum of one full time HSE Supervisor is required. Additional supervisors may be required to insure complete control of safety on large turn arounds, special projects or process facilities. This HSE supervision shall be furnished by APTIM.

4.5.4 Remote Blank/Blind With Vapor Barrier

4.5.4.1 When it is impractical to isolate at the structures, it is permissible through the Isolation Exception 4.5.3 to install an appropriately sized blank/blind at a remote location (i.e., battery limit). A vapor barrier is required at the structure so no product residue or liquid from low-areas in the piping can enter the structure. The vapor barrier can be 3/16 to 1/4 inch (4.76 to 6.35 mm) thick, skillet blind with a 1 inch wide X 6 inches long (25 to 152 mm)



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

handle. The skillet blind shall have a ¼ inch (6.35 mm) hole in the handle to attach a tag.

4.5.5 Company Policy on cleaning and gas-freeing vessels

4.5.5.1 APTIM personnel are not to assume responsibility for the cleaning and gas-freeing of any structure or pipeline. Exceptions to this rule shall be approved by Corporate HSE.

4.5.6 Blank Thickness

4.5.6.1 Carbon steel blank thickness can be determined based on pipeline design pressure when available, or flange class as follows:

- DESIGN PRESSURE KNOWN – Using Table 1.0, Exhibit 7.1, follow the pipe size vertically down to a pressure equal to or greater than the required design pressure, then horizontally across to the left to determine the required blank thickness i.e., 320 psi design pressure, 18" pipe - blank thickness required is 1-1/8 inches (minimum allowable temperature is 15° F - See Table 3.0, Exhibit 7.1
- FLANGE CLASS KNOWN – Using Table 1.0, Exhibit 7.1, flange class is stamped on the flange i.e., Class 600 flange, 18 inch pipe - blank thickness required is 2-3/8 inches (minimum allowable temperature is 40° F - See Table 3.0, Exhibit 7.1.

4.5.6.2 Test pressure maximum 1-1/2 times design pressure of pipeline

4.5.6.3 Blank thickness/pressure calculated per ASME B31.3 paragraph 304.5.3

4.5.6.4 Allowances, such as corrosion, assumed to be zero

4.5.6.5 Gasket required on both sides of installed blank

4.5.6.6 Sizes larger than 24 inches based on ASME B16.47 Series A

- Maximum temperature A283-C is 200° F
- Maximum temperature A36 is 700° F
- Minimum temperature - See Table 3.0, Exhibit 7.1

4.5.6.7 Stainless steel blank thickness can be determined based on pipeline design pressure when available or flange class as follows:

- DESIGN PRESSURE KNOWN - Using Table 2.0, Exhibit 7.1, follow the pipe size vertically down to a pressure equal to or greater than the required design pressure, then horizontally across to the left to determine the required blank thickness. i.e., 540 psi design pressure, 10 inch pipe - blank thickness required is 7/8 inches
- FLANGE CLASS KNOWN - Using Table 2.0, Exhibit 7.1, flange class is stamped on the flange i.e., Class 600 flange, 10 inch pipe - blank thickness required is 1-1/4 inches

4.5.6.8 Test pressure maximum 1-1/2 times design pressure of pipeline

4.5.6.9 Blank thickness/pressure calculated per ASME B31.3 paragraph 304.5.3

4.5.6.10 Allowances, such as corrosion, assumed to be zero

4.5.6.11 Temperature range is -325° F to 300 F for solution heat treated material

4.5.6.12 Gasket required on both sides of installed blank

4.6 Unauthorized Use of a Danger – Do Not Operate Tag

4.6.1 The standard Danger – Do Not Operate Tag shall be used only for the purpose of identifying a de-energized piece of equipment or system. It is not to be used as a substitute for a defective tag or a Caution Tag.



Control of Hazardous Energy

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

- 4.6.2 A Caution Tag is to be used to inform personnel of special precautions or instructions for safe and proper operation of equipment.
- 4.6.3 Do not use a Caution Tag to warn against operating a system or piece of equipment. Only a Danger – Do Not Operate Tag (AMS-710-02-FM-01503) may be used to prevent the operation of a system or piece of equipment.

4.7 Unauthorized Actions

- 4.7.1 The unauthorized removal of a Danger Tag from the controlling device of de-energized systems or pieces of equipment shall be grounds for immediate termination of the employee(s) involved.
- 4.7.2 The unauthorized operation of a controlling device of a de-energized system or piece of equipment that has been tagged out with a Danger Tag shall be grounds for immediate termination of the employee(s) involved.
- 4.7.3 The unauthorized removal of a blind or blank from a de-energized system or piece of equipment shall be grounds for immediate termination of the employee(s) involved.

4.8 Testing

4.8.1 Functional Testing

4.8.1.1 When the performance of a work activity requires the functional testing of a machine, component, or system, the locks and tags may be temporarily removed in accordance with this procedure, to perform the test. As a result of the testing, if it is determined that the equipment needs further work, the locks and tags shall be positioned back on to the device. If it is not necessary to replace all the locks and tags, then the unnecessary locks and tags shall be returned to the Lockout/Tagout Coordinator. The Site HSE Manager shall initial the Lockout/Tagout Request in the removal block to indicate that these locks and tags have been removed.

- Make sure all danger areas are clear of personnel.
- Verify that the main disconnect switch or circuit breaker cannot be moved to the on position.
- Use a voltmeter or other equipment to check the switch on electrical devices.
- Press all start buttons and other activating controls on the equipment itself.
- Shut off all machine controls when the testing is finished.

4.8.1.2 When multi-worker or multi-craft situations exist, a multi-lockout tag is to be used. These devices allow for multiple locks for protection of all craft involved. Each lock shall be properly tagged.

4.8.2 Safe Test Distances for Personal

4.8.2.1 The following AMS Procedures shall be reviewed for establishing safe personal test distances:

- Hydro-Pneumatic Testing of Field Erected Pressure Vessels - AMS-830-05-PR-46002
- Hydrostatic Testing of Field Erected Pressure Vessels – AMS-830-05-PR-46003
- Pneumatic Testing of Field Erected Pressure Vessels – AMS-830-05-PR-46004
- Safe Working Distance for Hearing Protection during Hydrotest of Piping – AMS-830-06-FM-40003
- Safe Working Distance for Hearing Protection During Pneumatic Testing of Piping – AMS-830-06-FM-40004



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

4.9 Emergency Removal of Employee's Lockout Lock

4.9.1 Lockout/tagout device removal

4.9.1.1 Each lockout/tagout device shall be removed from each energy-isolating device by the employee who applied the device. When the employee who applied the lockout/tagout device is not available to remove it, the device may be removed only after the following steps have been completed.

- The craft supervisor and general foreman/foreman shall verify that the employee who applied the lockout/tagout device is not at the facility or available to return.
- The craft supervisor and general foreman/foreman shall make a reasonable effort to contact the employee to inform him or her that the lockout/tag-out device shall be removed. The employee shall return to the site, to remove the lock if possible.
- The craft supervisor and the general foreman/foreman shall "walk-down" the entire system to verify it is safe to start the system.
- The craft supervisor and general foreman/foreman shall complete an "Emergency Lockout Device Removal" form (AMS-710-02-FM-01502) and present it to the site superintendent and the Site HSE Manager for approval to remove the lock.

Note: If the Site Superintendent or the Site HSE Manager is absent, the Site Manager assumes their signature authority. If the Site Manager is also absent then the designees that have received signature authority by designation may sign the "Emergency Lock-out Device Removal" form only after contacting the person they are receiving this signature authority from and that person has granted verbal permission to do so.

- The craft supervisor and/or general foreman/foreman shall ensure that the employee whose lock was removed has been notified prior to returning to work on the system.

4.10 Training

4.10.1 Personnel shall receive Lock-Out/Tag-Out Training as required by the OSHA Standard for Control of Hazardous Energy Sources.

4.10.2 Authorized employees shall also be trained to recognize hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

4.10.3 Each affected employee shall be instructed in the purpose and use of the energy control procedure. workers shall receive Lock-Out/Tag-Out Training to include the following minimum requirements:

4.10.3.1 Retraining of all affected employees shall be conducted and documented when there is a change in:

- Assignments
- Machines
- Equipment
- Processes
- When lock out/tag out inspections reveal a need, or supervision sees a need
- New hazards or changes in the energy control procedure



Control of Hazardous Energy

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

- 4.10.4 When tagout systems are used, employees shall also be trained in the following limitations of tags:
 - 4.10.4.1 Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.
 - 4.10.4.2 When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
 - 4.10.4.3 Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.
 - 4.10.4.4 Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.
 - 4.10.4.5 Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
 - 4.10.4.6 Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.
- 4.10.5 Sites shall maintain a list of the names and job titles of all employees who are authorized to lock out/tag out the specified machine, system or equipment.
- 4.10.6 A written record shall be maintained of all employees who have been trained in the company or site's lock out/tag out program.

4.11 Periodic Inspections

- 4.11.1 Periodic inspections of the energy control procedures shall be conducted at least annually.
 - 4.11.1.1 The periodic inspection shall be performed by an authorized employee other than the one utilizing the energy control procedure.
 - 4.11.1.2 The periodic inspection shall be conducted to correct deviations or inadequacies identified.
 - 4.11.1.3 Where lockout is used for energy control, the periodic inspection shall include a review between each authorized and affected employee, of that employee's responsibilities under the energy control procedure.
 - 4.11.1.4 The site shall certify that periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, and the person performing the inspection.

5.0 REFERENCES

| | |
|-----------------|-----------------------------------|
| 29 CFR 1910.147 | Control of Hazardous Energy |
| ASME B16.5 | Pipe Flanges and Flanged Fittings |
| ASME B16.47 | Series A Flanges |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|-------------------|---|
| Affected employee | An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or who's job requires him/her |



Control of Hazardous Energy

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

| | |
|-----------------------------|---|
| | to work in an area which such servicing or maintenance is being performed. |
| Authorized employee | A person who locks out tags out machines, systems or equipment in order to perform servicing or maintenance on that machine, system or equipment. An affected employee becomes and authorized employee when the employees' duties include performing servicing. |
| Blanking or Blinding | The absolute closure of a pipe, line or duct by the fastening of a solid plate (such as a spectacle blind or skillet blind) that completely covers the bore, that is capable of withstanding the maximum pressure of the pip, line or duct with no leakage beyond the plate. |
| Capable of being locked out | An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability. |
| Caution Tag | This tag is used to inform personnel of special precautions or instructions about safe and proper operation of equipment. This tag is not to be used to prevent the machines, systems, or equipment from being operated. |
| Danger – Do Not Operate Tag | This tag is attached to warn others that the machines, systems, and/or equipment has been isolated from its power source (de-energized) and that employees are working on the machines, systems, or equipment. |
| Double Valve and Vent | A valve arrangement in a piping system in which three valves are arranged in conjunction with a vent line. One valve is upstream of the vent, another downstream, on one is on the vent itself. To isolate the downstream system, the vent valve is opened, the other two are closed and all three valves are locked into position. |
| Energy Sources | Any source of energy, i.e., electrical, spring, gravity, hydraulic, pneumatic, and chemical. |
| Qualified Person | A person who by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |

7.0 EXHIBITS

| | |
|-------------|---|
| Exhibit 7.1 | Tables |
| Exhibit 7.2 | AMS-710-02-FM-01501 – Lock Out Log |
| Exhibit 7.3 | AMS-710-02-FM-01502 – Emergency Lock Out Device Removal |
| Exhibit 7.4 | AMS-710-02-FM-01503 – Do Not Operate Tag |
| Exhibit 7.5 | AMS-710-02-FM-05302 – Isolation of Structures and Pipelines |



Control of Hazardous Energy

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

| | |
|-------------|--|
| Exhibit 7.6 | New/Repair Work/Maintenance |
| Exhibit 7.7 | AMS-720-01-FM-00020 – Business Glossary |
| | AMS-720-01-FM-00021 – Technical Glossary |

8.0 ATTACHMENT

None



Control of Hazardous Energy

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

EXHIBIT 7.1 TABLES

PAGE 1 OF 2

**TABLE 1.0
CARBON STEEL BLANKS
(16.1 ksi stress - ASTM A283-C/A36)**

| | | PIPE SIZE | | | | | | | | | | | | | | | |
|----------------|-------|------------------------------|-------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| | | 1 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 30 | 36 |
| | | DESIGN PRESSURE (psi) | | | | | | | | | | | | | | | |
| THICKNESS (in) | 1/4 | 3120 | 1480 | 950 | 440 | 270 | 120 | 70 | 50 | 30 | 30 | 20 | 20 | 10 | 10 | 10 | 0 |
| | 3/8 | 7010 | 3320 | 2140 | 990 | 600 | 280 | 160 | 100 | 70 | 60 | 50 | 40 | 30 | 20 | 10 | 10 |
| | 1/2 | 12460 | 5910 | 3810 | 1750 | 1060 | 490 | 290 | 190 | 130 | 110 | 80 | 70 | 50 | 40 | 20 | 20 |
| | 5/8 | | 9230 | 5950 | 2740 | 1660 | 760 | 450 | 290 | 210 | 170 | 130 | 100 | 80 | 60 | 40 | 30 |
| | 3/4 | | | 8560 | 3940 | 2390 | 1100 | 650 | 420 | 300 | 250 | 190 | 150 | 120 | 80 | 50 | 40 |
| | 7/8 | | | | 5370 | 3250 | 1500 | 880 | 570 | 400 | 340 | 260 | 200 | 160 | 110 | 70 | 50 |
| | 1 | | | | 7010 | 4240 | 1960 | 1150 | 740 | 530 | 440 | 340 | 270 | 210 | 150 | 100 | 70 |
| | 1 1/8 | | | | 8870 | 5370 | 2480 | 1460 | 940 | 670 | 550 | 420 | 340 | 270 | 190 | 120 | 80 |
| | 1 1/4 | | | | | 6630 | 3060 | 1800 | 1160 | 830 | 680 | 520 | 410 | 340 | 230 | 150 | 100 |
| | 1 3/8 | | | | | 8020 | 3700 | 2180 | 1400 | 1000 | 830 | 630 | 500 | 410 | 280 | 180 | 130 |
| | 1 1/2 | | | | | 9540 | 4400 | 2600 | 1670 | 1190 | 990 | 750 | 600 | 480 | 340 | 210 | 150 |
| | 1 3/4 | | | | | | 5990 | 3530 | 2280 | 1620 | 1340 | 1030 | 810 | 660 | 460 | 290 | 200 |
| | 2 | | | | | | 7830 | 4620 | 2970 | 2110 | 1750 | 1340 | 1060 | 860 | 600 | 380 | 270 |
| | | BLANK THICKNESS (in) | | | | | | | | | | | | | | | |
| Class 150 | 1/4 | 1/4 | 1/4 | 1/4 | 3/8 | 3/8 | 1/2 | 5/8 | 3/4 | 7/8 | 1 | 1 1/8 | 1 1/4 | 1 1/2 | 1 3/4 | 2 1/8 | |
| Class 300 | 1/4 | 1/4 | 1/4 | 3/8 | 1/2 | 5/8 | 7/8 | 1 | 1 1/4 | 1 3/8 | 1 1/2 | 1 3/4 | 1 7/8 | 2 1/4 | 2 7/8 | 3 3/8 | |
| Class 600 | 1/4 | 1/4 | 3/8 | 1/2 | 5/8 | 7/8 | 1 1/4 | 1 1/2 | 1 5/8 | 1 7/8 | 2 1/8 | 2 3/8 | 2 3/4 | 3 1/4 | 4 | 5 | |

**TABLE 2.0
STAINLESS STEEL BLANKS
(20 ksi stress - ASTM A240 type 304/316)**

| | | PIPE SIZE | | | | | | | | | | | | | | | |
|----------------|-------|------------------------------|-------|-------|-------|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| | | 1 | 1 1/2 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 24 | 30 | 36 |
| | | DESIGN PRESSURE (psi) | | | | | | | | | | | | | | | |
| THICKNESS (in) | 1/4 | 3870 | 1830 | 1180 | 540 | 330 | 150 | 90 | 60 | 40 | 30 | 30 | 20 | 20 | 10 | 10 | 0 |
| | 3/8 | 8710 | 4130 | 2660 | 1220 | 740 | 340 | 200 | 130 | 90 | 80 | 60 | 50 | 40 | 30 | 20 | 10 |
| | 1/2 | 15480 | 7340 | 4730 | 2180 | 1320 | 610 | 360 | 230 | 160 | 140 | 100 | 80 | 70 | 50 | 30 | 20 |
| | 5/8 | | 11470 | 7390 | 3400 | 2060 | 950 | 560 | 360 | 260 | 210 | 160 | 130 | 100 | 70 | 50 | 30 |
| | 3/4 | | | 10640 | 4900 | 2960 | 1370 | 810 | 520 | 370 | 310 | 230 | 190 | 150 | 100 | 70 | 50 |
| | 7/8 | | | | 6670 | 4030 | 1860 | 1100 | 710 | 500 | 420 | 320 | 250 | 200 | 140 | 90 | 60 |
| | 1 | | | | 8710 | 5270 | 2430 | 1430 | 920 | 660 | 540 | 420 | 330 | 270 | 190 | 120 | 80 |
| | 1 1/8 | | | | 11020 | 6670 | 3080 | 1810 | 1170 | 830 | 690 | 530 | 420 | 340 | 230 | 150 | 100 |
| | 1 1/4 | | | | | 8230 | 3800 | 2240 | 1440 | 1030 | 850 | 650 | 510 | 420 | 290 | 190 | 130 |
| | 1 3/8 | | | | | 9960 | 4590 | 2710 | 1750 | 1240 | 1030 | 790 | 620 | 500 | 350 | 220 | 160 |
| | 1 1/2 | | | | | 11850 | 5470 | 3230 | 2080 | 1480 | 1220 | 940 | 740 | 600 | 420 | 270 | 190 |
| | 1 3/4 | | | | | | 7440 | 4390 | 2830 | 2010 | 1670 | 1280 | 1010 | 820 | 570 | 360 | 250 |
| | 2 | | | | | | 9720 | 5740 | 3690 | 2620 | 2180 | 1670 | 1320 | 1070 | 740 | 470 | 330 |
| | | BLANK THICKNESS (in) | | | | | | | | | | | | | | | |
| Class 150 | 1/4 | 1/4 | 1/4 | 1/4 | 1/4 | 3/8 | 1/2 | 5/8 | 3/4 | 3/4 | 7/8 | 1 | 1 1/8 | 1 1/4 | 1 5/8 | 1 7/8 | |
| Class 300 | 1/4 | 1/4 | 1/4 | 3/8 | 3/8 | 5/8 | 3/4 | 7/8 | 1 1/8 | 1 1/4 | 1 3/8 | 1 1/2 | 1 3/4 | 2 | 2 1/2 | 3 | |
| Class 600 | 1/4 | 1/4 | 3/8 | 1/2 | 5/8 | 7/8 | 1 | 1 1/4 | 1 1/2 | 1 3/4 | 1 7/8 | 2 1/8 | 2 3/8 | 2 7/8 | 3 1/2 | 4 1/4 | |



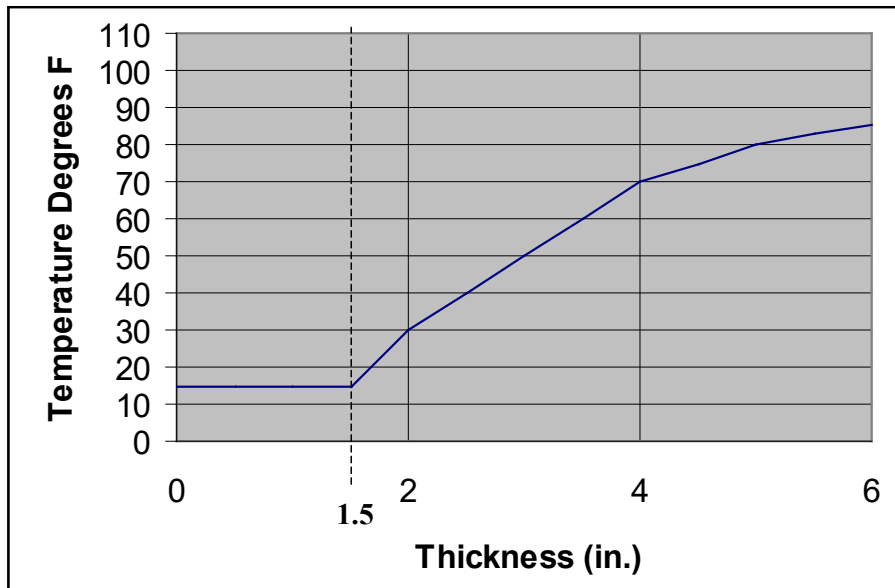
Control of Hazardous Energy

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01500 | INT | 7/30/2017 |

EXHIBIT 7.1 TABLES

PAGE 2 OF 2

**TABLE 3.0
MINIMUM TEMPERATURE FOR BLANKS W/O IMPACT TESTING
(A283-C/A36)**



**TABLE 4.0
BLANK AND GASKET DIAMETERS**

| Pipe Size | Class 150 | | | Class 300 | | | Class 600 | | |
|-----------|------------|--------|--------|------------|--------|--------|------------|--------|--------|
| | Blank O.D. | Gasket | | Blank O.D. | Gasket | | Blank O.D. | Gasket | |
| | | O.D. | I.D. | | O.D. | I.D. | | O.D. | O.D. |
| 1 | 2 1/2 | 2 5/8 | 1.0625 | 2 3/4 | 2 7/8 | 1.0625 | 2 3/4 | 2 7/8 | 1.0625 |
| 1 1/2 | 3 1/4 | 3 3/8 | 1.91 | 3 5/8 | 3 3/4 | 1.91 | 3 5/8 | 3 3/4 | 1.91 |
| 2 | 4 | 4 1/8 | 2 3/8 | 4 1/4 | 4 3/8 | 2 3/8 | 4 1/4 | 4 3/8 | 2 3/8 |
| 3 | 5 1/4 | 5 3/8 | 3 1/2 | 5 3/4 | 5 7/8 | 3 1/2 | 5 3/4 | 5 7/8 | 3 1/2 |
| 4 | 3/4 | 6 7/8 | 4 1/2 | 7 | 7 1/8 | 4 1/2 | 7 1/2 | 7 5/8 | 4 1/2 |
| 6 | 8 5/8 | 8 3/4 | 6 5/8 | 9 3/4 | 9 7/8 | 6 5/8 | 10 3/8 | 10 1/2 | 6 5/8 |
| 8 | 10 7/8 | 11 | 8 5/8 | 12 | 12 1/8 | 8 5/8 | 12 1/2 | 12 5/8 | 8 5/8 |
| 10 | 13 1/4 | 13 3/8 | 10 3/4 | 14 1/8 | 14 1/4 | 10 3/4 | 15 3/8 | 15 3/4 | 10 3/4 |
| 12 | 16 | 16 1/8 | 12 3/4 | 16 1/2 | 16 5/8 | 12 3/4 | 17 7/8 | 18 | 12 3/4 |
| 14 | 17 3/8 | 17 3/4 | 14 | 18 3/4 | 19 1/8 | 14 | 19 1/4 | 19 3/8 | 14 |
| 16 | 19 7/8 | 20 1/4 | 16 | 20 7/8 | 21 1/4 | 16 | 22 1/8 | 22 1/4 | 16 |
| 18 | 21 1/4 | 21 5/8 | 18 | 23 1/8 | 23 1/2 | 18 | 24 | 24 1/8 | 18 |
| 20 | 23 1/2 | 23 7/8 | 20 | 25 3/8 | 25 3/4 | 20 | 26 3/4 | 26 7/8 | 20 |
| 24 | 27 7/8 | 28 1/4 | 24 | 30 1/8 | 30 1/2 | 24 | 31 | 31 1/8 | 24 |
| 30 | 34 1/4 | 34 3/4 | 30 | 37 | 37 1/2 | 30 | 37 3/4 | 38 1/4 | 30 |
| 36 | 40 3/4 | 41 1/4 | 36 | 43 1/2 | 44 | 36 | 44 | 44 1/2 | 36 |



PROCEDURE

| | | | |
|-------------------------|-----------------------------|---------------------------|----------------------------|
| Procedure Title: | Bloodborne Pathogens | AMS Number: | AMS-710-01-PR-00300 |
| Procedure Owner: | HSE | Issuing Authority: | VP HSE |

BLOODBORNE PATHOGENS

| | | | |
|------------|---|-------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| 0 | Added 4.3.4.5 "Hand-washing Facilities" | M. Hetzler | 2/1/2018 |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Bloodborne Pathogens

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for the control of Bloodborne Pathogens on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors and visitors associated with APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

APTIM sites shall use this procedure as the minimum requirements for their site specific Bloodborne Pathogens Standard.

4.1 Program Development

The Bloodborne Pathogens Program Coordinator/Site HSE Manager shall ensure that the exposure determination is conducted during the mobilization stages of the project and that the Exposure Control Plan (ECP) is completed.

4.2 Exposure Determination

4.2.1 Exposure Determination includes:

- 4.2.1.1 Exhibit 7.1 - List I - list of job classifications in which all employees have occupational exposure.
- 4.2.1.2 Exhibit 7.2 - List II - list of job classifications in which some employees have occupational exposure.
- 4.2.1.3 Exhibit 7.3 - List III - list all tasks and Practices in which occupational exposure occurs and that are performed by employees in job classifications included in the lists above.

4.3 Exposure Control Plan

4.3.1 The Site HSE Manager completes the APTIM ECP.

4.3.2 The ECP is a template which includes the information as listed in 4.3.4, 4.3.5, 4.3.6, and 4.4. This Plan provides the overall requirements for compliance with this Practice, and instructs each project to include site specific information for disposal of contaminated waste, care of Personal Protection Equipment (PPE), laundering materials, personal hygiene, decontamination etc.

4.3.3 The Site HSE Manager implements the elements of the APTIM ECP and uses the template to develop the specific procedures and practices.

4.3.4 The ECP shall address the following Methods of Compliance at a minimum:

- 4.3.4.1 Engineering and Work Practice Controls
- 4.3.4.2 Universal Precautions



Bloodborne Pathogens

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

- 4.3.4.3 Personal Protective Equipment (PPE)
- 4.3.4.4 Housekeeping:
 - Decontamination
 - Handling of Regulated Waste
 - Laundry
- 4.3.4.5 Hand-washing Facilities - If provision of handwashing facilities are not feasible, then an appropriate antiseptic hand cleanser in conjunction with cloth/paper towels or antiseptic towelettes must be provided.
- 4.3.5 The ECP shall address the following Medical Management at a minimum:
 - 4.3.5.1 Hepatitis B Vaccination
 - 4.3.5.2 Post-Exposure Evaluation and Follow-up
- 4.3.6 The ECP shall address the following training elements at a minimum:
 - 4.3.6.1 Bloodborne Pathogen Training for employees included in the plan
 - 4.3.6.2 Awareness training for all employees
 - 4.3.6.3 Employees covered under this plan due to reasonably anticipated exposure shall be provided training that includes at least:
 - A copy of APTIM's reference standard and any additional country or regional specific standards.
 - A general explanation of epidemiology and symptoms of bloodborne diseases
 - An explanation of modes of transmission
 - An explanation of the ECP
 - Appropriate methods of identifying tasks that may involve exposure
 - An explanation of use and limitations of methods to prevent or reduce exposure
 - PPE information
 - Selection basis for PPE
 - Hepatitis B vaccination information
 - Actions and notification in emergency situation
 - Practices to follow in event of exposure
 - Post-exposure evaluation and follow-up
 - Signs and labels or color-coding system
 - Opportunity for interactive questions and answers
 - 4.3.6.4 Training shall be done at the time of initial assignment and at least annually thereafter, within one year of their previous training.
 - 4.3.6.5 Employees who are not expected to contact blood or Other Potentially Infectious Materials (OPIM) shall be informed of the existence of the ECP and the responsible individuals on site.
- 4.3.7 The ECP shall address the communication of hazards to employees, recordkeeping and the procedure for the evaluation of circumstances surrounding exposure incidents.
- 4.3.8 The ECP shall be accessible to employees so they can have the opportunity to examine and copy the plan.
- 4.3.9 The ECP shall be reviewed and updated at least annually and whenever necessary to reflect new or modified task and procedures which affect occupational exposure and to reflect new or revised employee positions with occupational exposure. The revisions to the ECP will also reflect changes in technology that eliminate or reduce exposure to bloodborne pathogens.



Bloodborne Pathogens

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

4.3.10 The Site HSE Manager will solicit input from non-managerial employees responsible for direct patient care who are potentially exposed to injuries from contaminated sharps in the identification, evaluation, and selection of effective engineering and work practice controls and shall document the solicitation in the ECP, as applicable.

4.4 Medical Management

4.4.1 Hepatitis B Vaccination Series

4.4.1.1 All employees who, due to the nature of their assignment are at risk of occupational exposure (those are the employees included in List I and List II above) shall be offered the Hepatitis B vaccination series. The offer shall be made following training and within 10 days of initial assignment. The employee need not accept the offer of the vaccination; however, the declining employee must complete the Declination Form included in the AMS-710-01-FM-00301 Bloodborne Pathogens Plan Template prior to performing any assigned duties.

4.4.1.2 If an employee initially declines HBV vaccination but at a later date, while still covered under the program decides to accept the HBV vaccine, APTIM will provide the vaccine at that time. Should a booster dose be recommended at a future date, such booster dose(s) shall be provided.

4.4.2 Post-Exposure Evaluation and Follow-Up

4.4.2.1 Following an exposure incident, APTIM will make available to each potentially exposed employee, a confidential medical evaluation and follow-up. This follow-up will include documentation of the route(s) of exposure and the circumstances under which the exposure incident occurred, identification and documentation of the source individual (unless the identification cannot be established or it is prohibited by a local law), appropriate testing, prophylaxis for Hepatitis B virus, illness reporting, evaluation of reported illnesses, and counselling following a report of an occupational exposure incident to blood or other potentially infectious materials.

4.4.2.2 Employees covered in the ECP (those included in List I and List ii) who are exposed to blood or other potentially infectious materials shall be offered the post exposure evaluation and follow-up within 24 hours of the exposure.

4.4.2.3 If an employee, who was not included in the program, has an occupational exposure through a "Good Samaritan" act, the employee will be offered the post-exposure evaluation and follow-up in addition to the Hepatitis B vaccination at no charge and at a reasonable time and place (within 24 hours of the exposure).

4.4.2.4 The site HSE Manager shall ensure that the healthcare professional evaluating an employee after an exposure incident is provided the following information:

- A copy of any applicable regulation;
- A description of the exposed employee's duties as they relate to the exposure incident;
- Documentation of the route(s) of exposure and circumstances under which exposure occurred;
- Results of the source individual's blood testing, if available; and
- All medical records relevant to the appropriate treatment of the employee including vaccination status.

4.5 Regulated Waste Handling and Disposal



Bloodborne Pathogens

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

4.5.1 Each site shall make arrangements for the proper disposal of medical wastes (i.e., bandages, gauze, sharps, etc.) in accordance with AMS-710-04-PR-04123.

4.6 Record Retention

4.6.1 The following records shall be maintained in the site HSE files for the duration of the employee's employment plus thirty (30) years.

4.6.1.1 Medical Records. The medical records shall include:

- Name and social security number, as applicable, of the employee;
- A copy of the employee's hepatitis B vaccination status including dates of all the hepatitis B vaccinations and any medical records relative to the employee's ability to receive vaccination;
- A copy of all results of examinations, medical testing, and follow up procedures;
- Healthcare written opinion; and
- A copy of the information provided to the healthcare professional.

4.6.1.2 Training. Training records shall include the following:

- Dates of training sessions;
- Contents or a summary of the training sessions;
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training session.

4.6.1.3 Sharps Injury Log. The Sharp Injury Log shall contain:

- Type and brand of device involved in the incident;
- Department or work area where the exposure incident occurred; and
- Explanation of how the incident occurred.
- Data will be entered into APTIM's HSE Data Management System for use as the Sharps Injury Log.

5.0 REFERENCES

| | |
|---------------------|--------------------------|
| AMS-720-01-FM-00020 | Business Glossary |
| AMS-720-01-FM-00021 | Technical Glossary |
| AMS-710-04-PR-04123 | Medical Waste Management |

6.0 TERMINOLOGY

| | |
|---|---|
| Bloodborne Pathogens | Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV). |
| Engineering Controls | Controls (e.g., sharps disposal containers, self-sheathing needles, safer medical devices, such as sharps with engineered sharps injury protections and needleless systems) that isolate or remove the bloodborne pathogens hazard from the workplace. |
| Other Potentially Infectious Materials (OPIM) | (1) The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids; |



Bloodborne Pathogens

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

- (2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and
- (3) HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV

| | |
|------------------------|---|
| Regulated Wastes | Liquid or semi-liquid blood or other potentially infectious materials; contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or other potentially infectious materials. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| Universal Precautions | An approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens. |
| Work Practice Controls | Controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique). |

7.0 EXHIBITS

| | |
|-------------|--|
| Exhibit 7.1 | List I – Job Classifications with Regular Exposure |
| Exhibit 7.2 | List II – Job Classifications with Some Exposure |
| Exhibit 7.3 | List III – Tasks and Practices With Exposure |
| Exhibit 7.4 | Bloodborne Pathogens Plan Template – AMS-710-01-FM-00301 |

8.0 ATTACHMENTS

None



Bloodborne Pathogens

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

9.0 EXHIBIT 7.1 – LIST I JOB CLASSIFICATIONS WITH REGULAR EXPOSURE PAGE 1 OF 1

| JOB CLASSIFICATION | REGULAR EXPOSURE | SOME EXPOSURE | NO EXPOSURE |
|------------------------------|------------------|---------------|-------------|
| Staff Physician | X | | |
| Registered Nurse | X | | |
| Licensed Practical Nurse | X | | |
| Emergency Medical Technician | X | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |



Bloodborne Pathogens

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

EXHIBIT 7.2 – LIST II JOB CLASSIFICATIONS WITH SOME EXPOSURE PAGE 1 OF 1

| JOB CLASSIFICATION | REGULAR EXPOSURE | SOME EXPOSURE | NO EXPOSURE |
|--|------------------|---------------|-------------|
| First Aid/CPR Certified Personnel | | X | |
| Safety Representative | | X | |
| Security Representative | | X | |
| Custodian | | X | |
| Non-Designated EMT and First Aid/CPR Certified Personnel (Good Samaritans) | | | X |
| All Other APTIM Personnel (Good Samaritans) | | | X |



Bloodborne Pathogens

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00300 | 0 | 2/1/2018 |

EXHIBIT 7.3 - LIST III TASKS AND PRACTICES WITH EXPOSURE

PAGE 1 OF 1

| |
|---|
| TASKS AND PROCEDURES |
| Bleeding Control With Spurting Blood |
| Bleeding Control With Minimal Bleeding |
| Emergency Childbirth |
| Blood Drawing (Phlebotomy, Needle sticks, Etc.) |
| Starting An Intravenous (IV) Line |
| Endotracheal Intubation, Esophageal Obturator Use |
| Oral/Nasal Suctioning, Manually Cleaning Airway |
| Handling And Cleaning Instruments With Microbial Contamination |
| Giving Injections |
| Rendering First Aid |
| Rendering Cardiopulmonary Resuscitation (CPR) |
| Decontamination Following Accidents/Injuries |
| Vehicle/Equipment Accidents Where There Is Presence Of Blood |
| Rescue Of Bleeding Employee |
| Medical Procedures With Blood (Suturing And Suture Removal) |
| Handling Of Regulated Waste Containers |
| Laboratory Blood Processing |
| Wound Care |
| Epistaxis (Nosebleed) Control |
| Handling Of Contaminated Waste |
| Handling Of Contaminated Personal Protective Clothing & Equipment |
| Handling Of Contaminated Laundry And Personal Clothing |
| Housekeeping/Custodial Duties Where There Is Presence Of Blood |
| |

10.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|---------------------|--------------------|---------------------|
| Procedure Title: | Stop Work Authority | AMS Number: | AMS-710-05-PR-00400 |
| Procedure Owner: | HSE | Issuing Authority: | VP HSE |

STOP WORK AUTHORITY

| Rev | Changes | Approved | Date |
|-----|---|-------------------------|-----------|
| 1 | Added sections 4.5.3.7 and 4.5.3.8 to give more clarity on existing requirements. | M. Hetzler | 5/31/2018 |
| 0 | Updated to incorporate the APTIM branded STOP WORK Authority Card | M. Hetzler | 2/9/2018 |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |



Stop Work Authority

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-05-PR-00400 | 1 | 5/31/2018 |

1.0 PURPOSE

The purpose of this procedure is to outline the requirement of all employees to stop an unsafe act or condition in the workplace.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors, vendors, and site visitors associated with an APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure.

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Vendors
- APTIM Site Visitors

4.0 PROCEDURE

4.1 As an APTIM representative, employees have the responsibility and the authority, without fear of reprimand or retaliation, to immediately stop any work activity that presents a danger to themselves, co-workers, clients, the public, or the environment.

4.2 It is each employee's responsibility to get involved by questioning and rectifying any situation that is an at-risk behavior or condition. If the employee does not feel the issue is addressed adequately, the employee has the responsibility to raise it to a higher level.

4.3 No work will resume until all stop work issues and concerns have been adequately addressed.

4.4 Any form of retribution or intimidation directed at any individual or company for exercising their authority as outlined in this program will not be tolerated.

4.5 Follow the three steps identified on the Stop Work Authority (SWA) Card (Attachment 8.1)

4.5.1 Recognize the hazard that could bring harm to you, fellow employees or the environment.

When a person identifies a perceived unsafe condition, act, error, omission, or lack of understanding that could result in an undesirable event, a "stop work intervention shall be immediately initiated with the person(s) potentially at risk.

4.5.2 Stop the task before an incident happens. This may be the most difficult part, but it is a responsibility and an expectation. Remember, every employee has the authority to do so.

4.5.2.1 If the supervisor is readily available and the affected person(s) are not in immediate risk, the "stop work action" should be coordinated through the supervisor.

4.5.2.2 If the supervisor is not readily available or the affected person(s) are in immediate risk, the "stop work" intervention should be initiated directly with those at risk.

4.5.2.3 "Stop work" interventions should be initiated in a positive manner by briefly introducing yourself and clarifying the intent and set expectations of the Stop Work events.



Stop Work Authority

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-00400 | 1 | 5/31/2018 |

- 4.5.2.4 Notify all affected personnel and supervision of the stop work issue. If necessary, stop associated work activities, remove person(s) from the area, stabilize the situation and make the area as safe as possible.
- 4.5.3 Discuss the hazardous condition or behavior and share the information with others to help avoid similar situations. Develop a plan to eliminate or mitigate the hazard.
 - 4.5.3.1 All parties shall discuss and gain agreement on the stop work issue.
 - 4.5.3.2 If determined and agreed that the task or operation is okay to proceed as is (i.e., the stop work initiator was unaware of certain facts or procedures), the affected persons should thank the initiator for their concern and proceed with the work.
 - 4.5.3.3 If determined and agreed that the stop work issue is valid, then every attempt should be made to resolve the issue to all affected person's satisfaction prior to the commencement of work.
 - 4.5.3.4 If the stop work issue cannot be resolved immediately, work shall be suspended until proper resolution is achieved. When opinions differ regarding the validity of the stop work issue or adequacy of the resolution actions, the location's "person in charge" shall make the final determination.
 - 4.5.3.5 Positive feedback should be given to all affected employees regarding resolution of the stop work issue. Under no circumstances should retribution be directed at any person(s) who exercise in good faith their stop work authority as detailed in this program.
 - 4.5.3.6 All stop work interventions and associated detail shall be documented and reported via the behavior-based safety observation processes.
 - 4.5.3.7 Stop Work reports shall be reviewed by a supervisor or manager in order to measure participation, determine quality of interventions and follow-up, trend common issues, identify opportunities for improvement, and facilitate sharing of lessons learned.
 - 4.5.3.8 It is the desired outcome of any Stop Work Intervention that the identified safety concern(s) have been addressed to the satisfaction of all involved persons prior to the resumption of work. Most issues can be adequately resolved in a timely manner at the job site, occasionally additional investigation and corrective actions may be required to identify and address root causes.

4.6 Training

- 4.6.1 All employees and contractors shall be trained in the use of Stop Work Authority during APTIM HSE Induction.
- 4.6.2 Upon completion of training, employees and contractors shall be issued a SWA card.

5.0 REFERENCES

None

6.0 TERMINOLOGY

Term

Definition

Site

Any location, facility, or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned or leased facilities, and/or project sites.



Stop Work Authority

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-00400 | 1 | 5/31/2018 |

Supervisor

Person in control of the work and the personnel conducting the work (foreman, general foreman, superintendent)

7.0 EXHIBITS

Exhibit 7.1

AMS-720-01-FM-00020 – Business Glossary

Exhibit 7.2

AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

Attachment 8.1

Stop Work Authority Card



Stop Work Authority

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-00400 | 1 | 5/31/2018 |

ATTACHMENT 8.1

STOP WORK AUTHORITY CARD

PAGE 1 OF 1

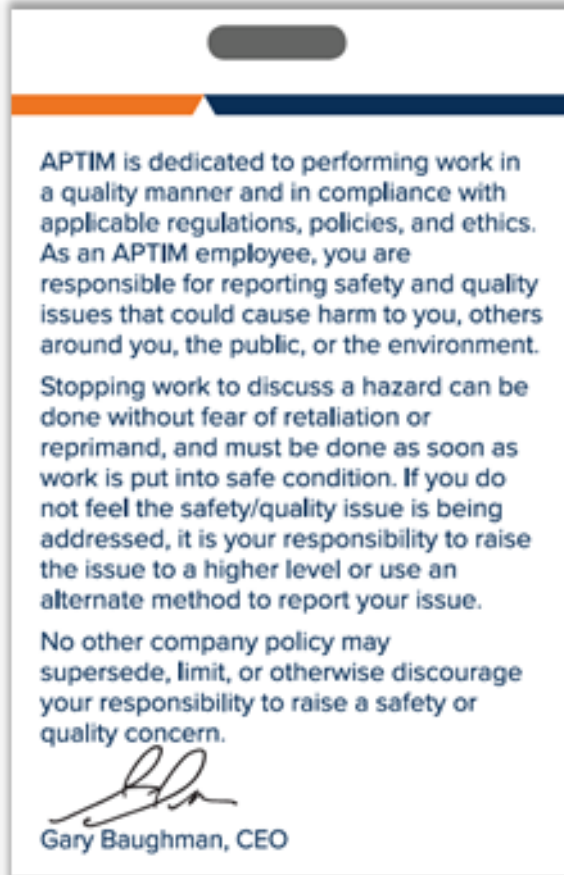


STOP WORK AUTHORITY

APTIM

- I will IDENTIFY** hazards that could cause harm to me, my fellow employees, others in the surrounding area, or to the environment.
- I will STOP** the task before a harmful event might occur. While this can be difficult or uncomfortable, I commit to using my authority to stop work in a respectful and timely manner.
- I will DISCUSS** the hazardous condition or behavior, share information with others to help avoid similar situations, and help develop a plan to eliminate or mitigate the hazard.


APTIM Ethics Line 1-800-461-9330



APTIM is dedicated to performing work in a quality manner and in compliance with applicable regulations, policies, and ethics. As an APTIM employee, you are responsible for reporting safety and quality issues that could cause harm to you, others around you, the public, or the environment.

Stopping work to discuss a hazard can be done without fear of retaliation or reprimand, and must be done as soon as work is put into safe condition. If you do not feel the safety/quality issue is being addressed, it is your responsibility to raise the issue to a higher level or use an alternate method to report your issue.

No other company policy may supersede, limit, or otherwise discourage your responsibility to raise a safety or quality concern.


Gary Baughman, CEO



PROCEDURE

| | | | |
|------------------|-----------------------------------|--------------------|---------------------------------|
| Procedure Title: | Hazardous Waste Operations | AMS Number: | AMS-710-04-PR-00300 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

HAZARDOUS WASTE OPERATIONS

| | | | |
|------------|------------------------|----------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Hazardous Waste Operations

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-04-PR-00300 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this procedure is to establish the minimum requirements for developing and implementing a written health and safety program for APTIM employees involved in hazardous waste operations conducted at treatment, storage, and disposal (TSD) facilities.

2.0 SCOPE

This procedure applies to personnel who develop and implement written HSE Programs for employees involved in hazardous waste operations.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees

4.0 PROCEDURE

4.1 General

The Site HSE Manager shall develop and implement a written safety and health program for employees involved in hazardous waste operations (AMS-710-04-WI-00301 Health and Safety Plans for Hazardous Waste Operations Sites). The program shall be designed to identify, evaluate, and control safety and health hazards in the facility for the purpose of employee protection. The program shall provide for emergency response and shall address, as appropriate, site analysis, engineering controls, maximum exposure limits, hazardous waste handling procedures, and the use of new technologies (AMS-710-04-WI-00302 Emergency Response at Hazardous Waste Sites).

4.2 Hazard Communication

The safety and health program shall contain a hazard communication program. Refer to AMS-710-01-PR-00400 Hazard Communication.

4.3 Emergency response

The safety and health program shall contain Emergency Response requirements or shall reference the Emergency Preparedness Plan (AMS-710-03-PR-00400).

4.4 Medical Surveillance

A medical surveillance program shall be developed and implemented. All employees who are or may be exposed to health hazards or hazardous substances at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels without regard to the use of respirators for thirty (30) days or more in a calendar year shall be included in the program at no cost to the employee.

4.5 Decontamination

4.5.1 A decontamination program shall be developed, communicated to employees, and implemented before any employees or equipment enters an area on site where potential exposure to hazardous substance(s) exists (AMS-710-04-WI-00305 Hazardous Waste Decontamination).

4.5.2 All employees leaving a contaminated area shall be appropriately decontaminated. All contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated (AMS-710-04-PR-04113 Waste Characterization).



Hazardous Waste Operations

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-04-PR-00300 | INT | 7/30/2017 |

- 4.5.3 Decontamination shall be performed in geographical areas that will minimize cross contamination or the exposure of uncontaminated employees or equipment.
- 4.5.4 The Site HSE Manager shall monitor all methods of decontamination and determine their effectiveness. If methods are found to be ineffective, appropriate steps will be taken to correct the deficiencies.
- 4.5.5 Regular showers and changing rooms shall be provided outside the contaminated area.

4.6 New Technology

A program shall be developed and implemented to introduce new and innovative equipment for employee protection into the work place.

4.7 Material Handling

Where employees handle drums or containers, AMS-710-02-PR-00300 Material Storage and Handling shall be implemented prior to starting such work.

4.8 Engineering Controls

Engineering controls work practices, personal protective equipment, or a combination of these shall be implemented in accordance with 29 CFR 1910.120 (g) to protect employees from exposure to hazardous substances and safety and health hazards.

4.9 Monitoring

4.9.1 General

Monitoring shall be performed in accordance with 29 CFR 1910.120 (h) to prevent employee exposure to hazardous concentrations of hazardous substances and to assure proper selection of engineering controls, work practices, and personal protective equipment (AMS-710-04-WI-00304 Hazardous Waste Site Control).

4.9.2 Air Monitoring

Air monitoring shall be used to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of employee protection.

4.9.3 Initial Entry

Upon initial entry, representative air monitoring shall be conducted to identify any immediately dangerous to life and health (IDLH) condition, exposure over Permissible Exposure Limits (PELs) or if other dangerous condition(s) exist (i.e., the presence of flammable atmosphere or oxygen deficient environments).

4.9.4 Periodic Monitoring

Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed, or when there is indication that exposure may have risen over PELs. Periodic monitoring shall be considered when the PELs have risen and one or more of the following scenarios occur:

- Beginning of new work on a different portion of the site
- Contaminates other than those previously identified are being handled
- When a different type of operation is initiated
- When obvious liquid contamination is present

4.10 Training

All employees working on sites or at treatment, storage, and disposal (TSD) operations where they may be exposed to health hazards or hazardous substances must receive training to enable the employees to perform their assigned duties and functions in a safe and healthful manner so as not to endanger themselves or other employees (AMS-710-04-WI-00303 Hazardous Waste Operations Training).



Hazardous Waste Operations

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-04-PR-00300 | INT | 7/30/2017 |

4.10.1 New Employees

Employees engaged in hazardous substance removal or other activities, which expose or potentially expose them to hazardous substances and health hazards shall receive initial training which consists of a minimum of 40 hours of instruction off-site and three days of field experience, under direct supervision of a trained, experienced supervisor as described in 29 CFR 1910.120.

4.10.2 Current Employees

Current employees whose previous work experience and/or training are equivalent to the initial training requirement shall be considered as having met the initial training requirements. The Training Manager or his/her designee shall make the determination of equivalency. Current employees shall receive 8 hours of refresher training annually as described in 29 CFR 1910.120.

4.10.3 Trainers

Trainers shall be qualified to instruct employees on the subject matter presented in training. Such trainers shall have satisfactorily completed a training program for teaching their subjects, or they shall have the academic credentials and instructional experience necessary to teach as described in 29 CFR 1910.120.

4.11 Project Manager shall:

4.11.1 Verify compliance with the appropriate regulatory standard(s)

4.11.2 Ensure project-specific Health and Safety Program (HASP) documents are applicable health and safety requirements

4.12 HSE Representative shall:

4.12.1 Verify compliance with the appropriate regulatory standard(s) (AMS-710-04-WP-00001 Implement Environmental Management System (EMS)).

4.12.2 Ensure project-specific Health and Safety Program (HASP) documents are applicable health and safety requirements

4.12.3 Ensure medical and exposure records are handled correctly (AMS-710-01-PR-03500)

5.0 REFERENCES

| | |
|---------------------|--|
| 29 CFR 1910.1200 | Hazard Communication |
| 29 CFR 1910.141 | Sanitation |
| AMS-710-01-PR-00400 | Hazard Communication |
| AMS-710-03-PR-00400 | Emergency Preparedness Plan |
| AMS-710-01-PR-03500 | Medical and Exposure Records |
| AMS-710-02-PR-00300 | Material Storage and Handling |
| AMS-710-04-PR-04113 | Waste Characterization |
| AMS-710-04-WI-00301 | Health and Safety Plans for Hazardous Waste Operations Sites |
| AMS-710-04-WI-00302 | Emergency Response at Hazardous Waste Sites |
| AMS-710-04-WI-00303 | Hazardous Waste Operations Training |



Hazardous Waste Operations

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-04-PR-00300 | INT | 7/30/2017 |

| | |
|---------------------|---|
| AMS-710-04-WI-00304 | Hazardous Waste Site Control |
| AMS-710-04-WI-00305 | Hazardous Waste Decontamination |
| AMS-710-04-WP-00001 | Implement Environmental Management System (EMS) |

6.0 TERMINOLOGY

Term

Definition

| | |
|---|--|
| Buddy System | A system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in case of an emergency. |
| Clean-up Operation | An operation where hazardous substances are removed, contained, incinerated, neutralized, cleared-up, or in any manner processed or handled with ultimate goal of making the site safer for people or the environment. |
| Decontamination | The removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health effects. |
| Emergency Response or Responding to Emergencies | A response effort by employees from outside the immediate release area or by designated responders to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered emergency responses. Responses to releases of hazardous substances where there is no potential safety or health hazard are not considered to be emergency responses. |
| Facility | Any building, structure, installation, equipment, pipe or pipeline, well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel. |
| Hazardous Substance | A substance which results or may result in adverse effects on the health or safety of employees. |
| Health Hazard | A chemical, mixture of chemicals, or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. Health hazards include: chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes, or mucous membranes. |

7.0 EXHIBITS

| | |
|---------------------|-------------------|
| AMS-720-01-FM-00020 | Business Glossary |
|---------------------|-------------------|



Hazardous Waste Operations

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-04-PR-00300 | INT | 7/30/2017 |

AMS-720-01-FM-00021

Technical Glossary

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|-----------------------------|--------------------|--------------------------|
| Procedure Title: | Work Area Hazard Assessment | AMS Number: | AMS-710-05-PR-01700 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

WORK AREA HAZARD ASSESSMENT

| | | | |
|------------|------------------------|-------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Work Area Hazard Assessment

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-01700 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Work Area Hazard Assessment on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors, and visitors associated with a APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors

4.0 PROCEDURE

4.1 Work Area Hazard/Recognition Process Philosophy

4.1.1 It is The Work Area Hazard/Recognition Process Philosophy that a hazard's risk potential is the product of the Level of Focus and the Level of Distraction. The Level of Focus and the Level of Distraction have an inverse relationship. An increase in focus shall decrease the distraction resulting in less risk potential for an incident to occur at the actual work front. An increase in distraction shall have a decrease in focus resulting in a greater risk potential for an incident to occur at the actual work front. This philosophy is applicable at all levels, phases, and stages of work activity.

4.1.2 Varied types of work hazard analyses are to be conducted to mitigate hazard risk potential with the Level of Focus increasing and the Level of Distraction decreasing as the hazard analysis becomes nearer to the actual work activity.

4.1.3 The result from the completion of every hazard analysis/recognition process becomes the basis from which to begin the next level of hazard analysis/recognition study. This process is visually displayed in the Pyramid of Work Area Hazard Recognition/ Assessment (Figure 4-1).

4.1.4 If during the Work Area Hazard/Recognition Process it is discovered that a previous step failed to identify a potential risk or hazard, then the previous step shall be repeated or revisited to incorporate the new findings.

4.1.5 Work shall not proceed to the next level or step of the Work Area Hazard Analysis Process prior to the completion of the previous step.

4.2 Work Area Hazard Assessment Flow

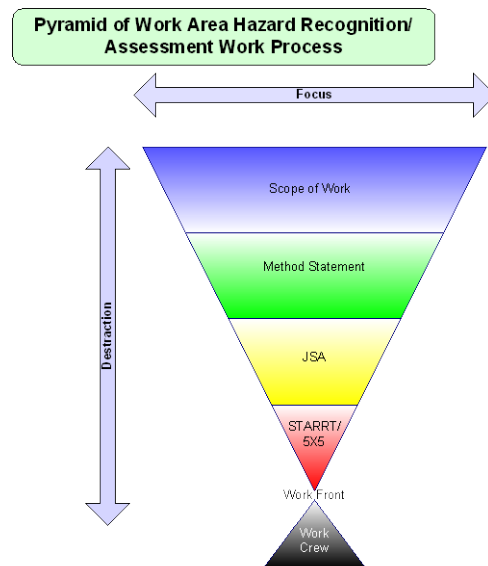


Figure 4-1



Work Area Hazard Assessment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-01700 | INT | 7/30/2017 |

- 4.2.1 The basic work flow process is depicted in Attachment 8.1. Utilizing this methodology each site shall develop a Work Area Hazard Assessment Process specific to their needs. Performing a method statement is a best management practice to tie steps one (1) and three (3) together, but is not required
- 4.2.2 The location specific Work Area Hazard Assessment Process shall minimally include a means of engaging the supervision in developing an assessment prior to the start of work and a method of engaging their respective work crews in the assessment process. The location specific Work Area Hazard Assessment Process shall, minimally, have a means of ensuring each worker has the opportunity to conduct a 360° review of their specific work task, as well as documenting that review.
- 4.2.3 Scope of Work (Step One)
 - 4.2.3.1 The first step in the Work Hazard Analysis/Recognition Process begins with the process of defining the Scope of Work. The Scope of Work is a definition of the work to be performed. The objective is to establish an understanding of the work to be performed.
 - 4.2.3.2 The Scope of Work shall define the major elements of work to be executed (e.g., civil, structural, mechanical, or electrical).
 - 4.2.3.3 Within the Scope of Work each of the major disciplines shall be defined to include elements such as:
 - Painting and coating
 - Instrumentation and electrical
 - Structural
 - Civil
 - 4.2.3.4 The major disciplines identified in the Scope of Work review shall serve as the basis for development of the method statements
- 4.2.4 Method Statement (Step Two)
 - 4.2.4.1 The second step in the Work Hazard Analysis/Recognition Process entails the development of a Work Method Statement or equivalent document (e.g., Job Hazard Assessment). A Work Method Statement shall provide specific instructions on the work to be performed, outline hazards involved, and identify key safety measures to be implemented during the work activity. The Method Statement shall also detail which control measures have been introduced to ensure the safety of anyone who is affected by the task or process.
 - 4.2.4.2 For each discipline of work identified under the site scope of work the Site Manager shall prepare Method Statements, using AMS-710-05-FM-01702— Sample Method Statement 2.
 - 4.2.4.3 The site HSE Manager/Supervisor shall maintain a copy of the site method statements and shall submit copies to Business Unit/Operating Group HSE Director or designee for business sector, area, district and/or global application.
 - 4.2.4.4 Within the Method Statement the following minimum information shall be included:
 - Sequence of key activities
 - Identification of the craft required, including necessary skill/certification
 - Identification of the tools and equipment required
 - A clear statement of responsible persons, i.e., who is in charge of the work, who has specific responsibilities, e.g., flagmen, riggers.
 - Identification of what materials are required for execution of the activity



Work Area Hazard Assessment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-01700 | INT | 7/30/2017 |

- Identification of what services are required and how they shall be provided
- Reference to emergency procedures, including contact telephone numbers, reference to emergency provisions such as spill kits.
- Key activities identified in the Method Statement(s) (or equivalent document(s)) shall serve as the basis for the development of an activity specific Job Safety Analysis (JSA).

4.2.5 Job Safety Analysis (Step Three)

4.2.5.1 The third step in the Work Area Hazard Analysis/Recognition Process is to develop a JSA for each key activity to be performed, during the shift. A JSA shall document each step of the activities, identify potential hazards associated with each step, and list the control measure(s) to be used to mitigate the potential hazard(s).

4.2.5.1 A new JSA shall be completed at the work location every day, before commencement of any work activity and updated in the event of changing conditions. If conditions that a work crew encounters during a work period (inclement weather, another contractor began work in area change), the JSA shall be modified to address the new hazards. The JSA shall be changed to reflect new conditions in the task being performed or new hazards not identified previously.

4.2.5.2 Utilize the hierarchy of control measures to develop safe job procedures to eliminate or mitigate the hazards and prevent potential accidents:

1. Eliminate the hazard if possible
2. Use engineering controls to mitigate the hazard
3. Use administrative controls to minimize exposure
4. Use PPE

4.2.5.3 For each key activity identified under the site method statement supervision shall prepare a JSA. Supervision should use one of the following to prepare the JSA:

- AMS-710-05-FM-01704—Sample JSA 1
- AMS-710-05-FM-01705—Sample JSA 2
- AMS-710-05-FM-01708—Sample JSA 3

4.2.5.4 Supervision shall review the prepared JSA prior to work and ensure all appropriate elements are addressed in the JSA and that it is specific to their planned work activities.

4.2.5.5 The supervisor shall review the completed JSA with their respective work crews prior to starting the work activity.

4.2.5.6 Periodic reviews shall be conducted by the site HSE Manager and Senior Level Site Manager to ensure the integrity of the JSA process.

4.2.5.7 JSA's are to remain with the work crew(s) until the task(s) are completed at which time they shall be submitted to the site HSE Manager for inclusion in the site HSE files.

4.2.5.8 These steps identified in the JSA shall serve as the basis for development of job step specific worker completed assessments.

4.2.6 5 x 5 Analysis/STARRT (Step Four)

4.2.6.1 The fourth step in the Work Hazard Analysis/Recognition Process is to develop a 5 X 5 Analysis/Safety Task Analysis and Risk Reduction Talk (STARRT) Card or equivalent form) just prior to the performance of the work. The job or task specific analysis is performed by the individual who is to



Work Area Hazard Assessment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-01700 | INT | 7/30/2017 |

perform the work. This is the individual's opportunity to confirm that he has everything needed to perform the work in a safe manner.

- 4.2.6.2 The individual shall prepare job step specific analysis, using one of the following
 - AMS-710-05-FM-01706—Sample 5x5 Analysis
 - AMS-710-05-FM-01707—Sample STARRT Card
 - Or an equivalent form
- 4.2.6.3 The work crew shall be actively involved in conducting a 360° review of their specific work area, identifying hazards of their work and the hazards of work activities that surround them. The work crew lead and the work crew shall collectively review the means of mitigation and ensure proper controls and measures are in place.
- 4.2.6.4 The job or task specific analysis is a tool for the individual to identify any unaccounted hazards that one may encounter associated with the tasks they shall actually be performing.

5.0 REFERENCES

None

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|-----------------------------|--|
| Hazard | A condition, practice, behavior or situation, or a combination of these, that can cause injury or illness in people, or damage to the environment or property. |
| JSA | Job Safety Analysis, technique that focuses on job tasks as a way to identify hazards before they occur |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| Work Area Hazard Assessment | Evaluation of a work place condition, practice, behavior or situation that an employee may encounter while performing a job/task that has the potential for risks/hazards. |

7.0 EXHIBITS

| | |
|-------------|---|
| Exhibit 7.2 | AMS-710-05-FM-01702—Sample Method Statement 2 |
| Exhibit 7.3 | AMS-710-05-FM-01704—Sample JSA 1 |
| Exhibit 7.4 | AMS-710-05-FM-01705—Sample JSA 2 |
| Exhibit 7.5 | AMS-710-05-FM-01706—Sample 5x5 Card |
| Exhibit 7.6 | AMS-710-05-FM-01707—Sample STARRT Card |
| Exhibit 7.7 | AMS-710-05-FM-01708---Sample JSA 3 |
| Exhibit 7.8 | AMS-720-01-FM-00020---Business Glossary |
| Exhibit 7.9 | AMS-720-01-FM-00021---Technical Glossary |

8.0 ATTCHMENTS

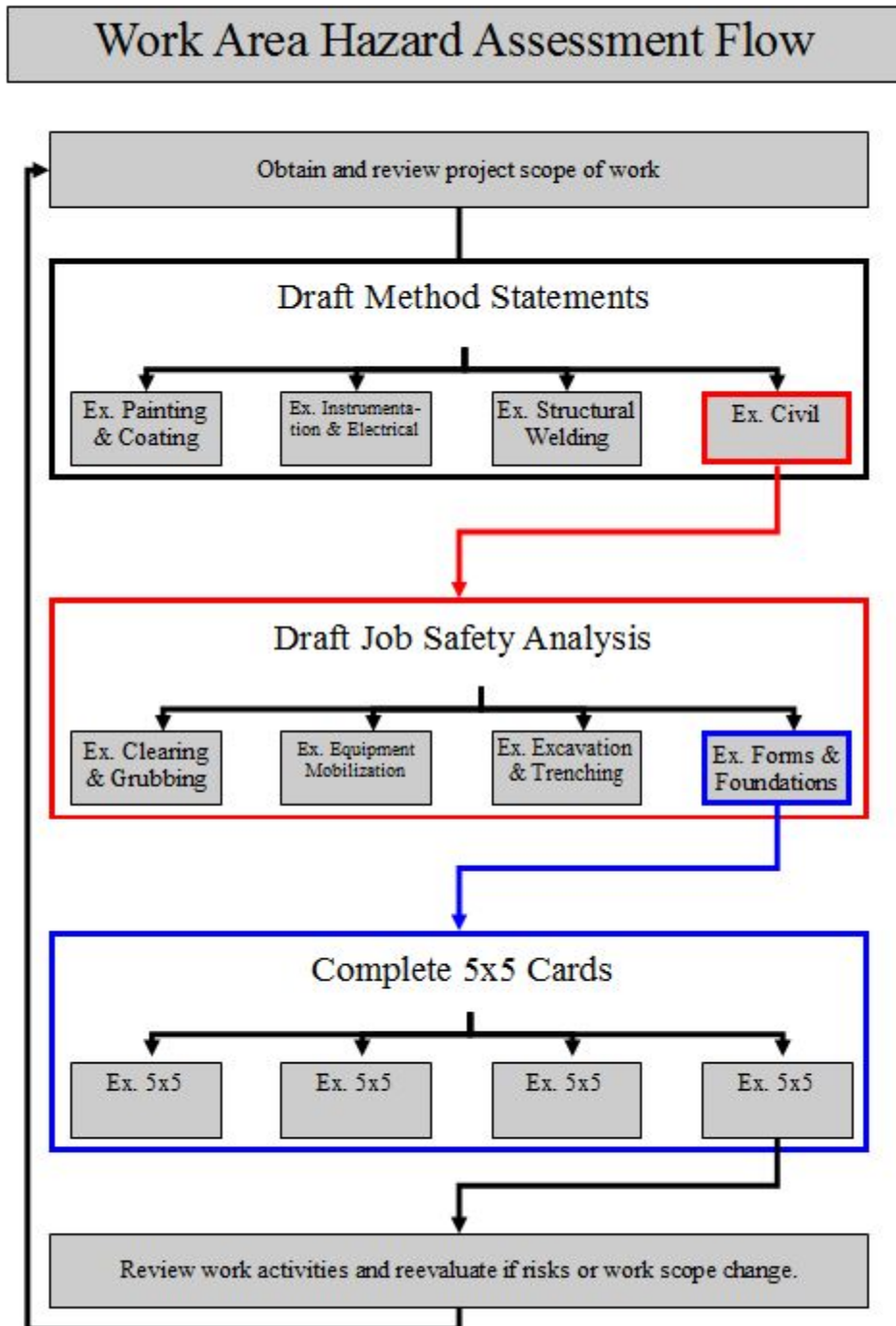
Attachment 8.1 Work Area Hazard Assessment Process Flow



Work Area Hazard Assessment

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-05-PR-01700 | INT | 7/30/2017 |

Attachment 8.1 Work Area Hazard Assessment Process Flow





PROCEDURE

| | | | |
|------------------|-------------------------------|--------------------|--------------------------|
| Procedure Title: | Personal Protective Equipment | AMS Number: | AMS-710-02-PR-03000 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

PERSONAL PROTECTIVE EQUIPMENT

| Rev | Changes | Approved | Date |
|-----|------------------------|----------------------------|-----------|
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| | | | |
| | | | |
| | | | |
| | | | |



Personal Protective Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03000 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for the use of Personal Protective Equipment (PPE) on APTIM sites.

2.0 SCOPE

This procedure applies to all employees of APTIM, contractors, subcontractors and visitors associated with a APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

4.1 Requirements

- 4.1.1 PPE is the last line of defense against hazards and shall not be used as a substitute for engineering, work practice, and/or administrative controls. PPE shall be used in conjunction with these controls to ensure employee safety and health. PPE includes all clothing or other work accessories designed to create a barrier against work place hazards. Employees must be made aware that PPE does not eliminate the hazard. If PPE fails, hazard exposure will occur.
- 4.1.2 Every attempt shall be made to prevent the possibility of incidents when employees perform work activities by providing them with the appropriate PPE, through compliance with safety regulations and training of employees to properly use, inspect and wear the required PPE and through employee involvement in safe work activities.
- 4.1.3 The Company reserves the right to select and/or approve all PPE to be issued and used by its employees, visitors, and/or subcontractors. Only such equipment issued or approved will be allowed on its jobsites. Failure to comply with this procedure will result in disciplinary action up to and including termination in accordance with AMS-710-05-PR-00200.
- 4.1.4 The Site Manager shall ensure that the Site HSE Manager has assessed the workplace to determine if hazards are present or likely to be present. This assessment shall be documented in writing. The documentation shall identify the work place, the person(s) evaluating the work place, the dates of the assessment, and the hazards if any. The Site Manager shall approve the hazard assessment as accurate and complete. If hazards are present, controls shall be implemented to eliminate or reduce the hazard. If controls are not available and/or the hazard is not eliminated, the requisite PPE shall be used. APTIM Management shall:
 - 4.1.4.1 Select and have each affected employee use the types of PPE chosen.
 - 4.1.4.2 Communicate appropriate selection of PPE to employees. (Training).
 - 4.1.4.3 Ensure that employees have PPE that properly fits them.
 - 4.1.4.4 Ensure that employees understand the proper usage of the required PPE.



Personal Protective Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03000 | INT | 7/30/2017 |

- 4.1.5 Workers must report any damaged or defective PPE and the defective or damaged PPE shall be removed from service and shall not be reused.
- 4.1.6 APTIM shall ensure that each employee who is required to wear PPE is trained in the following:
 - 4.1.6.1 When PPE is necessary.
 - 4.1.6.2 What PPE is necessary.
 - 4.1.6.3 How to put on, take off, adjust, and wear the PPE.
 - 4.1.6.4 The limits of the PPE.
 - 4.1.6.5 The proper care, maintenance, useful life, inspection and disposal of the PPE.
 - 4.1.6.6 The proper practices for keeping the PPE clean and hygienic.
 - 4.1.6.7 The proper use to ensure the PPE is not misused or damaged.
- 4.1.7 Each affected employee shall demonstrate an understanding of the training and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE.
- 4.1.8 When there is reason to believe that any affected employee who has already been trained does not have the understanding and skill required, the employee shall be retrained. Circumstances where retraining is required include, but are not limited to, the following:
 - 4.1.8.1 Changes in the workplace which renders previous training obsolete.
 - 4.1.8.2 Changes in the type of PPE to be used which renders previous training obsolete.
 - 4.1.8.3 Inadequacies in an affected employee's knowledge or use of assigned PPE.
- 4.2 The Site HSE Manager along with Site Management will authorize the purchase of appropriate types and models of PPE.
- 4.3 The company will provide all PPE to the employee at no cost to the employee with exception of items deemed to be personal in nature to include, but not limited to:
 - 4.3.1 Prescription Safety Eyewear
 - 4.3.2 Thermal undergarments
 - 4.3.3 Safety Toed Protective Footwear
 - 4.3.4 Sites may, at their discretion, accept the cost of these personal in nature items as well.
- 4.4 The site shall document each affected employee has been trained using the Personal Protective Equipment Training Record form, AMS-710-01-FM-03001. The written documentation shall include the name of each employee trained, the dates of the training, and the subject of the training.
- 4.5 Employee-owned Equipment
 - 4.5.1 Each employee shall be issued a hard hat (AMS-710-02-PR-03100), protective eyewear (AMS-710-02-PR-03200), hearing protection (AMS-710-01-PR-00900), hand protection (AMS-710-02-PR-03400) and/or respiratory protection (AMS-710-02-PR-03500), fall protection (AMS-710-02-PR-00900), personal flotation devices (AMS-710-02-PR-03700) and flagmen and traffic vests (AMS-710-02-PR-03600) if required. An employee wishing to utilize their own PPE must be able to demonstrate it meets APTIM requirements and must pass inspection by the Site HSE Manager.



Personal Protective Equipment

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03000 | INT | 7/30/2017 |

4.5.2 Employees are responsible to provide their own work clothes (AMS-710-02-PR-03800) and sturdy safety-toed work boots (AMS-710-02-PR-03300) that meet APTIM's PPE requirements. Should an employee report for work with unsatisfactory PPE, the employee will not be permitted to work until APTIM's requirements are met.

4.6 Miscellaneous

4.6.1 Sweat Pads

4.6.1.1 When weather or working conditions cause perspiration, sponge pads can be worn on the forehead to prevent perspiration from seeping into eyes or fogging safety goggles.

4.6.2 Sunscreen

4.6.2.1 Clothing, hats and shade are the best method for protecting skin from ultraviolet (UV) rays. Any remaining exposed skin may be protected by applying sunscreen with approval from the Site HSE Manager. In active facilities approval for use of sunscreen must be obtained from the client.

5.0 REFERENCES

| | |
|---------------------|--|
| AMS-710-02-PR-03100 | Head Protection |
| AMS-710-02-PR-03200 | Eye Protection |
| AMS-710-02-PR-03300 | Foot Protection |
| AMS-710-02-PR-03400 | Hand Protection |
| AMS-710-02-PR-03500 | Respiratory Protection |
| AMS-710-02-PR-03600 | Flagmen and Traffic Vests |
| AMS-710-02-PR-03700 | Personal Floatation Devices |
| AMS-710-02-PR-03800 | Basic Work Clothing |
| AMS-710-02-PR-00900 | Fall Protection |
| AMS-710-01-PR-00900 | Noise Control and Hearing Conservation |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|-------------|--|
| PPE | Personal Protective Equipment |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |

7.0 EXHIBITS

| | |
|-------------|---|
| Exhibit 7.1 | AMS-710-02-FM-03001 – Personal Protective Equipment Training Record |
| Exhibit 7.2 | AMS-710-02-FM-03002 – Global Approved PPE Listing |
| Exhibit 7.3 | AMS-720-01-FM-00020 – Business Glossary |
| Exhibit 7.4 | AMS-720-01-FM-00021 – Technical Glossary |

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|------------------------|--------------------|--------------------------|
| Procedure Title: | Respiratory Protection | AMS Number: | AMS-710-02-PR-03500 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

RESPIRATORY PROTECTION

| | | | |
|-----|------------------------|----------------------------|-----------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Respiratory Protection on APTIM projects and at office, warehouse, or shop locations.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors and visitors associated with a APTIM project, office, warehouse, or shop locations.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

Each project, shop, warehouse or facility shall follow this procedure and use it as the minimum guidelines to develop their site specific procedure for Respiratory Protection.

4.1 General

- 4.1.1 Every consideration will be given to the use of effective engineering controls to eliminate or reduce exposure to respiratory hazards to the point where respirators are not required. However, when feasible engineering controls are not effective in controlling toxic substances, the company, at no charge, will provide appropriate respiratory protective equipment to the employee.
- 4.1.2 Employees required to use respiratory protective devices because of exposure to toxic substances will do so as a condition of employment. Employees required to use respirators will be properly fitted, appropriately tested, medically screened, and thoroughly trained in their use.

4.2 Written Plan

- 4.2.1 A written Respiratory Protection Plan will be developed for the specific respiratory hazards of the location based upon a location/task risk assessment. The written Plan will also include information that is to be included in training, the provisions for controlling the distribution of respirators, the method to be used for cleaning and maintenance of respirators, and how the requirements of this Procedure will be met at the location level.
- 4.2.2 The Location HSE Manager is responsible for the development and implementation of the location-specific respiratory protection program.
- 4.2.3 The Location HSE Manager will develop a respiratory hazard assessment specific to their risks using AMS-710-02-FM-03507. This hazard assessment will be reviewed, minimally, on an annual basis or as changing conditions warrant.

4.3 Respirator Selection and Use

- 4.3.1 If a question exists concerning the type of respirator required Corporate HSE shall be consulted.
- 4.3.2 The Location HSE Manager will select respirators to be used on site, based on the hazards to which workers are exposed. The Location HSE Manager will conduct a hazard evaluation for each operation, process, or work area where airborne



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

contaminants may be present in routine operations or during an emergency. The hazard evaluation will include:

- 4.3.2.1 Identification and development of a list of hazardous substances used in the workplace, by department, or work process.
- 4.3.2.2 Review of work processes to determine where potential exposures to these hazardous substances may occur. This review shall be conducted by surveying the workplace, reviewing process records, and talking with employees and supervisors.
- 4.3.2.3 Exposure monitoring to quantify potential hazardous exposures.
- 4.3.3 Issuing Respirators
 - 4.3.3.1 Respirators will not be fit tested or issued to individuals who have facial hair (including stubble) or any other condition, which interferes with the sealing surface of the respirator.
 - 4.3.3.2 Respirators will not be fit tested nor issued to individuals who have not received appropriate respirator training in addition to fit testing and a medical clearance.
 - 4.3.3.3 Employee owned respirators shall not be used.
- 4.3.4 General Use Procedures:
 - 4.3.4.1 Employees will use their respirators under conditions specified by this program, and in accordance with the training they receive on the use of each particular model. In addition, the respirator shall not be used in a manner for which it is not certified by NIOSH or by its manufacturer.
 - 4.3.4.2 All employees shall conduct user seal checks each time that they wear their respirator. Employees shall use either the positive or negative pressure check (depending on which test works best for them) specified in Appendix B-1 of the Respiratory Protection Standard.
 - 4.3.4.3 All employees shall be permitted to leave the work area to go to the locker room to maintain their respirator for the following reasons: to clean their respirator if the respirator is impeding their ability to work, change filters or cartridges, replace parts, or to inspect respirator if it stops functioning as intended. Employees should notify their supervisor before leaving the area.
 - 4.3.4.4 Employees are not permitted to wear tight-fitting respirators if they have any condition, such as facial scars, facial hair, or missing dentures, that prevents them from achieving a good seal. Employees are not permitted to wear headphones, jewelry, or other articles that may interfere with the face piece-to-face seal.
 - 4.3.4.5 Once the type of respirator that is applicable and suitable for the purpose intended has been selected, the selection process should give consideration to the fit and comfort of the respirator.
- 4.3.5 Emergency Procedures:
 - 4.3.5.1 When an alarm sounds, employees in the affected department must immediately don their emergency escape respirator, shut down their process equipment, and exit the work area. All other employees must immediately evacuate the building. The location specific Emergency Preparedness Plan describes these procedures (including proper evacuation routes and rally points) in greater detail.
- 4.3.6 Respirator Malfunction



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

- 4.3.6.1 For any malfunction of an APR (e.g., such as breakthrough, facepiece leakage, or improperly working valve), the respirator wearer should inform his or her supervisor that the respirator no longer functions as intended, and go to the designated safe area to maintain the respirator. The supervisor must ensure that the employee receives the needed parts to repair the respirator, or is provided with a new respirator.
- 4.3.6.2 All workers wearing atmosphere-supplying respirators will work with a “buddy”.
- 4.3.6.3 If a worker experiences a malfunction of an SAR, he or she should signal to the “buddy” that he or she has had a respirator malfunction. The buddy shall don an emergency escape respirator and aid the worker in immediately exiting the spray booth.

4.4 Breathing Air Quality and Use

- 4.4.1 The Location HSE Manager shall ensure that compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration accords with the following specifications:
- 4.4.2 Compressed and liquid oxygen shall meet the United States Pharmacopoeia requirements for medical or breathing oxygen; and
- 4.4.3 Compressed breathing air shall meet at least the requirements for Grade D breathing air described in ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989, to include:
 - 4.4.3.1 Oxygen content (v/v) of 19.5-23.5%;
 - 4.4.3.2 Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;
 - 4.4.3.3 Carbon monoxide (CO) content of 10 ppm or less;
 - 4.4.3.4 Carbon dioxide content of 1,000 ppm or less; and
 - 4.4.3.5 Lack of noticeable odor.
- 4.4.4 The Location HSE Manager shall ensure that compressed oxygen is not used in atmosphere-supplying respirators that have previously used compressed air.
- 4.4.5 The Location HSE Manager shall ensure that oxygen concentrations greater than 23.5% are used only in equipment designed for oxygen service or distribution.
- 4.4.6 For supplied-air respirators, only Grade D breathing air shall be used in the cylinders. The Location HSE Manager will coordinate deliveries of compressed air with the company’s vendor, Compressed Air Inc., and require Compressed Air Inc. to certify that the air in the cylinders meets the specifications of Grade D breathing air.
- 4.4.7 The Location HSE Manager will maintain a minimum air supply of one fully charged replacement cylinder for each SAR unit. In addition, cylinders may be recharged as necessary from the breathing air cascade system located near the respirator storage area.
- 4.4.8 For all IDLH atmospheres, the location shall ensure that:
 - 4.4.8.1 One employee or, when needed, more than one employee is located outside the IDLH atmosphere;
 - 4.4.8.2 Visual, voice, or signal line communication is maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere;
 - 4.4.8.3 The employee(s) located outside the IDLH atmosphere are trained and equipped to provide effective emergency rescue;



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

- 4.4.8.4 The Location HSE Manager shall be notified before the employee(s) located outside the IDLH atmosphere enter the IDLH atmosphere to provide emergency rescue;
- 4.4.8.5 The Location Area HSE Manager shall review the JSA and approve all respiratory protection to be used in potentially IDLH Environments.
- 4.4.8.6 Equivalent means for rescue where retrieval equipment is not required.

4.5 Medical Evaluation

- 4.5.1 Employees who are either required to wear respirators, or who choose to wear an APR voluntarily, must successfully complete a medical evaluation before being permitted to wear a respirator on the job.
- 4.5.2 Employees are not permitted to wear respirators until a physician has determined that they are medically able to do so. Any employee refusing the medical evaluation will not be allowed to work in an area requiring respirator use.
- 4.5.3 A licensed and company approved physician will provide the medical evaluations. Medical evaluation procedures are as follows:
 - 4.5.3.1 The medical evaluation will be conducted using AMS-710-02-FM-03501. The Location HSE Manager will provide a copy of this questionnaire to all employees requiring medical evaluations. To the extent feasible, the company will assist employees who are unable to read the questionnaire (by providing help in reading the questionnaire). When this is not possible, the employee will be sent directly to the physician for medical evaluation.
 - 4.5.3.2 All affected employees will be given a copy of the medical questionnaire to fill out, along with a stamped and addressed envelope for mailing the questionnaire to the company physician. Employees will be permitted to fill out the questionnaire on company time.
 - 4.5.3.3 Follow-up medical exams will be granted to employees as required by the standard, and/or as deemed necessary by the company approved physician.
 - 4.5.3.4 All employees will be granted the opportunity to speak with the physician about their medical evaluation, if they so request.
 - 4.5.3.5 The Location HSE Manager has provided the company approved physician with a copy of this program, a copy of the Respiratory Protection standard, the list of hazardous substances by work area, and for each employee requiring evaluation:
 - His or her work area or job title
 - Proposed respirator type and weight
 - Length of time required to wear respirator
 - Expected physical work load (light, moderate, or heavy)
 - Potential temperature and humidity extremes
 - Any additional protective clothing required
 - 4.5.3.6 Any employee required for medical reasons to wear a positive pressure air purifying respirator will be provided with a powered air purifying respirator.
 - 4.5.3.7 After an employee has received clearance and begun to wear his or her respirator, additional medical evaluations will be provided under the following circumstances:
 - Employee reports signs and/or symptoms related to their ability to use a respirator, such as shortness of breath, dizziness, chest pains, or wheezing.



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

- The company approved physician or supervisor informs the Location HSE Manager that the employee needs to be reevaluated;
- Information from this program, including observations made during fit testing and program evaluation, indicates a need for reevaluation;
- A change occurs in workplace conditions that may result in an increased physiological burden on the employee.

4.5.4 The Location HSE Manager will maintain a list of employees currently included in the respiratory protection program and having successfully completed the medical evaluation requirements of this procedure.

4.5.5 All examinations and questionnaires are to remain confidential between the employee and the physician.

4.5.6 Medical Forms

4.5.6.1 When conducting the initial medical evaluation, the Medical Questionnaire for Respirator Use (AMS-710-02-FM-03501) must be used.

4.5.6.2 In addition to the standardized questionnaire, the physician must also be furnished with a copy of the latest OSHA Standard governing the type of exposure to which the employee will be subjected. A description of the employee's duties as they relate to the exposure, the anticipated exposure level, a description of the respiratory protective equipment to be used, and any available information from previous medical evaluations of the employee must also be furnished to the physician on the Request for Medical Evaluation for Respirator Use (AMS-710-02-FM-03502).

4.5.6.3 At the conclusion of the evaluation, the physician will submit a written opinion to the Company on the bottom of AMS-710-02-FM-03502. This will contain the results of the evaluation and any recommendations from the physician regarding the employee's limitations.

4.5.6.4 The Company must furnish a copy of the physician's opinion to the employee, within thirty (30) days of its receipt by the Company.

4.6 Fit-Testing Requirements

4.6.1 Employees who are required to wear half-facepiece APRs will be fit tested:

4.6.1.1 Prior to being allowed to wear any respirator with a tight fitting facepiece.

4.6.1.2 Annually.

4.6.1.3 When there are changes in the employee's physical condition that could affect respiratory fit (e.g., obvious change in body weight, facial scarring, etc.).

4.6.2 Employees will be fit tested with the make, model, and size of respirator that they will actually wear. Employees will be provided with several models and sizes of respirators so that they may find an optimal fit. Fit testing of PAPRs is to be conducted in the negative pressure mode.

4.6.3 Respirators will be fitted properly and be tested for their face piece-to-face seal.

4.6.4 There are two acceptable methods for conducting these tests:

- Qualitative
- Quantitative

4.6.5 The fit test is valid only for respirators of the same model and size tested.

4.6.6 Qualitative fit testing is based on the wearer's subjective response to a challenge atmosphere, of which three popular tests are: the irritant smoke test, the saccharin solution test, and the odorous vapor test.



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

4.6.7 Irritant Smoke Test:

4.6.7.1 Directing an irritant smoke from a smoke tube towards the respirator being worn performs the Irritant Smoke Test. If the wearer does not detect the irritant smoke, a satisfactory fit is assumed to be achieved.

4.6.7.2 Since this type of test provokes an involuntary response from the employee, it is the preferred testing method when available.

4.6.8 Saccharin Solution Test:

4.6.8.1 This test relies on the wearer's ability to taste a saccharin solution sprayed around the outside of the respirator. The test is performed by placing an enclosure over the respirator wearer's head and shoulders and administering the solution from a nebulizer. If the wearer does not react to the chemical, then a satisfactory fit is assumed to be achieved.

NOTE: This test is dependent on the wearer's honest indication of taste. There is not an involuntary response.

4.6.8.2 The saccharin solution aerosol protocol is the only currently available, validated test protocol for use with disposable particulate respirators not equipped with high-efficiency filters.

4.6.9 Odorous Vapor Test:

The odorous vapor test relies on the respirator wearer's ability to detect an odorous material, usually isoamyl acetate (banana oil) inside the respirator. The test is performed by placing an isoamyl acetate saturated material near the respirator. If the wearer is unable to smell the chemical, then a satisfactory fit is assumed to be achieved.

4.6.10 Fit Test Card

4.6.10.1 The respirator wearer shall be issued an employee fit test card (AMS-710-02-FM-03504) with the following information:

- Name
- Date of fit test
- Manufacturer, model, and size of each successfully tested respirator
- Name and signature of the person that conducted the test
- Fit test challenge agent used
- Fit factor if a quantitative fit test was performed

4.6.11 Semi-annual Testing

The qualitative fit test should be repeated at least once every 12 months for routine use.

4.6.12 Fit Checks

There are two tests that are used in the field to check the seal of the respirator. These are known as the positive and negative fit checks. Each of these two tests must be performed every time an employee puts on a respirator and prior to entering a contaminated area.

4.7 Purchase of Approved Equipment

These requirements apply to all NIOSH/MSHA approved respirators used on APTIM locations. Non-approved "Dust Masks" with one strap shall not be used on APTIM projects.

4.8 Cleaning, Care, Maintenance, and Storage

4.8.1 Cleaning

4.8.1.1 Respirators shall be cleaned, disinfected, or sanitized as frequently as necessary recommended weekly to ensure that proper protection is provided to the user. Each worker shall be briefed on the cleaning procedure and be



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

assured that they will always receive a clean and disinfected/sanitized respirator. Such assurances are very important when respirators are not individually assigned to workers. Respirators maintained for emergency or general use shall be cleaned and disinfected/sanitized after each use.

- 4.8.1.2 The following procedure is recommended for cleaning and disinfecting/sanitizing respirators:
 - Remove any filters, cartridges, canisters, speaking diaphragms or valve assemblies.
 - Wash facepiece and breathing tube in cleaner-disinfectant or detergent solution (43°C or 110°F maximum temperature). Use a soft hand brush to help in removal of dirt and grime.
 - Rinse completely in clean water (43°C or 110°F maximum temperature).
 - Air dry in clean area or wipe dry with clean rags.
 - Clean other respirator parts as recommended by the manufacturer.
 - Inspect valves, headstraps, and other parts. Replace with new parts if defective.
 - Insert new filters, cartridges, or canisters, and make sure seal is tight.
 - After completely dry, place in a plastic zip-lock baggie or other suitable container for storage.
- 4.8.1.3 Cleaner-disinfectant solutions are available that effectively clean the respirator and contain a bactericidal agent.
- 4.8.1.4 Alternately, respirators may be washed in a liquid detergent solution, and then wiped with a clean piece of paper toweling, which has been dipped into a disinfecting/ sanitizing solution or a solution of rubbing alcohol. The respirator must then be rinsed in fresh water and air dried.
- 4.8.1.5 Respirators must be cleaned and disinfected after each day's use.
- 4.8.1.6 Respirator-freshening wipes are not an adequate substitute for this cleaning and disinfecting process.
- 4.8.1.7 The location shall assign specific individuals to be responsible for the cleaning and disinfecting of respirators.
- 4.8.1.8 A log shall be maintained which will include a record of date of cleaning and the cleaning attendant.
- 4.8.2 Storing the Respirator
 - 4.8.2.1 When respirators are not being used, they shall be individually sealed in plastic bags and stored at locations established by location management in order to protect them against dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals. Respirators should not be stored (thrown) in toolboxes or gang boxes. They shall be stored in such a way that the face piece and exhalation valve are not distorted.
 - 4.8.2.2 Atmosphere supplying respirators will be stored in the storage cabinet outside of the Location HSE Manager's office.
- 4.8.3 Inspecting the Respirator
 - 4.8.3.1 All respirators shall be inspected by the individual before and after each use, and at least monthly by the user's supervisor to ensure that they are in satisfactory working condition. These maintenance inspections will be documented by the supervisor using AMS-710-02-FM-03509.



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

4.8.4 Maintenance

4.8.4.1 Personnel involved in respirator maintenance shall be thoroughly trained. Substitution of parts from different brands or types of respirators invalidates approval of the device. Repairs and adjustments should never be made beyond the manufacturer's recommendations.

4.8.4.2 Respirators are to be properly maintained at all times in order to ensure that they function properly and adequately protect the employee. Maintenance involves a thorough visual inspection for cleanliness and defects. Worn or deteriorated parts will be replaced prior to use.

4.8.4.3 No components will be replaced or repairs made beyond those recommended by the manufacturer. Repairs to regulators or alarms of atmosphere-supplying respirators will be conducted by the manufacturer.

4.8.4.4 The following checklist will be used when inspecting respirators

- Facepiece:
 - cracks, tears, or holes
 - facemask distortion
 - cracked or loose lenses/faceshield
- Headstraps:
 - breaks or tears
 - broken buckles
- Valves:
 - residue or dirt
 - cracks or tears in valve material
- Filters/Cartridges:
 - approval designation
 - gaskets
 - cracks or dents in housing
 - proper cartridge for hazard
- Air Supply Systems:
 - breathing air quality/grade
 - condition of supply hoses
 - hose connections
 - settings on regulators and valves

4.8.4.5 Employees are permitted to leave their work area to perform limited maintenance on their respirator in a designated area that is free of respiratory hazards. Situations when this is permitted include to wash their face and respirator facepiece to prevent any eye or skin irritation, to replace the filter, cartridge or canister, and if they detect vapor or gas breakthrough or leakage in the facepiece or if they detect any other damage to the respirator or its components.

4.8.5 Defective Respirators

4.8.5.1 Respirators that are defective or have defective parts shall be taken out of service immediately.

4.8.5.2 If, during an inspection, an employee discovers a defect in a respirator, he/she is to bring the defect to the attention of his or her supervisor. Supervisors will give all defective respirators to the Location HSE Manager. The Location HSE Manager will decide whether to:

- Temporarily take the respirator out of service until it can be repaired.
- Perform a simple fix on the spot such as replacing a headstrap.
- Dispose of the respirator due to an irreparable problem or defect.



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

4.8.5.3 When a respirator is taken out of service for an extended period of time, the respirator will be tagged out of service, and the employee will be given a replacement of similar make, model, and size. All tagged out respirators will be kept in the storage cabinet inside the Location HSE Manager's office.

4.9 Training

4.9.1 All personnel shall be trained in the proper use of respirators prior to wearing one in the field.

4.9.2 The Location HSE Manager will provide training to respirator users and their supervisors on the contents of the Respiratory Protection Program and their responsibilities. Workers will be trained prior to using a respirator in the workplace. Supervisors will also be trained prior to using a respirator in the workplace or prior to supervising employees that must wear respirators.

4.9.3 The training course will cover the following topics:

- The location specific Respiratory Protection Program
- The OSHA Respiratory Protection standard
- Respiratory hazards encountered at the location and their health effects
- Proper selection and use of respirators
- Limitations of respirators
- Respirator donning and user seal (fit) checks
- Fit testing
- Emergency use procedures
- Maintenance and storage
- Medical signs and symptoms limiting the effective use of respirators

4.9.4 Employees will be retrained annually or as needed (e.g., if they change departments and need to use a different respirator). Employees must demonstrate their understanding of the topics covered in the training through hands-on exercises and a written test. Respirator training will be documented by the Location HSE Manager and the documentation will include the type, model, and size of respirator for which each employee has been trained and fit tested.

4.10 Program Evaluation

The Location Manager shall ensure that the Program is periodically evaluated to determine the effectiveness of the Program during all phases of operation in which respirators are being used. Frequent walk-through inspections during these activities shall be conducted to monitor and document supervisor and worker compliance with the requirements of the program. In addition to general assessment of the overall Respiratory Protection Program, specific evaluations of the respirator cleaning, inspection, maintenance, repair, storage, and use practices shall be conducted and documented weekly to ensure that the desired results of these operations are consistently achieved.

4.11 6.0 Documentation and Recordkeeping

4.11.1 A written copy of this program will be maintained in the Location HSE Manager's office and is available to all employees who wish to review it.

4.11.2 Also maintained in the Location HSE Manager's office are copies of training and fit test records.

4.11.3 These records will be updated as new employees are trained, as existing employees receive refresher training, and as new fit tests are conducted.

4.11.4 The Location HSE Manager will also maintain copies of the medical records for all employees covered under the respirator program. The completed medical questionnaire and the physician's documented findings are confidential and will remain at the company



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

approved medical provider. The company will only retain the physician's written recommendation regarding each employee's ability to wear a respirator.

5.0 REFERENCES

Title 30, Part II of the Code of Federal Regulations - NIOSH/MSHA Approvals for Respirators

Title 29 CFR (Code of Federal Regulation) 1926.103 Respiratory Protection

Title 29 CFR (Code of Federal Regulation) 1910.134 Respiratory Protection

Title 29 CFR (Code of Federal Regulation) 1910.1020 Hazardous waste operations and emergency response.

Title 30, Part II of the Code of Federal Regulations - NIOSH/MSHA Approvals for Respirators

American National Standards Institute - Practices for Respiratory protection Z88.2-1992

American National Standards Institute - Practices for Respiratory protection Z88.2-1992

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|-------------|--|
| Approved | Tested and listed as satisfactory jointly by the Mine Safety and Health Administration (MSHA) of the U. S. Department of Labor and the National Institute for Occupational Safety and Health (NIOSH) of the U. S. Department of Health and Human Services. |

7.0 EXHIBITS

- Exhibit 7.1 AMS-710-02-FM-03501 – Medical Questionnaire for Respirator Use
- Exhibit 7.2 AMS-710-02-FM-03502 – Request for Medical Evaluation for Respirator Use
- Exhibit 7.3 AMS-710-02-FM-03503 – Respirator Training and Fit Test Record
- Exhibit 7.4 AMS-710-02-FM-03504 – Employee Fit Test Card
- Exhibit 7.5 AMS-710-02-FM-03505 – Selection Table for Respiratory Protection
- Exhibit 7.6 AMS-710-02-FM-03506 – Respiratory Protection Training Program Certificate
- Exhibit 7.7 AMS-710-02-FM-03507 – Location Specific Respiratory Hazard Evaluation Form
- Exhibit 7.8 AMS-710-02-FM-03508 – Location Specific Voluntary and Mandatory Respirator Use
- Exhibit 7.9 AMS-710-02-FM-03509 – Monthly Maintenance Checklist for Respirators
- Exhibit 7.10 AMS-720-01-FM-00020 – Business Glossary



Respiratory Protection

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-03500 | INT | 7/30/2017 |

Exhibit 7.11 AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|----------------|--------------------|--------------------------|
| Procedure Title: | Permit to Work | AMS Number: | AMS-710-02-PR-06400 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

PERMIT TO WORK

| | | | |
|-----|------------------------|----------------------------|-----------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for a permit to work system on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors, and visitors associated with a APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

Each site shall make every attempt to prevent the possibility of incidents and accidents to employees when performing work activities through implementation, as determined by the Site HSE Manager and the Site Manager, of this non-mandatory permit to work system.

4.1 General

- 4.1.1 The intent of this procedure is to describe the APTIM Permit to Work System (PTW), which is used to provide the controls necessary during construction and commissioning activities in ensuring the safe performance of potentially hazardous tasks which cannot be adequately controlled under standard work practices, procedures, or method statements.
- 4.1.2 This procedure specifically applies to all site activities under the control of APTIM and as determined by the Site HSE Manager and the Site Manager.
- 4.1.3 This procedure may be superseded by Client mandated PTW.
- 4.1.4 This PTW is not required to be implemented during routine/normal construction activities. Activities where PTW shall be implemented may include:
 - 4.1.4.1 Where a task is deemed hazardous and/or specific control measures are required above and beyond standard work practices e.g.,
 - Excavations.
 - Hotwork.
 - Confined space entry (including activities that may generate hazardous atmospheres)
 - Energised systems.
 - Radiography (surveys using radioactive source).
 - Heavy and/or Critical Lifts
 - 4.1.4.2 In special cases when the APTIM Site HSE Manager and/or Site Manager deems it necessary to keep adequate control of hazards on site or area construction
- 4.1.5 This procedure shall be applied to all APTIM and subcontractor construction activities including construction or maintenance activities.



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

4.1.6 Any work or activity not falling under the category of a permitted activity or type of activity as listed in 4.1.3 shall be controlled by the “Work Area Hazard Assessment Process” (AMS-710-05-PR-01700).

4.2 Key Personnel and Associated Activities

4.2.1 The Issuer (The Party who Approves the Permit)

- 4.2.1.1 The Issuer has the sole authority to issue and approve the permit.
- 4.2.1.2 The Issuer shall be fully aware of Site conditions, the type of work to be carried out, and all the requirements stated in the permit.
- 4.2.1.3 The Issuer shall consult with the APTIM HSE Department to ensure all required safety precautionary measures are stated in the permit.
- 4.2.1.4 Prior to approving a permit, the Issuer shall conduct an onsite inspection jointly together with the Executor to ensure that Site conditions are safe to work, that there are no interferences either to or from other work groups, and ensure that all requirements stated in the permit are implemented.
- 4.2.1.5 The Issuer shall withhold approval of the permit if the requirements are not met, or Site conditions are not safe for the work to be carried out.
- 4.2.1.6 The Issuer shall, if noticing the presence of any other potential hazards that may jeopardize the safety of the workers, tools, or equipment, stop the work and then advise the Executor of appropriate countermeasures to be taken before approving the permit.
- 4.2.1.7 The Issuer shall ensure that all required safety-monitoring measurements are properly completed prior to the approval of the permit and so stated in the permit, e.g., gas tests, isolation of potential energy releases.
- 4.2.1.8 Once informed that the work is complete, the Issuer shall visit the Site jointly with the Executor to ensure that the work has been completed and the site is duly reinstated and proper job site clean up is complete.

4.2.2 The Executor (Receiver of the Permit)

- 4.2.2.1 The Executor must be able to speak, read, and write at a level sufficient to understand the requirements of the permit.
- 4.2.2.2 The Executor shall accept all requirements stated in the permit and comply with them at all times.
- 4.2.2.3 The Executor shall ensure that his work crew fully understand requirements stated in the permit and that the pre-task safety toolbox meeting attendance is completed for every permit.
- 4.2.2.4 The Executor shall ensure the requirements specified in the permit are implemented prior to the commencement of the work. He shall remain at the workplace to supervise the work at all times while the work is in progress, as defined in the PTW. In the event that the supervisor must leave the workplace for any reason, he must either arrange for an alternate, competent person as a stand in or the work must cease until such a person is provided. This change over must be recorded in writing and accepted by the Issuer.
- 4.2.2.5 The Executor shall under no circumstances, either by his own discretion or that of his work crew, change the original scope of the work, which is described in the permit.
- 4.2.2.6 The Executor shall request a new permit in the event a change in the scope of the work becomes necessary.



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

- 4.2.2.7 Whenever Site conditions are drastically changed such as to create a hazard, the Executor shall immediately stop the work and inform the Issuer of the change and await further instruction from him/her.
- 4.2.2.8 Upon the occurrence of an emergency, the Executor shall immediately stop the work and follow emergency procedure. Upon resolution of the emergency, the Executor shall have the PTW revalidated before resuming work.
- 4.2.2.9 The Executor shall report the completion of the work or the expiration of the validity of the permit to the Issuer and on completion of the work ensure that the site is duly reinstated without any remaining risks.
- 4.2.3 Authorized Gas Testers (AGT)
 - 4.2.3.1 All Authorized Gas Testers must undergo the AGT course which is presented by APTIM and annual training thereafter.
 - 4.2.3.2 APTIM will maintain a register of personnel who have undertaken this course. This course will cover issues such as the physical and chemical properties of gases, the reasons for testing, and the method of testing. In addition to the classroom based course a competent person will assess the AGT in the field.
 - 4.2.3.3 All gas detectors shall be bump tested in accordance with the manufacturer's guidelines. The bump test and reading will be documented.
 - 4.2.3.4 All gas detectors must be calibrated by a third party at a frequency stated by the manufacturer as a minimum or when it fails a bump test. APTIM will maintain a register of records of calibration for all of their detectors.
 - 4.2.3.5 The AGT must ensure that the gas meter in use is fully functional and has an in-date calibration certificate.
 - 4.2.3.6 The Authorized Gas Testers approved by APTIM shall conduct any required gas testing prior to the commencement of the work and validation of the PTW.
 - 4.2.3.7 In case the concentration of any gas is detected outside of the permissible level of concentration (H₂S, 0ppm, LEL >2%, O₂ 19.5-23%) the AGT shall withhold the permit and immediately inform the Issuer and conduct retesting. Should the re-test also show levels in excess of these concentrations then additional means of ventilation shall be employed, such as fans, air movers, etc., prior to allowing work to commence.
 - 4.2.3.8 Gas tests shall be carried out before any entry into a Confined Space and before validation of any Hot Work Permit. The AGT will use appropriate PPE, (SCBA, SABA), while testing an unknown atmosphere in a confined space where the AGT has to enter the confined space to take the readings.
 - 4.2.3.9 AGT's may be required, depending upon the work, to carry out further gas tests throughout the working day. Should any gas concentration exceed those stated above, then the work shall be immediately stopped and APTIM informed.
- 4.2.4 The APTIM Permit Coordinator
 - 4.2.4.1 The designated Permit Coordinator reports to the APTIM Construction Manager and is responsible for daily coordination of the work permits, including maintenance of a log showing the status of all PTW's. In addition, he/she shall maintain a copy of all PTW's Job Safety Analysis and Method Statements in sequential order.



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

- 4.2.4.2 He/she is responsible for full clerical control of the permit to work system including retention of the closed out Work Permits until the end of the Site.
- 4.2.4.3 He/she is responsible for displaying all planned, open, and suspended work permits on visual display in the permit to work office.

4.3 Permit to Work (PTW) System Components

4.3.1 Under this procedure, individual Permit to Work Forms are issued for works as described in section 4.1.4.

4.3.2 A set of PTW Forms, applicable Certificates, Documents, and authorized Permit signatories is called a PTW System. The components of the PTW are described below.

4.3.3 Permit to Work

4.3.3.1 A Permit to Work (PTW) is an official document with which APTIM authorizes activities to be carried out under specific safe working conditions. It is a signed declaration by the Issuing Party that the worksite conditions are safe to perform the specified task within a specified period. The work shall be done in accordance with the requirements of the PTW.

4.3.3.2 Each PTW shall be uniquely and individually numbered for identification purposes with sufficient copies made for all parties involved.

4.3.3.3 Every application for a PTW must have attached to it as a minimum the following supporting documentation:

- Job Safety Analysis (JSA)
- Material Safety Data Sheet (MSDS) where applicable
- Other items that may be required include:
 1. Marked up Drawings
 2. Isolation details, LO/TO
 3. Crane Inspection Certificate, including load test
 4. Rigging Certificates
 5. Competent Person Certificates.
 6. Rigging/Lifting Plan

4.4 Types of Work Requiring a Permit to Work

Any work falling into the following categories may require a specific PTW issued by APTIM. The APTIM Site HSE Manager and Site Manager may designate any other works as work requiring a permit in addition to the above when deemed necessary.

4.4.1 Excavation/Ground Disturbance

The definition of an excavation shall be consistent with AMS-710-02-PR-01600. For the purposes of the PTW the definition of excavation/ground disturbance may also include, but not be limited to:

- Any excavation involving the removal of soil deeper than thirty (30) cm or driving of a peg below this depth in areas known to have underground piping/utilities
- Cutting into of ground or floors below surrounding level where there is the risk of damage to existing services or harm to personnel
- Cutting into or drilling into walls or ceilings where existing services are known to run

4.4.2 Hot Work

All work involving ignition sources performed within fifteen meters (15m) of equipment containing flammable/combustible liquids or work performed within ten meters (10m) of large quantities of ordinary combustible materials (e.g., cardboard, wood).



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

4.4.3 Electrical Work

Any work requiring de-energizing or isolation of electrical System and/or its associated component parts including any work on any item or piece of equipment capable of being electrically charged or activated, energized or pressurized.

4.4.4 Confined Space Entry

Any entry into an area which is not designed for human occupancy has restricted access/egress or where the presence of toxic or flammable gases or deficiency/enrichment in oxygen possibly exists, as defined in AMS-710-02-PR-01700.

4.4.5 Heavy and/or Critical Lifts

The following lifts will require a Permit to Work:

- Lifts over live Equipment or Plant
- Lifts equal to or exceeding eighty percent (80%) of crane's rated capacity.
- Lifts of > 25 tons
- Lifts requiring more than one crane.

4.4.6 Radiation Work

Any work requiring the use of radioactive sources or x-ray machines for NDE works.

4.5 Validity of the Permit

Validity of the permit shall be restricted to the number of hours or days as specified in the permit, to a maximum of seven (7) days. No works shall be carried out after the validity has expired unless the permit has been duly extended or a new permit has been obtained from the Issuer.

4.6 Revalidation of the Permit

If the validity of the permit extends across more than one working day/shift then the permit shall be re-validated by the Executor at the start of the oncoming shift.

4.7 Closure of the Permit

4.7.1 On completion of the work, the Executor shall signify that the work is complete and that they wish to close the permit by signing in the correct space on the permit and returning the permit to the Issuer.

4.7.2 The permit is only considered closed when signed by the Issuer and after the Issuer has visited the Site and confirmed that the worksite has been left in a safe condition.

4.8 Training and Authorization

4.8.1 All Permits to Work Executors are required to attend the APTIM Permit to Work Training course and must pass an accompanying written examination.

4.8.2 All Executors must be sufficiently conversant, written and verbal, to enable them to understand the requirements that the PTW places on them and their workers.

4.8.3 In the event of any incident involving non-compliance with a PTW then the relevant Executor must undergo refresher training before he is allowed to sign further permits.

4.8.4 No Executor will be permitted to undergo more than two (2) refresher courses before he/she is removed from the authorized list permanently.

4.9 Operational Procedures for the APTIM PTW System

4.9.1 Under this procedure, there are three-sheet PTW Forms.

4.9.2 Original Form of PTW shall stay at the worksite with the Executor, the subcontractor task supervisor/engineer responsible for the work as stated in the PTW. The PTW must be displayed on a stand located at the workplace; the stand should be clearly



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

marked and placed in a prominent location within the work area. The first copy remains with the Issuer of the permit. The second copy is held by the PTW Coordinator.

- 4.9.3 The description of the work shall be a precise statement of the planned activity and the location of the work by identification of the area or equipment to be worked upon. Broad scopes of work of a general nature are not acceptable.
- 4.9.4 Job Safety Analyses will be produced and shall be attached to form part of the permit. Such additional documents shall be attached to the original of the Permit.
- 4.9.5 The Executor shall submit the permits to the Issuer by 08:00 hours the day before the actual commencement of the work.
- 4.9.6 The Issuer shall distribute the permits to the APTIM PTW Coordinator for HSE review and verification by 11:00 hours the day before work commences.
- 4.9.7 The APTIM Permit Coordinator shall submit the permits to the Site Construction Manager or his designee who shall verify that all HSE requirements specified in the permits are appropriate and return the verified permits to the Permit Coordinator.
- 4.9.8 The APTIM Permit Coordinator shall produce all verified permits to the Issuer the evening before work is due to commence.
- 4.9.9 The Issuer shall review the permit to ensure that all required safety precautionary measures are stated and that concurrence has been received from all appropriate parties for authorization of the permits.
- 4.9.10 On the day of the work, the Issuer or his nominees together with the Executor shall go to the Site to ensure that all requirements in the permit are met and hand over the permit to the Executor. Issuance of the permit to the Executor in the office shall not take place.
- 4.9.11 Upon receipt of the permit from the Issuer, the Executor can commence the work after the HSE requirements of the permit have been discussed with the personnel performing the work. (JSA and 5 X 5 Pre-Task Safety Talk)
- 4.9.12 When the work is completed, or when no further work is to take place under a permit, the Executor shall sign in the permit and return the permit to the Issuer or his nominees to indicate he has completed the work satisfactorily.
- 4.9.13 Upon receipt of the permit, the Issuer and the Executor shall inspect the work Site to ensure that the work Site is duly reinstated with all waste material removed and no remaining risks. When satisfied that the site has been left in a safe condition the Executor shall sign the permit as closed.
- 4.9.14 The Issuer shall return the completed permit to the APTIM Permit Coordinator for file.
- 4.9.15 The APTIM permit coordinator shall attach the original of the closed permit to his file copy to verify closure. Copies of closed permits are to be kept for the life of the site; remaining copies may be disposed of.
- 4.10 Emergency and Changing Conditions
 - 4.10.1 In the event of an emergency, the Executor shall immediately stop all works and shut down all equipment before moving to the appropriate Muster Point.
 - 4.10.2 All permits shall be nullified and no work shall be resumed unless the permit has been revalidated or a new permit has been issued out by the Issuer.
 - 4.10.3 Prior to the revalidation or issuance of a new permit, the Issuer shall visit the work Site to ensure that there is no imminent hazard/risk present and that the Work Site is safe to work.



Permit to Work

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

- 4.10.4 All workers have the right to stop work should they find an unsafe condition after inspection of the Work Site and work methods that the conditions listed in the permit are not being followed.
- 4.10.5 Should the work conditions change significantly, e.g., underground services being found where not expected, a positive gas reading in excess of the levels mentioned above, or other such circumstances, the work must be immediately stopped and the Issuer informed. In such cases, the permit will be reviewed and if necessary cancelled and a new PTW issued taking account of new circumstances.

5.0 REFERENCES

| | |
|---------------------|-------------------------------------|
| AMS-710-05-PR-01700 | Work Area Hazard Assessment Process |
| AMS-710-02-PR-01600 | Excavation and Trenching |
| AMS-710-02-PR-01700 | Confined Space Entry |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|----------------------------------|---|
| Executor | <ul style="list-style-type: none"> • This is the person responsible for initiating the PTW and supervising the work specified in the PTW. • The Executor may be APTIM or subcontractor. |
| Issuer | <ul style="list-style-type: none"> • For activities taking place within the site, the Issuer will always be APTIM or supervisors nominated by the Site Construction Manager and Site HSE Manager to approve the permits. • APTIM will develop and maintain a list of positions authorized to issue permits, including nominated personnel allowed to sign. |
| Site | Any location, facility, or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| The Authorized Gas Testers (AGT) | <ul style="list-style-type: none"> • The only personnel authorized to perform initial gas tests required for permit validation. Authorized Gas testers must pass the AGT training course provided by APTIM. • Initial gas tests for the validation of PTW' s may only be carried out by AGT' s from APTIM, follow up testing during the working day may then be performed by AGT' s from the subcontractor. |

7.0 EXHIBITS

| | |
|-------------|--|
| Exhibit 7.1 | PTW Flow Chart |
| Exhibit 7.2 | AMS-720-01-FM-00020 – Business Glossary |
| Exhibit 7.3 | AMS-720-01-FM-00021 – Technical glossary |

8.0 ATTACHMENTS

None



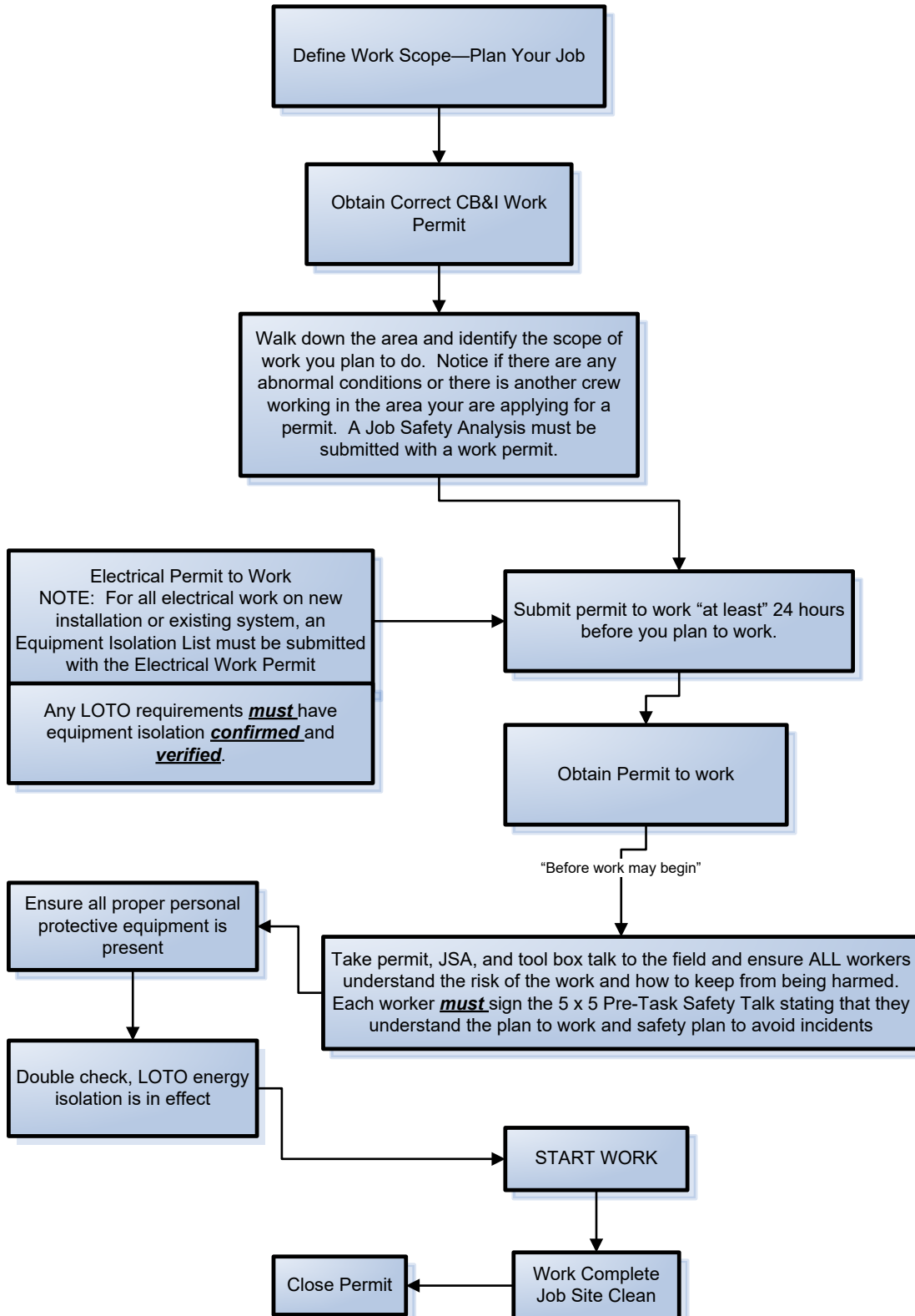
Permit to Work

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-06400 | INT | 7/30/2017 |

EXHIBIT 7.1

PTW FLOW CHART

PAGE 1 OF 1





PROCEDURE

| | | | |
|------------------|-------------------------------------|--------------------|---------------------------------|
| Procedure Title: | Medical Surveillance Program | AMS Number: | AMS-710-01-PR-05000 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

MEDICAL SURVEILLANCE PROGRAM

| | | | |
|------------|------------------------|----------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Medical Surveillance Program

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-05000 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for the implementation and management of the Medical Surveillance Program.

2.0 SCOPE

This procedure applies to all APTIM employees and temporary employees associated with a APTIM site.

Subcontractors and lower tier subcontractors (a lower tier subcontractor is any subcontractor at any level working on any company project whether directly with APTIM or through a third party) are required to provide documentation that they maintain, at a minimum, a medical surveillance program equal to this procedure.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure.

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Vendors
- APTIM Site Visitors

4.0 PROCEDURE

4.1 Medical screening and medical surveillance are two fundamental necessities for ensuring the health and safety of employees when used in conjunction with AMS-710-01-PR-02300 Occupational Health Plan. Medical screening is, in essence, only one component of a comprehensive medical surveillance program. Occupational health regulations concerning "medical surveillance" requirements are generally a combination of medical screening and medical surveillance and are clinically focused with information obtained from the clinical processes used in the monitoring and analysis of results.

4.2 The company's Medical Surveillance Program consists of various examination protocols which vary based upon each employee's essential job functions, site specific requirements, and jurisdictional regulatory requirements.

4.3 General

4.3.1 APTIM reserves the right to modify this procedure at any time consistent with changes in medical procedures, technologies, laws, or APTIM's operational needs. This procedure shall not, in any event, alter the basic "at will" status of any employee, nor shall it create any expressed or implied contractual rights relative to employment with APTIM.

4.3.2 This procedure is subject to the regulations, laws, and customs of the jurisdictions in which the work will occur; therefore, each APTIM site will use this procedure as a template to create a site specific medical surveillance procedure.

4.3.3 This procedure is intended to set forth the minimum medical surveillance program standards for APTIM. In accordance with the applicable authority matrices, business groups or projects may implement more stringent requirements as needed to satisfy any specific industry concerns, additional contractual, legal, and/or regulatory obligations that may be applicable.

4.3.4 Medical surveillance exams and consultations will be performed by or under the direct supervision of a licensed physician and all medical test analyses should be performed



Medical Surveillance Program

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-05000 | INT | 7/30/2017 |

by a laboratory that has demonstrated satisfactory performance in an established inter-laboratory testing program and meets the minimum requirements for certification in the jurisdiction in which it is located.

4.3.5 APTIM will provide medical surveillance exams at a reasonable time and location, at no cost to the employee and without loss of pay.

4.3.6 The licensed physician providing written opinion may review the result of any associated drug screen against the medical questionnaire when evaluating the final opinion. Failure to disclose any medical condition or the use of any prescribed medication capable of affecting the employee's mental and/or physical ability to perform the essential functions of the job on the medical questionnaire is a violation of this procedure and is grounds for disciplinary action up to and including termination.

4.4 Baseline Medical Protocols

4.4.1 Employees will be subject to pre-employment and pre-placement baseline examination based on the essential functions of the job, site-specific requirements, and the regulatory requirements of the jurisdiction. Baseline examinations are performed on a conditional post offer basis, and when potential hazardous exposures are identified by the project site's hazardous risk assessment.

4.4.1.1 All baseline examinations are conducted strictly upon a post-offer of employment and/or pre-placement basis. The individual responsible for scheduling the examinations must verify that a formal offer of employment has been made and the offer accepted prior to arranging the exam.

4.4.1.2 Following an employment offer and prior to becoming an active employee, the prospective employee will be tested for alcohol and illegal drugs. No prospective employee will begin work on any project or at any subcontractor location without submitting to and successfully passing an approved pre-employment drug test pursuant to the requirements set forth in the Substance Abuse Program procedure AMS-710-01-PR-03600.

4.4.1.3 Offer letters must be provisioned that the receipt of a negative drug/alcohol screen result and physician written opinion (PWO) noting that an individual is medically fit to perform the specific job assignment is required prior to proceeding with employment.

4.4.2 All employees whose job functions involve potential exposure at or above action levels are subject to periodic/annual examinations as required by the occupational health laws of the jurisdiction.

4.4.3 Employees who participate in the asbestos medical surveillance program must follow the requirements set forth in AMS-710-01-PR-02500 Asbestos on the Job.

4.5 Periodic/Annual Medical Protocols

The frequency and content of examinations will vary based on the essential functions of the job, site-specific requirements, and the regulatory requirements of the jurisdiction. More frequent examinations may be necessary, depending on the extent of potential or actual exposure, the type of chemicals involved, the duration of the work assignment, and the individual worker's profile.

4.6 Exit Protocols

At the end of employment, all personnel in the medical surveillance program should complete an Exit Examination Acceptance/Declination form. Exit examinations are required for all employees leaving the company unless their most recent exam is less than six months old.

4.7 Medical Surveillance Protocols – Baseline, Periodic/Annual, and Exit, as applicable, includes but is not limited to:

- 1,2-dibromo-3-chloropropane



Medical Surveillance Program

| AMS Number: | Revision: | Approval Date: |
|----------------------------|------------|------------------|
| AMS-710-01-PR-05000 | INT | 7/30/2017 |

2. 1,3-Butadiene
3. Acrylonitrile
4. Arsenic (Inorganic) (AMS-710-01-PR-02900)
5. Asbestos (Construction and Shipyards)
6. Asbestos (General Industry)
7. Benzene (AMS-710-01-PR-03000)
8. Bloodborne Pathogens (AMS-710-01-PR-00300)
9. Cadmium
10. Carcinogens (Suspect)
11. Chromium(VI), Hexavalent Chromium (AMS-710-01-PR-03800)
12. Coke Oven Emissions
13. Compressed Air Environments
14. Crane Operator Exam
15. Designated Qualified Operator Exam (DQO)
16. Diver Exam
17. Diver Medical Exam
18. DOT Exam (Department of Transportation)
19. Ethylene Oxide
20. Fit for Duty Exam – Craft, Professional/Salary, and Clean Construction (Union/Non-Union) (AMS-710-01-PR-01100)
21. Fit for Duty Exam – Field Labor (AMS-710-01-PR-01100)
22. Formaldehyde
23. Functional Assessment Exam
24. GE Hudson Exam
25. HAZWOPER Field Exposure
26. Knoll's Atomic Power Laboratory (KAPL)
27. Laboratory - Hazardous Chemicals
28. Lead (AMS-710-01-PR-02700)
29. Medical Surveillance Exams – Baseline, Periodic/Annual, and Exit (AMS-710-01-PR-03500)
30. Methylene Chloride
31. Methylenedianiline
32. Noise (AMS-710-01-PR-00900)
33. Pre-Placement General Labor Exam
34. Quantitative/ Qualitative Respirator Fit Test
35. Respirator Certification Exam (AMS-710-02-PR-03500)
36. U.S. Army Corp of Engineers (USACE)
37. Vaccinations (Business Travel and Potential Exposure)
38. Vinyl Chloride

4.8 Physician Written Opinions (PWO)

4.8.1 It is important to note that physician written opinions (PWO) are not considered confidential medical records. The physician written opinion (PWO) is designed and intended to communicate employee medical clearances, restrictions, and disqualifications to management and the employee. A physician written opinion (PWO) that notes restrictions will be signed by both the employee and the employee's manager.

4.8.2 The physician written opinion (PWO) must include:

- a. Name of the individual
- b. Date of the exam
- c. Employee number or personal identification numbers
- d. Name of the specific regulation upon which the medical opinion was based (if applicable)



Medical Surveillance Program

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-01-PR-05000 | INT | 7/30/2017 |

- e. If any detected medical conditions would place the employee at increased risk of material impairment of the employee's health while working in the specific job position
- f. Recommended limitations/restrictions upon the employee's assigned work
- g. If the employee is unable to perform his or her job duties with or without accommodations
- h. If the employee has been informed of the examination results
- i. Any medical recommendations for respirator use such as:
 - No limitations,
 - Medically not able to wear a respirator,
 - May wear a respirator for escape only,
 - Any specific limitations that have been placed on the use of the respirator, and
 - If the document has been provided to the employee.
- j. Date, printed name, and signature of the licensed physician providing the opinion

4.8.3 Whenever a restricted medical clearance is issued, the HSE manager, Human Resource manager, and hiring manager will be notified and will determine if the medical restriction will have an impact on the employee's ability to perform the essential duties of the intended job.

Specifically, all persons must be able to perform the essential functions of their job, with or without reasonable accommodations, and without posing a direct threat to the health and safety of themselves or others.

4.9 Re-Hiring Former Employees

4.9.1 When a former employee is being re-hired, if the most current company medical examination is less than six months old and the HSE manager can confirm that the individual was not subject to hazardous exposures during non-company employment, the HSE manager may choose to waive a new baseline examination. Periodic/Annual examinations will be based on the most recent examination date rather than a new date of hire.

4.9.2 Returning former employees shall be subject to post offer/pre-employment drug and alcohol testing at the time of re-hire unless the break in service has been less than 30 days, as permitted under the laws and customs of the jurisdiction in which the employee is employed.

5.0 REFERENCES

| | |
|---------------------|--|
| AMS-710-01-PR-02900 | Arsenic Exposure Control Program |
| AMS-710-01-PR-02500 | Asbestos on the Job |
| AMS-710-01-PR-00300 | Bloodborne Pathogens |
| AMS-710-01-PR-03000 | APTIM Benzene Safety Program |
| AMS-710-01-PR-02700 | Construction Lead Hazard Abatement Program |
| AMS-710-01-PR-01100 | Fitness for Duty Program |
| AMS-710-01-PR-03800 | Hexavalent Chrome |
| AMS-710-01-PR-03500 | Medical and Exposure Records |
| AMS-710-01-PR-00900 | Noise Control and Hearing Conservation |
| AMS-710-01-PR-02300 | Occupational Health Plan |



Medical Surveillance Program

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-05000 | INT | 7/30/2017 |

AMS-710-02-PR-03500

Respiratory Protection

AMS-710-01-PR-03600

Substance Abuse Program

6.0 TERMINOLOGY

Term

Fitness for Duty

Toxic Substance or Harmful
Physical Agent

Definition

The employees' physical, mental, and medical qualifications to perform their job duties

Any chemical substance, biological agent (bacteria, virus, fungus, etc.), or physical stress (noise, heat, cold, vibration, repetitive motion, ionizing and non-ionizing radiation, hypo-hyperbaric pressure, etc.) which: (1) be listed in the latest edition of the NIOSH Registry of Toxic Effects of Chemical Substances, (2) have yielded positive evidence of an acute or chronic health hazard in testing conducted by or known to the employer, or (3) be the subject of a material safety data sheet (MSDS) kept by or known to the employer indicating that the material may pose a hazard to human health.

7.0 EXHIBITS

Exhibit 7.1

AMS-720-01-FM-00020 – Business Glossary

Exhibit 7.2

AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|------------------------------|--------------------|--------------------------|
| Procedure Title: | Sanitation and Potable Water | AMS Number: | AMS-710-01-PR-01000 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

SANITATION AND POTABLE WATER

| | | | |
|------------|------------------------|-------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Sanitation and Potable Water

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-01000 | INT | 7/30/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Sanitation and Potable Water on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors and visitors associated with an APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

APTIM sites shall ensure they follow the Sanitation and Potable Water requirements in this procedure.

4.1 Potable Water

- 4.1.1 An adequate supply of potable water shall be provided in all places of employment.
- 4.1.2 Portable containers used to dispense drinking water shall be capable of being tightly closed, sealed, and equipped with a tap. Water shall not be dipped from containers.
- 4.1.3 Any container used to distribute drinking water shall be clearly marked as to the nature of its contents and the current fill date, and shall not be used for any other purpose.
- 4.1.4 A common drinking cup shall not be used for potable water facilities.
- 4.1.5 Where single service cups (disposable) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.
- 4.1.6 Drinking Water containers shall be cleaned and sanitized on a daily basis according to the following steps:
 - 4.1.6.1 The individual assigned to the task of cleaning the containers shall wash their hands with soap and water and put on disposable or rubber gloves.
 - 4.1.6.2 The outside of the container shall be rinsed off prior to opening the container.
 - 4.1.6.3 Containers are to be washed with a detergent daily. Hot water shall be used when available. Dishwashing liquid and a scrub brush or sponge shall be used to clean the containers.
 - 4.1.6.4 Containers are to be rinsed with clean water to remove all soap residues.
 - 4.1.6.5 Containers are to be sanitized using the following method:
 - Rinse containers in a solution of 2 tablespoons of chlorine bleach in one gallon of water.
 - Rinse containers in clean water.
 - When a location is available, the containers shall be allowed to air dry prior to refilling.



Sanitation and Potable Water

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-01000 | INT | 7/30/2017 |

- Containers should be cleaned on an elevated or grated, platform to keep them from being subjected to dirt and grime.

4.1.6.6 Potable water shall be sampled periodically and records maintained of the sample results or appropriate documentation verifying the water meets the quality standards prescribed in the U.S. Public Health Service Drinking Water Standards, published in 42 CFR Part 72, or water which is approved for drinking purposes by the State or local authority having jurisdiction.

4.2 Non-potable Water

- 4.2.1 Outlets for non-potable water, such as water for industrial or fire fighting purposes only, shall be identified by signs to indicate clearly that the water is unsafe and is not to be used for drinking, washing or cooking purposes.
- 4.2.2 There shall be no open or potential cross-connection between a potable water system and a non-potable water system.

4.3 Toilets at Construction Projects

- 4.3.1 Temporary toilets shall be maintained in accordance with Federal, State, or Local ordinances.
- 4.3.2 Toilets shall be constructed to shield the occupants from view and protect against weather and falling objects.
- 4.3.3 Toilets shall be ventilated and all windows and vents screened.
- 4.3.4 All toilet facilities shall be cleaned and emptied on a regular basis and an adequate supply of tissue shall be made available according to project needs.
- 4.3.5 All toilet facilities shall be located on the project so that clear access is provided for cleaning and servicing.
- 4.3.6 Toilets shall be placed where users do not exit into roadways.
- 4.3.7 The following table provides the minimum number of toilet facilities to be provided for employees:

| Number of employees | Minimum number of facilities |
|---------------------|---|
| 20 or less | 1 |
| 20 or more | 1 toilet seat and 1 urinal per 40 workers |
| 200 or more | 1 toilet seat and 1 urinal per 50 workers |

4.4 Washing Facilities

- 4.4.1 Lavatories shall be made available in all places of employment.
- 4.4.2 The washing facilities shall be maintained in a sanitary condition.
- 4.4.3 Each lavatory shall be provided with running, potable water.
- 4.4.4 Hand soap or similar cleansing agents shall be provided.
- 4.4.5 Individual hand towels or sections thereof, of cloth or paper, warm air blowers or clean individual sections of continuous cloth toweling, convenient to the lavatories shall be provided.
- 4.4.6 Whenever showers are required by a particular standard, the showers shall meet the following requirements:
 - 4.4.6.1 One shower shall be provided for each 10 employees of each sex, or numerical fraction thereof, who are required to shower during the same shift.



Sanitation and Potable Water

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-01000 | INT | 7/30/2017 |

- 4.4.6.2 Body soap or other appropriate cleansing agents shall be provided.
- 4.4.6.3 Showers shall be provided with hot and cold water feeding a common discharge line.
- 4.4.6.4 Employees who use showers shall be provided with individual clean towels.

4.5 Eating and drinking areas

- 4.5.1 No employees shall be allowed to consume food or beverages in a toilet room or in any area exposed to a toxic material.
- 4.5.2 Eating and drinking will be allowed only in designated areas.

4.6 Vermin Control

Every enclosed workplace shall be so constructed, equipped, and maintained so far as reasonable to prevent the entrance or harbouring of rodents, insects, and other vermin. A continuous, effective extermination program shall be instituted where their presence is detected.

4.7 Change rooms

Whenever employees are required by a particular standard to wear protective clothing because of the possibility of contamination with toxic materials, change rooms equipped with storage facilities for street clothes and separate storage facilities for the protective clothing shall be provided.

5.0 REFERENCES

| | |
|--|---|
| Title 29 CFR (Code of Federal Regulation) 1926.27 | Sanitation |
| Title 29 CFR (Code of Federal Regulation) 1926.51 | Sanitation |
| American National Standards Institute (ANSI) Z4.1 | Sanitation in Places of Employment-Minimum Requirements |
| ANSI Z4.3 | Sanitation-Non-sewered Waste-Disposal Systems – Minimum Requirements |
| ANSI Z4.4 | Sanitation in Fields and Temporary Labor Camps – Minimum Requirements |
| Title 42 Code of Federal Regulations (CFR) Part 72 | Occupational Injury and Illness Recording and Reporting |
| ANSI Z4.4 | Sanitation in Fields and Temporary Labor Camps – Minimum Requirements |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|---------------|---|
| Potable Water | Water that meets the quality standards prescribed in the US Public Health Service Drinking Water Standards, published in 42 CFR Part 72, or water that is approved for drinking purposes by the State or local authority having jurisdiction. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, |



Sanitation and Potable Water

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-01000 | INT | 7/30/2017 |

shops, owned facilities, leased facilities and/or project sites.

7.0 EXHIBITS

- Exhibit 7.1 AMS-720-01-FM-00020 – Business Glossary
- Exhibit 7.2 AMS-720-01-FM-00021 – Technical Glossary

8.0 ATTACHMENTS

None



PROCEDURE

| | | | |
|------------------|---------------------------------|--------------------|---------------------------------|
| Procedure Title: | Excavation and Trenching | AMS Number: | AMS-710-02-PR-01600 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM Quality Management |

EXCAVATION AND TRENCHING

| | | | |
|------------|------------------------|-------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Excavation and Trenching

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

1.0 PURPOSE

This procedure establishes the minimum requirements for Excavation and Trenching activities on APTIM sites.

The following deliverables are defined within this procedure:

- Excavation Permit (AMS-710-02-FM-01601)
- Daily Excavation Inspection Form (Short) (AMS-710-02-FM-01602)
- Daily Excavation Inspection Form (long) (AMS-710-02-FM-01603)
- Soil Classification Worksheet (AMS-710-02-FM-01604)
- Excavation and Trenching Awareness training for affected employees

2.0 SCOPE

This procedure is to be utilized for all excavation and trenching activities on APTIM sites.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Superintendent
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

This procedure establishes the minimum requirements for work, activities, inspections, and training, required for work in and around excavation and trenching operations on APTIM sites. This procedure will also apply to all APTIM subcontractors.

4.1 General

- 4.1.1 A designated Competent Person shall be onsite at all times when excavation activities are conducted.
- 4.1.2 APTIM Supervisors shall ensure employees, contractors, subcontractors, and visitors meet the requirements listed in this procedure when conducting excavation and trenching work.
- 4.1.3 Before any excavation can be started, an Excavation Permit (AMS-710-02-FM-01601) must be completed by the responsible Superintendent or equivalent with input from the Authorized Person for underground testing (utility identification) and the Excavation Competent Person. Appropriate Client approval and use of Client Excavation permit is also necessary where required by Client regulations. Client and/or utility company representatives shall be notified 24 hours prior to beginning excavations.
- 4.1.4 Underground Storage Tank (UST) Removal
AMS-710-02-WI-01601 contains specific instructions for trenches and excavations relating to UST removal.
- 4.1.5 Underground Utilities
 - 4.1.5.1 Utility locating personnel shall locate and mark all known underground utilities within excavation area using utility locating equipment and



Excavation and Trenching

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

techniques. The utilities shall be marked with paint or flags. For more guidance, please refer to AMS-710-02-PR-01610 (Identifying Underground Installations).

- 4.1.5.2 At least 3 feet (0.9144 m) of clearance between any underground utility and the cutting edge or point of powered excavation equipment will be maintained until the precise location of the utility is determined. Initial excavation within this 3 foot area will be conducted manually.
- 4.1.5.3 All utilities exposed during an excavation will be protected from accidental damage. Machine excavation within 3 feet (0.9 m) of a located utility requires a spotter.
- 4.1.5.4 The underground utilities information obtained shall be provided to affected personnel via the job safety analysis (JSA). Underground utilities information, in relation to proposed excavation work, means the following information about underground essential services that may be affected by the excavation:
 - The utilities that may be affected
 - The location, including the depth, of any pipes, cables or other plant associated with the affected essential services
 - Any conditions on the proposed excavation work.
- 4.1.5.5 Any essential services information obtained must be readily available for inspection. The information must be available:
 - For at least two (2) years after the incident occurs
 - In every other case, until the excavation work is completed.
- 4.1.5.6 When working on a pressurized liquid system (i.e., site service water, processed cooling water, pumped sanitary system) with piping 1" or more in diameter in an excavation 4 foot or greater in depth where an engulfment hazard exists must:
 - De-energize and drain the system
 - Lockout/Tagout
 - All persons entering the excavation, whether working on the system or not shall apply safety locks and danger tags to the system in accordance with AMS-710-02-PR-01500, Control of Hazardous Energy.
 - No personnel shall be allowed in the excavation during pressure/leak testing.
- 4.1.6 The work area around a excavation over 4 feet (1.2 m) deep shall be, so far is reasonably practicable, secured from unauthorized access (including inadvertent entry).
- 4.1.7 When mobile equipment is operated adjacent to an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs.
- 4.1.8 Soil classification shall be made by the Competent Person or a registered Professional Engineer trained in soil classification. Based on the results of tests described in Exhibit 7.4, "Soil Classification Worksheet," the competent person will classify each soil/rock deposit as stable rock, Type A, Type B, or Type C. When layers of soil/rock exist, the weakest layer will be classified; however, each layer may be classified individually when a more stable layer lies under a less stable layer. If the properties or conditions of a soil/rock deposit change in any way, re-evaluation will be required. Unclassified soil shall be assumed to be Class "C" and will be sloped 1½:1 or shored when the excavation exceeds 4 feet (1.2 m) in depth.
- 4.1.9 Each employee in an excavation shall be protected from cave-ins. Excavations over 4 feet (1.2 m) deep shall be shored, sloped, or benched as required. Excavations and the



Excavation and Trenching

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

work scheduled to be performed in the excavation shall be evaluated by the Competent Person to determine if the shoring, sloping, or benching needs to begin at a depth less than 4 feet (1.2 m).

- 4.1.10 Shoring for excavations over 20 feet deep (6 m) shall be designed by a registered Professional Engineer and shoring installed shall be approved and signed off by a registered Professional Engineer.
- 4.1.11 Spoils must be placed a minimum of 3 feet (0.9 m) from the edge of the excavation. Loose soil or rocks shall be removed from the sides of excavation walls.
- 4.1.12 Excavations 4 feet (1.2 m) in depth or greater, shall have a stairway, ladder, ramp, or other safe means of egress within 25 feet (7.6 m) of any employee. Excavations that are less than 4 feet (1.2 m) in depth shall have safe access and egress for all employees with a maximum break in elevation of 19 inches (48.3 cm).
- 4.1.13 Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person.
- 4.1.14 Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design, and shall be constructed in accordance with the design.
- 4.1.15 Excavations shall be inspected by a Competent Person and the results recorded on either AMS-710-02-FM-01602 or AMS-710-02-FM-01603:
 - 4.1.15.1 Prior to entry
 - 4.1.15.2 After rain or snowfall
 - 4.1.15.3 After freezing and/or thawing temperatures occur
 - 4.1.15.4 After any condition that can change the integrity of the soil
- 4.1.16 During rainy weather, work in excavations shall cease until the Competent Person has evaluated the excavation and the effect of the rain on the excavation. The Competent Person will maintain a regular inspection schedule to ensure the excavation stability and condition during rain events if employees continue to work in the excavation. Depending on the amount of rainfall, the duration of the rainfall and the soil type, the Competent Person may need to maintain continuous observation of the excavation conditions.
- 4.1.17 For excavations that have the potential for oxygen deficiency or to contain hazardous atmosphere, an atmosphere evaluation shall be performed. This test will be performed by the Construction HSE Manager or their designee. Indications of the potential for a hazardous atmosphere include, but are not limited to: gas lines, sewer lines, areas with hydrocarbons, and proximity to emissions sources for H₂S, SO₂, CO, CO₂ and other gases that are heavier than air. Excavations with hazardous atmospheres should be treated as a confined space.
- 4.1.18 Excavations shall be evaluated for hazards in addition to cave-in potential and atmospheric hazards. Electrical sources, energized (pressurized) pipes, underground tanks, etc. may also present a hazard to employees who are required to enter an excavation.
- 4.1.19 The Competent Person responsible for the crew working in the excavation shall inspect the excavation throughout the work period, record the observations on AMS-710-02-FM-01602, and stop operations when unsafe conditions exist.
- 4.1.20 Water shall not be allowed to accumulate in excavations at any time. Pumps, drains, or other means shall be used to remove water constantly.
- 4.1.21 Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems shall be provided, such as shoring, bracing, or underpinning to ensure the stability of such structures. Excavation below the level of the



Excavation and Trenching

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be done unless:

- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure;
- The excavation is in stable rock;
- A registered professional engineer has determined that the structure is sufficiently removed from the excavation so that it will be unaffected by the excavation activity; or
- A registered professional engineer has determined that such excavation work will not pose a hazard to employees.

4.1.22 Sidewalks, pavements and appurtenant structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures. The support system shall be capable of withstanding a minimum live load of 125 lb/ft.

4.1.23 Emergency rescue plans shall be developed and rescue equipment shall be readily available.

4.1.24 Employees will not be permitted to work under loads or near digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded provided the vehicles are equipped with a cab shield and/or canopy adequate to protect the operator from shifting or falling materials.

4.1.25 Employees exposed to falls by excavation crossings and walkways will be provided with fall protection in accordance with Procedure AMS-710-02-PR-00900 - Fall Protection.

4.2 Training

4.2.1 Employee Training

4.2.1.1 Each employee who works in or around an excavation shall be trained to recognize potential hazards associated with excavations: cave-in potential, fall hazards, safe entry and exit, proximity to excavating equipment, air quality, back-filling and compacting activities, protective systems, etc. This training shall be documented in accordance with AMS-710-05-PR-01900 (HSE Education and Training) and records maintained in the Site HSE files

4.2.1.2 Each individual assigned as an Excavation Competent Person shall have documented training (see 4.2.1.1) or shall send documentation of experience and qualifications in excavation activities to the Global HSE Education and Training Director for review.

5.0 REFERENCES

| | |
|---------------------|---------------------------------------|
| AMS-710-02-PR-00900 | Fall Protection |
| AMS-710-02-WI-01601 | Underground Storage Tank Removal |
| AMS-710-02-PR-01500 | Control of Hazardous Energy |
| AMS-710-02-PR-01610 | Identifying Underground Installations |
| AMS-710-05-PR-01900 | HSE Education and Training |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|--------------------------------|---|
| Accepted Engineering Practices | Those requirements that are compatible with standards of practice required by a registered professional engineer. |



Excavation and Trenching

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

| | |
|---|---|
| Angle of Repose | The greatest angle above the horizontal plane at which a material will lie without sliding. |
| Authorized Person for Underground Testing | The person(s) designated by the Construction Manager to identify underground utilities using a combination of blue prints and underground testing equipment. This individual shall coordinate excavation activities with the Client (as applicable) and outside utility companies. Several individuals (such as the Piping Superintendent, Electrical Superintendent, Equipment Superintendent, and Field Engineer) may serve as Authorized Persons as necessary. |
| Benching (Benching system) | A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels. |
| Cave-In | The separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or other wise injure and immobilize a person. |
| Competent Person | One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. |
| Excavation | Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal. |
| Excavation Competent Person | A person capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The Construction Manager and Construction HSE Manager shall designate the Competent Person in writing and their qualifications shall be documented. |
| Hazardous Atmosphere | An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury. |
| Protective System | A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face, into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection. |
| Ramp | An inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood. |
| Registered Professional Engineer | A person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce. |



Excavation and Trenching

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

| | |
|----------------------------|---|
| Sheeting | Members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system. |
| Shield | A structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Shields may be pre-manufactured or job-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields." |
| Shoring (Shoring System) | A structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| Sloping (Sloping System) | A method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads. |
| Stable Rock | Natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer. |
| Structural Ramp | A ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock is not considered structural ramps. |
| Support System | A structure such as underpinning, bracing, or shoring that provides support to an adjacent structure, underground installation, or the sides of an excavation. |
| Tabulated Data | Tables and charts approved by a registered professional engineer and used to design and construct a protective system. |
| Trench (Trench Excavation) | A narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench. |
| Type A Soil | Cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144kPa) or greater. Examples of cohesive soils are clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, soil is not Type A if: <ul style="list-style-type: none"> – Soil is fissured |



Excavation and Trenching

| | | |
|---------------------|-----------|----------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

- Soil is subject to vibration from heavy traffic, pile driving, or similar effects
- Soil has been previously disturbed
- Soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater
- Material is subjected to other factors that would require it to be classified as a less stable material

Type B Soil

This classification refers to:

- Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa)
- Granular cohesionless soils including angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and, in some cases, silty clay loam and sandy clay loam
- Previously disturbed soils except those which would otherwise be classified Type C soil
- Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subjected to vibration
- Dry rock that is not stable

Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B

Type C Soil

This classification refers to:

- Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less
- Granular soils including gravel, sand, and loamy sand
- Submerged soil or soil from which water is freely seeping
- Submerged rock that is not stable
- Material in a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper

7.0 EXHIBITS

| | |
|-------------|--|
| Exhibit 7.1 | AMS-710-02-FM-01601 – Excavation Permit |
| Exhibit 7.2 | AMS-710-02-FM-01602 – Daily Excavation Inspection Form (Short) |
| Exhibit 7.3 | AMS-710-02-FM-01603 – Daily Excavation Inspection Form (long) |



Excavation and Trenching

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-02-PR-01600 | INT | 7/30/2017 |

| | |
|-------------|---|
| Exhibit 7.4 | AMS-710-02-FM-01604 – Soil Classification Worksheet |
| Exhibit 7.5 | AMS-720-01-FM-00020 – Business Glossary |
| Exhibit 7.6 | AMS-720-01-FM-00021 – Technical Glossary |

8.0 ATTACHMENTS

None

CORONA VIRUS CONTROL PLAN

COVID-19 CONTROL PLAN**1.0 GENERAL**

Coronavirus Disease 2019 (COVID-19) is a respiratory disease caused by the SARS-CoV-2 virus. The COVID-19 pandemic is impacting all aspects of daily life, including travel, trade, tourism, food supplies, and financial markets. This plan defines location-specific efforts regarding:

- Awareness and Education
- Screening Methods
- Contamination Prevention and Sanitation
- Reporting and Illness/Exposure Management

This COVID-19 Control Program (CCP) is applicable to all APTIM employees at Redstone Arsenal (RSA). APTIM expects subcontractors/visitors/vendors to protect their employees through compliance with APTIM's CCP or through the development and implementation of a COVID-19 control plan specific to their risks. APTIM leadership must approve subcontractor plans, as applicable before implementation at RSA.

These requirements are in effect at least for the duration of the pandemic. The COVID-19 Management Team will amend these requirements or suspend their operation when no longer necessary.

2.0 CONTROLS**2.1 Awareness and Education**

A continual assessment of hazards is required to maintain a current awareness of exposures and the effectiveness of current controls. These methods will ensure employees have access to current information on how the pandemic is progressing, known site-specific exposures, site-specific controls and how to effectively implement them, and reporting requirements.

- At a minimum, COVID-19 training shall be provided through internal communications, new hire orientation, daily toolbox talks, risk assessment tools including JSA's, TARGET observation program, Near Miss/Great Catch reporting, findings from inspections, informational postings and informal discussions with supervision or employees.
- All employees reporting to work in an office location must complete the APTIM COVID-19 training available on-line through assignment in Talent Connection.
- On-going assessment of local, state and federal guidelines from organizations such as the Centers for Disease Control (CDC) and Occupational Safety Health Administration (OSHA), are required by all leadership employees to maintain an accurate understanding of the current hazards.
- The APTIM Corporate COVID-19 Management Team meets regularly to evaluate APTIM's pandemic efforts and implement appropriate responses.

CORONA VIRUS CONTROL PLAN

- APTIM maintains a Corporate COVID-19 resource page providing guidance from the CDC, World Health Organization (WHO), as well as APTIM-specific information. This page is located on the company intranet and is available to all employees with a company email address.
- Signage: HSE, working with Facilities, will ensure that CDC-recommended signage reminding employees about social distancing, handwashing, and staying home when sick is posted in common areas (restrooms, bulletin boards, lobby, etc.).

2.2 Screening Methods

Employees can be exposed to the virus either at the work location or away from work. Fever, coughing, and shortness of breath are primary symptoms that may be present between two and fourteen days from exposure to the virus. It is critical to remind employees to identify any of these symptoms and to quickly isolate employees who are symptomatic from other employees.

- Employees are reminded to continually evaluate themselves for the onset of any symptoms, particularly tfever, coughing or shortness of breath.
- If the location requires a screening tool at arrival, APTIM will use the screening questionnaire in Appendix 1. [Client-required questionnaires may be used in lieu of Appendix 1 where applicable.]
- If the screening tool in Appendix 1 is used, APTIM may separate individuals and send individuals home or away, as warranted, depending on the answers to questions in the tool, read in accordance with current guidance from the CDC or other applicable health organization.
- Contactless thermometers will be deployed as available and as necessary to assess all individuals for potential fevers prior to entering the workspace.
 - A temperature measured as greater than 100.4 °F is considered a fever.
 - Individuals registering a fever may sit isolated for no more than 10 minutes before being rechecked to confirm the fever. If a temperature of 100.4 °F or greater is registered after the second reading, the individual will not be allowed into the workspace and will be turned away/sent home.
- Any employee experiencing symptoms of illness will be isolated from the workforce and turned away/sent home.
- An employee who notices a co-worker exhibiting or complaining of symptoms of acute respiratory illness (fever, coughing, shortness of breath) has Stop Work Authority if they are concerned about another's health. The immediate supervisor should be notified and HSE contacted to evaluate how to proceed and limit further exposure.
 - NOTE: Employees are expected to treat each other with respect and dignity in keeping with APTIM's policies and collaborative culture. **Harassment, bullying or other mistreatment of employees because of a suspicion of symptoms is grounds for discipline, up to and including termination of employment.**

CORONA VIRUS CONTROL PLAN

- APTIM may require employees to complete fitness for duty evaluations as needed to respond to an objective concern for the health or safety of an employee and co-workers. A manager/supervisor must discuss a request for a fitness for duty evaluation with HR and HSE in advance; HSE will coordinate the fitness for duty process.

2.3 Contamination Prevention and Sanitation

Current medical understanding is that the virus is primarily transmitted via respiratory droplets when an infected person coughs, sneezes or talks. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose or eyes. The virus can potentially survive on varying surfaces from hours to multiple days. Primary routes of entry include the mouth, eyes and nose.

2.3.1 Sick Employees Stay Home

- Any employee who is experiencing symptoms of acute respiratory illness (fever, cough, shortness of breath) shall notify the employee's supervisor and not report to work.
- Employees who are well but who have a sick family member at home with COVID-19 should notify their supervisor and follow CDC recommended precautions.

2.3.2 Social Distancing Practices:

- Whenever possible, everyone is to maintain a minimum 6ft. distance from other people. This practice insulates individuals from potential exposure to respiratory droplets. If situations require close contact, time within 6ft. should be minimized. Employees are also to not touch other employees unless absolutely necessary to complete a task. Any touching should be followed by appropriate disinfecting as soon as possible. Please don't shake hands with other employees; a wave or a nod is a better practice to greet others during this pandemic.
- APTIM supports remote working where it is an efficient and effective option to complete assigned work. APTIM encourages managers to consider carefully before determining that employees who are temporarily working remotely should return to the office environment. APTIM's strong preference during the pandemic is to continue efficient, effective remote working assignments instead of returning employees to office environments. Think carefully about who needs to be in the office and who can still work from home.
- Workspaces, conference rooms, etc. shall be reconfigured, to provide at least 6ft. of distancing. Please do not rearrange, place chairs closer together, or bring in additional seating.
- Avoid congregating in common areas such as lobbies, kitchens, and restrooms and always maintain 6 ft distance. Allow a person to complete their task such as using the microwave and exit the space before entering.
- Visitors, sales representatives, and others whose presence at the location is not business critical are restricted from visiting the location until further notice. The Project Manager must approve any deviation request in advance. All visitors will be required to be met by staff in the lobby where they will be asked to complete the APTIM COVID-19 Questionnaire. [Once

CORONA VIRUS CONTROL PLAN

cleared to enter the visitor will be escorted to the temperature monitoring station. Visitors with temperatures above 100.4 degrees will not be allowed to enter and asked to leave.]

- Break times, including lunch times, have been staggered to minimize interactions with others.
- Whenever possible, meetings are to be conducted via teleconference rather than in person. In-person meetings or gatherings must not exceed 10 people and proper social distancing must be enforced.
- Other site-specific measure to maintain distance are captured on the COVID-19 Job Site Practices Activity Hazard Analysis (AHA).
- For project office facilities
 - Employees should not enter another's office until invited. Whenever possible, conduct conversation from the doorway. If privacy/confidentiality is required, the office occupant should invite the other party in, and the parties should don face masks and remain 6-foot distance throughout the discussion.
 - Employees assigned to cubicle workspaces are already limited in their ability to maintain 6-foot distance, and no employee should enter another's cubicle unless necessary and invited. Communication should be conducted via email, phone and Teams/Chat whenever possible. If a discussion is necessary, the parties should locate an available larger space such as a conference room. If the discussion requires the cubicle equipment (such as to discuss and revise a drawing) both parties shall don face masks throughout the interaction.
- Site-specific restroom use is included on the COVID-19 Job Site Practices AHA.

2.3.3 Sanitation Measures:

- Employees should not cover any cough or sneeze with their hands but should use a tissue or their elbow to contain the cough or sneeze. This process reduces contamination on their hands and in the air. Employees must properly wash their hands following any cough or sneeze.
- At a minimum, all employees shall conduct adequate hand washing prior to eating, before and after preparing food, following use of the restroom, following sneezing or coughing, and following touching of the face, especially the mouth, eyes or nose.
 - Adequate hand washing is achieved by following these five steps:
 1. Wet your hands with clean, running water (warm or cold); turn off the tap, and apply soap.
 2. Lather your hands by rubbing them together with the soap. Lather the backs of your hands, between your fingers, and under your nails.
 3. Scrub your hands for at least 20 seconds. Need a timer? Hum the "Happy Birthday" song from beginning to end twice.
 4. Rinse your hands well under clean, running water.
 5. Dry your hands using a clean towel or air dry them.

CORONA VIRUS CONTROL PLAN

- An adequate supply of soap must be available to maintain the ability for effective hand washing. **If there is no soap available, hand sanitizing liquid/gel may be utilized as a substitute. If neither option is available, the office/location will be closed unless it is deemed to be “critical” by senior leadership and/or government entities.**
- Do not touch your eyes, nose or mouth. Sores should also stay covered and protected. These measures are to prevent routes of entry.
- Face Masks: Wherever possible, APTIM is working to ensure that employees can work at least 6’ away from other individuals, in order to maintain the recommended social distance in this pandemic. Employees working in an area where they can avoid prolonged interaction with others can choose to use a cloth mask (as recommended by the [CDC](#)). Please see Appendix 2 for information from the CDC about making cloth masks, directions on how to don and doff these masks, and instructions for properly laundering the masks. The site has a small for use by employees in unexpected/planned close-contact situations that do not have a mask with them.
- HSE will work with employees who are working on tasks that require working within 6’ feet of others for a prolonged period to help plan steps to minimize this close contact work and to ensure that, where required, employees have adequate respiratory protection suited to the job task (such as NIOSH-approved, particulate filtering masks). Cloth masks are not a good substitute in these situations.
- [for office locations]: Masks requirements:
 - Employees are not required to wear a mask when;
 - Alone or in an office/cubicle with no interaction with others closer than 6-foot distance
 - In the break room while eating or drinking. During the pandemic employees should confine break/lunchroom time to eating/drinking and avoid lingering or congregating. Stay 6’ away from others.
 - Employees must wear masks;
 - Whenever engaged in an interaction/conversation within 6-foot distance
 - When engaged in a conversation inside an office; all parties should don masks upon invitation to enter by the occupant
 - In all common spaces, including conference rooms, elevators, hallways, breakrooms, restrooms, etc.
- Site-specific hand-washing solutions are included on the COVID-19 Job Site Practices AHA
- If means for handwashing are not immediately available, employees should use hand sanitizer containing at least 60% alcohol. Hand sanitizer should not be used in lieu of handwashing if hands are visibly soiled. Hand sanitizer shall be made readily available for employees to frequently disinfect their hands throughout the jobsite.
 - Use hand sanitizer in the following manner:

CORONA VIRUS CONTROL PLAN

- Apply the gel product to the palm of one hand. (Read the label to learn the correct amount).
- Rub your hands together.
- Rub the gel over all the surfaces of your hands and fingers until your hands are dry. This process should take around 20 seconds.
- Hand sanitizer should be placed and maintained in strategic locations throughout the workspace.
- Site-specific solutions to janitorial service issues are included on the COVID-19 Job Site Practices AHA.
- Site-specific solutions to restroom cleaning are included on the COVID-19 Job Site Practices AHA.
- [for office locations:] Disinfectant wipes are also available in the printer/copier areas and the kitchens and employees are encouraged to use them to wipe/sanitize touch surfaces as desired. Employees are also encouraged to wipe/disinfect their desks, phones, and keyboards as desired and at least once a day using the wipes provided.
- The procurement and ongoing availability of materials such as soap, disinfectant, PPE, etc. is the responsibility of the site Director/Manager. HSE and Procurement are continually evaluating availability of these products and may assist in this process if requested.
- Some business processes are heavily reliant on the shared handling of paper or other office products. The site must assess and implement measures to minimize exposure to paper, limit interactions among employees, discontinue use of shared pens, use personal protective measures (such as gloves) and disinfect following handling.
- Commonly touched surfaces and items should be identified for cleaning, as well as the frequency required based on the exposure. The CDC recommends that these surfaces be cleaned at least weekly.

2.3.4 Travel Limitations:

- APTIM has suspended all non-essential business travel. Essential business travel must be approved by APTIM Executive Leadership. Anyone approved to travel will be screened prior to reporting back to the jobsite.
- Employees traveling domestically or internationally may be subject to a self-quarantine period and should be familiar with the federal, state and local orders prior to traveling.

2.4 Reporting and Illness Management**2.4.1 General**

- 2.4.1.1 To ensure both prompt medical evaluation and prevention of any potential contamination to the jobsite, APTIM requires employees to immediately report any symptoms (fever, cough, or difficulty breathing), no matter how slight, to their manager, HSE and HR.

CORONA VIRUS CONTROL PLAN

- 2.4.1.2 APTIM will communicate appropriate notifications in accordance with established protocols and in keeping with applicable privacy laws.
- 2.4.1.3 Employees experiencing symptoms of any illnesses are to stay home and not report to work until symptom and fever-free for at least 24 hours, without the assistance of fever reducing medications. Employees experiencing symptoms consistent with COVID-19 who should stay home and not report to work until the protocols for return to work are met (test based, or symptom based). See below. Please take the necessary steps for your health and safety and the health and safety of your co-workers. Notification to supervision is required.
- 2.4.1.4 HSE, working with site Leadership and HR, maintains a confidential log of information related to employees who are symptomatic, who test positive for COVID-19, or who were potentially exposed outside of work. The log should include the name of the affected employees, the potential exposure or test date, date of onset and description of symptoms (if symptomatic), information about the exposure event, dates of expected quarantine, and status. HSE, working with site Leadership, also maintains a confidential log of any employees assigned to the jobsite potentially exposed by "close contact" to another COVID-19 positive (test, diagnosed or suspected) employee, including the potential exposure date, any testing information, a description of the potential exposure, the dates of any quarantine period, and a status update.
- 2.4.1.5 Site Leadership is responsible to notify HSE and HR of any COVID-19 positive (test, diagnosis or suspicion).
- 2.4.1.6 If an employee's illness appears to be personal and non-emergent, APTIM will direct the employee to see his or her personal health care provider.
- 2.4.1.7 Cases believed to be emergent in nature without regard to work-relatedness will be handled by following this AMS.
- 2.4.1.8 Cases potentially work-related will be evaluated at:
- Crestwood Workers Care Madison Clinic, 2236 Madison Blvd, Huntsville, AL
Crestwood Family Practice Clinic, 1868 Sparkman Dr. NW, Huntsville, AL
Huntsville Hospital, 878 Madison St. SE, Huntsville, AL

For potentially work-related cases, consideration should be given to allowing the affected employee to self-transport to seek medical care in order to maintain social distancing of 6ft. or greater. Vehicles offering adequate distance, such as passenger vans may also be used. Vehicles used for transport will be disinfected following the trip.

2.4.1.9 Return to Work Protocol

APTIM follows current CDC recommendations for returning employees to work after COVID-19 diagnosis or exposure. Please see Appendix 3 for a flow chart setting forth these criteria. Information about return to work protocols is also contained in the next sections.

CORONA VIRUS CONTROL PLAN

- A. Person with COVID-19 (tested, diagnosed, or suspected due to symptoms) can return to work after meeting one of the following protocols:
- Symptom Based Strategy: At least 10 days have passed since symptoms first appeared;
 - At least 24 hours have passed since resolution of fever without the use of fever-reducing medications; and
 - Other symptoms* of COVID-19 have improved.
 - (*Note that loss of taste and smell may persist for weeks or months after recovery and need not delay the end of isolation.
 - Most people do not require testing to decide when they can be around others. However, APTIM employees should follow the advice of their healthcare provider regarding when it is safe for the employee to return to work.
- B. People who have not had COVID-19 Symptoms but Tested Positive for COVID-19 can return to work after:
- At least 10 days have passed since the date of their first positive COVID-19 diagnostic test (assuming they have not developed symptoms.)
 - If symptoms develop, then follow symptom-based or test-based strategy for the return-to work protocol.
- C. People who are severely immunocompromised or who were severely ill with COVID-19 Test Based Strategy: May need to stay home longer than 10 days and up to 20 days after symptoms first appeared and may require testing to determine when it is appropriate to return to work. These individuals will need a release from their healthcare provider before returning to work.

2.4.2 Potential or Known Exposure to COVID-19 or Employees with Symptoms:**2.4.2.1 Symptomatic employees**

If an employee is experiencing symptoms of acute respiratory illness and a fever (greater than 100.4 degrees Fahrenheit, or 37.8 degrees Celsius), the employee must not come to work. The employee must alert his or her supervisor that he or she is symptomatic and is staying away from work. Supervisors should alert HSE immediately once they receive information that an employee is staying home with acute respiratory illness symptoms. Please see Potential Workplace Exposure section below for the required analysis of potential exposure to symptomatic employees. Please see Return to Work Protocol for persons who are positive for COVID-19 with symptoms, above.

2.4.2.2 Diagnosed Employees

Employees testing positive for COVID-19 are required to follow their health care provider's orders and will not be allowed to return to work until cleared by the health care provider to return to work. Recognizing strains on the medical system during this pandemic, APTIM will work with employees to

CORONA VIRUS CONTROL PLAN

balance the need for information on the employee's fitness to work with the availability of a health care provider. We will follow CDC guidelines for return to work criteria for employees who test positive or are presumed positive for COVID-19. Please see Return to Work Protocol above.

Please see Potential Workplace Exposure section below for the required analysis of potential exposure to symptomatic employees.

2.4.2.3 Potentially exposed but asymptomatic employees

If an employee has been exposed to:

- a. a household member or intimate partner or
- b. has provided care in a household without using recommended infection control precautions, or
- c. has had "close contact" (< 6 feet) for a "prolonged" period of time

to a person with symptomatic COVID-19 (can be a laboratory-confirmed disease or a clinically compatible illness) but the employee does not have symptoms, the employee may also need to stay home and not come to work or may be able to continue work, subject to workplace protections being in place, if the employee is working in a critical infrastructure position. (see section below).

The potential exposure period is the 48-hour period before the person with symptomatic COVID-19 began experiencing symptoms.

Please note the following definitions of "close contact" and "prolonged" (from CDC guidance):

Factors to consider when defining close contact include proximity, the duration of exposure (e.g., longer exposure time likely increases exposure risk), whether the individual has symptoms (e.g., coughing likely increases exposure risk) and whether the individual was wearing a facemask (which can efficiently block respiratory secretions from contaminating others and the environment).

Prolonged exposure varies on the length of time of exposure from 10 minutes or more to 30 minutes or more. Brief interactions are less likely to result in transmission; however, symptoms and the type of interaction (e.g., did the person cough directly into the face of the individual) remain important.

The potentially exposed employee must alert the employee's supervisor and HSE will work with the employee to determine whether, following CDC guidelines, the employee must remain self-quarantined and return to work for 14 days from the last exposure to the confirmed or suspected COVID-19 individual.

Asymptomatic Employees Working in Critical Infrastructure Positions:

Potentially exposed but asymptomatic employees who are working in "Critical Infrastructure" positions whose presence is critical to the ongoing progress of the project may continue to work with the following required protective measures in place:

- Prescreen: A temperature screening to confirm the absence of a fever (100.4 °F) and a symptom assessment is required prior to entering the workplace.

CORONA VIRUS CONTROL PLAN

- **Regular Monitoring:** Ongoing self-monitoring with assistance from HSE to ensure the employee remains asymptomatic and fever-free.
- **Wear a Mask:** The employee should wear a face mask at all times while in the workplace for 14 days after last exposure. Employee-supplied face masks are acceptable (see Appendix 2), or a site can issue a face mask (where supplies are adequate).
- **Social Distance:** The employee should maintain social distancing of at least 6ft. from other individuals. Any encroaching of 6ft. requires additional controls, such as adequate respiratory protection. (Contact HSE for support)
- **Disinfect and Clean:** The jobsite must clean and disinfect all areas such as offices, bathrooms, common areas, and shared equipment routinely.

If the employee becomes sick during the day, the employee should be sent home immediately. Surfaces in their workspace should be cleaned and disinfected. Information on persons who had contact with the ill employee during the time the employee had symptoms and 2 days prior to symptoms should be compiled. Others at the facility with close contact within 6 feet of the employee during this time would be considered exposed.

2.4.2.4 Potential Workplace Exposure

APTIM will inform employees of a potential workplace exposure while maintaining confidentiality (i.e., without revealing the infected individual's name unless otherwise directed by the CDC, applicable public health authority, or specifically required by applicable written government directive).

APTIM will analyze whether any other employees were potentially exposed to an employee diagnosed with COVID-19 through "close contact" with the diagnosed employee during the 48-hour period before the diagnosed employee started experiencing symptoms. Following CDC recommendations and directives, APTIM will direct potentially exposed asymptomatic employees to self-quarantine and remove them from the workplace for a 14-day period from the date of the employee's last exposure to the confirmed or suspected positive individual.

Please see above for information about potentially exposed, but asymptomatic, employees working in critical infrastructure. These employees can continue to work as long as they remain asymptomatic and the workplace protections set forth above are in place.

Employees are eligible to continue receiving per diem (if the employee is otherwise eligible for per diem) during the time the employee is not able to work because the employee is experiencing symptom of acute respiratory illness (fever, cough, shortness of breath) or is quarantined and away from home. The employee may need to provide medical documentation in order to be considered for continued per diem while they are not at work.

2.5 Roles and Responsibilities

2.5.1 Project Manager

CORONA VIRUS CONTROL PLAN

- Responsible for oversight and coordination of the CCP implementation to ensure consistency in program content and efficient use of resources.
- Responsible for ensuring that all employees adhere to the procedures, including training and awareness of CCP issues.
- Responsible to ensure communication of project/office expectations regarding the CCP.
- Support and endorse the Project HSE Management System and CCP.
- Ensure compliance to the CCP by all employees, subcontractors, and vendors.
- Provide the resources necessary for implementation of the CCP.
- Ensure that adequate Emergency Response Procedures are in place for the evacuation of employees.
- Communicate with Facilities department regarding office closure and re-opening (to include return to work plans).

2.5.2 Project Manager Designee]

- Assists the Project Manager in ensuring that all employees adhere to the procedures, including training and awareness of CCP issues.
- Assists the Project Manager in ensuring communication of project expectations in regard to the CCP.
- Actively support the CCP.

2.5.3 HSE Manager

- Review and analyze new data on COVID-19 risk, prevention, and management.
- Identify and provide training and awareness materials.
- Provide leadership with health risk assessment efforts for each area of the project.
- Identify and communicate program expectations (i.e., diagnosis, treatment and notification) to preferred medical providers.
- Review COVID-19 incident data.

2.5.4 Employees

- Adhere to all program requirements regarding prevention and mitigation measures.
- Participate actively and vocally in the awareness program.
- Report any suspected symptoms of acute respiratory illness (fever, coughing, shortness of breath) immediately to supervision.
- Stay home when sick.

CORONA VIRUS CONTROL PLAN

- Provide regular updates to leadership regarding anticipated return to work if the employee is required to stay home due to quarantine or illness.

2.5.5 Preferred Occupational Medical Provider

- Use rapid diagnosis method to test for COVID-19.
- Report confirmed or unconfirmed cases of COVID-19 to APTIM HSE Manager.
- Communicate with HSE Manager related to COVID-19 diagnosis and treatment as needed.
- Ensure clinic staff understands COVID-19 requirements for diagnostics and treatment.

3.0 RESOURCES:

Public Health Recommendations for Community-Related Exposure,

<https://www.cdc.gov/coronavirus/2019-ncov/php/public-health-recommendations.html>

[CDC RECOMMENDATIONS FOR MASK - https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html](https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/about-face-coverings.html)

IMPLEMENTING SAFETY PRACTICES FOR CRITICAL INFRASTRUCTURE WORKERS WHO MAY HAVE HAD EXPOSURE TO A PERSON WITH SUSPECTED OR CONFIRMED COVID-19, <https://www.cdc.gov/coronavirus/2019-ncov/community/critical-workers/implementing-safety-practices.html>

DISCONTINUATION OF ISOLATION FOR PERSONS WITH COVID-19 NOT IN HEALTHCARE SETTINGS (INTERIM GUIDANCE) [HTTPS://WWW.CDC.GOV/CORONAVIRUS/2019-NCOV/HCP/DISPOSITION-IN-HOME-PATIENTS.HTML](https://www.cdc.gov/coronavirus/2019-ncov/hcp/disposition-in-home-patients.html)

WHEN YOU CAN BE AROUND OTHERS: <https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/end-home-isolation.html> ENDING HOME ISOLATION: <https://www.cdc.gov/coronavirus/2019-ncov/hcp/disposition-in-home-patients.html>



CORONA VIRUS CONTROL PLAN

**APPENDIX 1
COVID-19 QUESTIONNAIRE**



CORONA VIRUS CONTROL PLAN

APPENDIX 1 – COVID-19 QUESTIONNAIRE

| | |
|---|--------|
| Name: | |
| Contact Number/Cell: | |
| Date: | |
| Department: | |
| Supervisor: | |
| For use with On-Site temperature check: Verified that temp is less than 100.4? | Yes/No |
| Self-Fever Check – did you check your temperature today? Is it less than 100.4 F? If you have a fever of greater than 100.4, stay home and do not report to this work site. | Yes/No |
| Have you read the Covid-19 Safety Plan applicable to our location, and do you understand the safety measures we are asking you to take while working at this jobsite? | |
| Do you understand that you are required to wear a mask (in accordance with CDC recommendations) when working within a 6ft. proximity of coworkers? | |
| Do you understand that when possible you are to maintain 6ft. social distancing if you are not able to wear a mask? | |
| Within the last 14 days, have you had close contact (less than 6' for 15 minutes or more) with a person with COVID-19 (diagnosed with test or symptoms)? | Yes/No |
| Are you currently experiencing (now or in the last 24 hours) any symptoms of Covid-19? (symptoms can include some or all of the following: fever, chills, cough, shortness of breath, difficulty breathing, fatigue, muscle or body ache, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea, vomiting, diarrhea)? | Yes/No |
| Are you currently diagnosed with COVID-19 or are you waiting for test results? | Yes/No |
| Do you understand that if you are running a fever or exhibiting any signs of illness you are not to come into work? | Yes/No |



CORONA VIRUS CONTROL PLAN

**APPENDIX 2
INSTRUCTIONS RELATED TO CLOTH MASKS**



CORONA VIRUS CONTROL PLAN

[DIY CLOTH FACE COVERING INSTRUCTIONS](#)

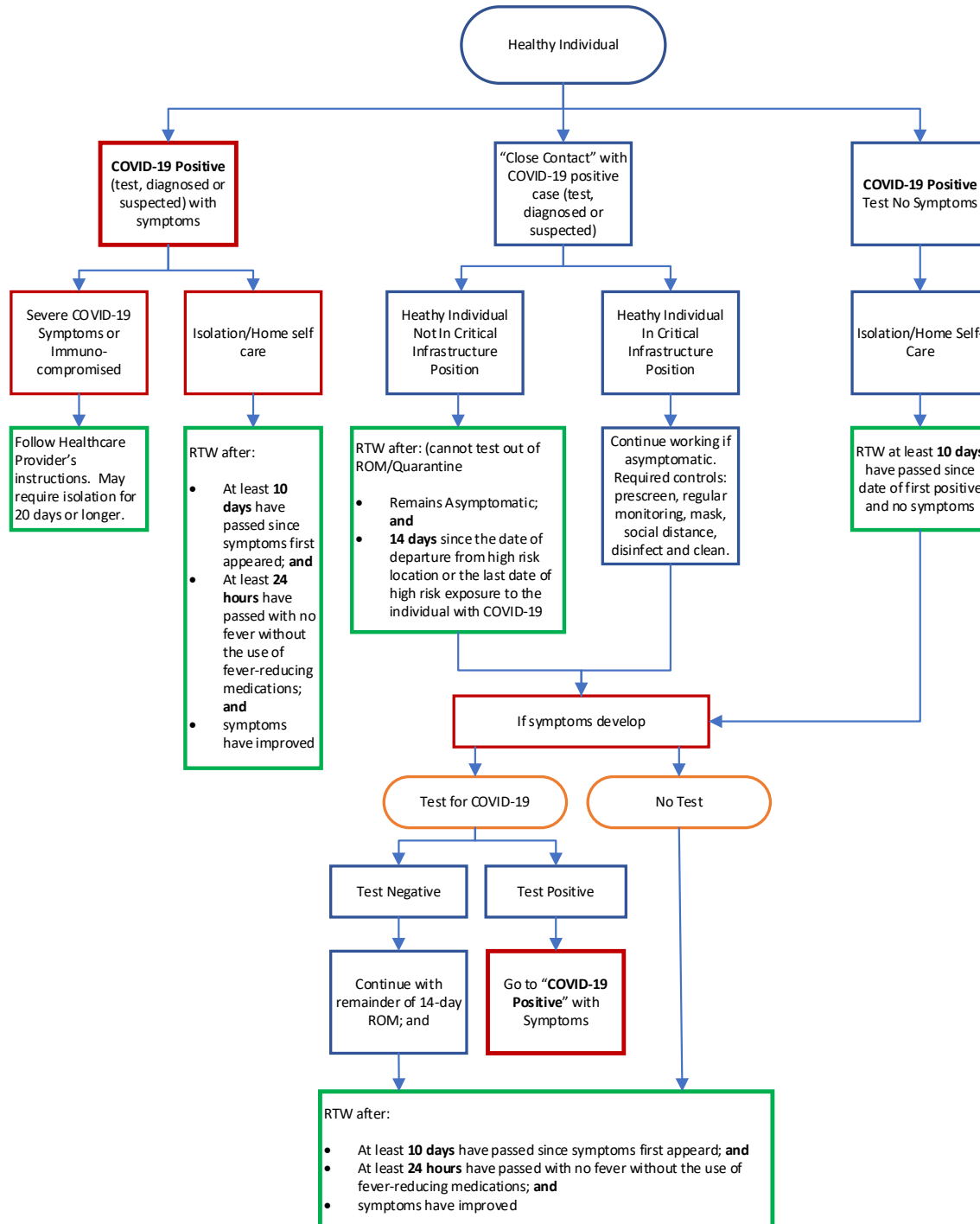


CORONA VIRUS CONTROL PLAN

**APPENDIX 3
RETURN TO WORK PROTOCOL**

CORONA VIRUS CONTROL PLAN

RETURN TO WORK (RTW) FLOWCHART COVID-19





PROCEDURE

| | | | |
|-------------------------|-----------------------------|---------------------------|----------------------------|
| Procedure Title: | Hazard Communication | AMS Number: | AMS-710-01-PR-00400 |
| Procedure Owner: | HSE | Issuing Authority: | APTIM HSE |

HAZARD COMMUNICATION

| | | | |
|------------|---|-------------------------|-------------|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| 0 | Changed all references of "Material Safety Data Sheet" to "Safety Data Sheet" | M. Hetzler | 12/20/2017 |
| INT | Issued for Interim Use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for the use of Hazard Communication on APTIM sites.

2.0 SCOPE

This procedure applies to all APTIM employees, contractors, subcontractors and visitors associated with a APTIM site.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Contractors
- APTIM Subcontractors
- APTIM Visitors

4.0 PROCEDURE

APTIM sites shall make every attempt to prevent the possibility of incidents and injury to employees due to hazardous chemical and materials in the work environment when performing work activities through compliance with safety regulations, training of employees to properly perform their job activities and through employee involvement in safe work behaviors.

4.1 Written Plan

- 4.1.1 Each site shall develop and implement a written site specific Hazard Communication Plan for their workplace.
- 4.1.2 Template Hazard Communication Plans for sites are included with this procedure as AMS-710-01-FM-00403 and AMS-710-01-FM-00404, respectively.

4.2 The plan shall describe how:

- 4.2.1 The site will maintain labels and other forms of warnings on hazardous chemicals in the workplace.
- 4.2.2 The site will obtain Safety Data Sheets (SDS's), how the information will be used, how employees will be trained on the information, and how the SDS file will be maintained. How employees will be provided access to SDS's will also be covered in the written program.
- 4.2.3 The site will provide information and training to employees concerning the Hazard Communication Program and the chemical hazards in their work place.
- 4.2.4 Communication of information and training for non-English speaking employees will be evaluated on a site by site basis, if the location HSE Manager deems it necessary then a Hazardous Communication program shall be created for the non-English speaking employees.

4.3 The Plan shall also contain:

- 4.3.1 A chemical inventory. List of all the hazardous chemicals known to be present in the workplace using an identity that is referenced on the appropriate SDS. (AMS-710-01-FM-00401)
- 4.3.2 The methods the employer will use to inform employees of the hazards of non-routine tasks and the hazards associated with chemicals contained in unlabeled pipes and vessels in their work areas.



Hazard Communication

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

4.3.3 A detailed method for making information available to other employers and their employees on multi-employer work sites, including:

4.3.3.1 The methods used to make sure SDS's are either stored in a central location or copied and provided to other employers:

- The methods used to inform the other employers of any precautionary measures that need to be taken to protect employees during the workplace's normal operating condition and in foreseeable emergencies.
- The methods used to inform the other employers of the labeling system used in the workplace.

4.3.4 Every three (3) years a general review of hazardous chemicals or substances used at the facility must be made to determine if less hazardous chemicals or substances can be substituted for those in use.

4.4 General Requirements

4.4.1 In areas where employees are handling or exposed to hazardous or corrosive chemicals, there shall be immediate access to a safety shower / eye wash station. In remote areas, portable safety showers / eye wash stations may be required.

4.4.2 The disposal of any Hazardous Waste must be coordinated with the appropriate Environmental Manager.

4.4.3 Materials Exempt From Hazard Communication Program

4.4.3.1 There are some types of chemicals that are specifically exempt from this procedure. These materials include:

- Any hazardous waste as defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1967, as amended (42 U.S. Code 6901 *et seq.*), when subject to regulations issued under that Act by the U.S. Environmental Protection Agency.
- Any hazardous chemical as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) when the hazardous chemical is the focus of remedial or removal actions being conducted under CERCLA in accordance with U.S. Environmental Protection Agency regulations.
- Tobacco or tobacco products.
- Wood or wood products, including lumber, which will not be processed, where the manufacturer or importer can establish that the only hazard they pose to employees is the potential for flammability or combustibility. **Wood or wood products that have been treated with a hazardous chemical are covered by this procedure, and wood which may be subsequently sawed or cut, generating dust.**
- Articles.
- Food or alcoholic beverages which are sold, used, or prepared in a retail establishment, or foods intended for personal consumption by employees while in the workplace.
- Any drug, as defined by the Federal Food, Drug, and Cosmetic Act, when it is in solid, final form for direct administration to patient; drugs which are packaged by the manufacturer for sale to consumers in a retail establishment; and drugs intended for personal consumption by employees while in the workplace.
- Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace.

Hazard Communication

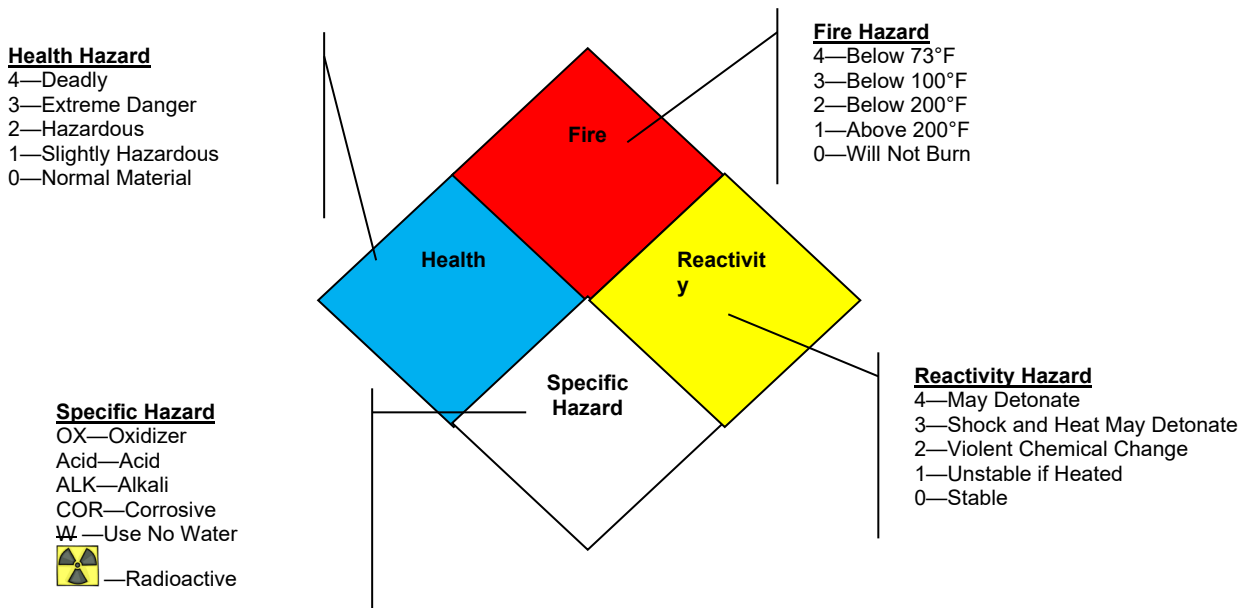
| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

- Any consumer product or hazardous chemical, as defined by Consumer Product Safety Act and Federal Hazardous Chemicals Act, where the employer can show that it is used in the workplace for the purpose intended by the manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended.
- Nuisance particulates where the manufacturer, distributor, or importer can establish that they do not pose any physical or health hazard covered under this procedure.
- Ionizing and nonionizing radiation.
- Biological hazards.

4.5 Labeling

4.5.1 Containers of hazardous chemicals in the workplace shall be labeled, tagged, or marked with the following information:

4.5.1.1 APTIM has adopted the National Fire Protection Association (NFPA) Standard 704 for identification of hazardous materials. Containers of materials with hazardous components are to be labeled using NFPA labels identifying those hazardous components and any applicable warnings.



4.5.1.2 The identity of the hazardous chemicals contained therein; and,

4.5.1.3 The appropriate hazard warnings.

4.5.2 The manufacturer's labels and warning symbols shall not be removed or defaced unless a new label with the appropriate information is immediately affixed to the container (AMS-710-01-FM-00405 and AMS-710-01-FM-00406).

4.5.3 All containers being shipped from one location to another must meet the Department of Transportation (DOT) requirements. The person initiating the shipment of hazardous chemicals or substances must:

4.5.3.1 Prepare a "Request for Shipping" form

4.5.3.2 Ensure shipping containers are in good condition

4.5.3.3 Attach the proper SDS to each container



Hazard Communication

| AMS Number: | Revision: | Approval Date: |
|---------------------|-----------|----------------|
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

- 4.5.3.4 Provide additional SDS's for the truck driver and the shipping records
- 4.5.4 Hazardous materials received at the site without proper labels shall be set aside and not distributed for use until properly labeled.
- 4.5.5 Labels shall be prominently located on the container in its upright position when the container is in its usual position for use, so as to be legible (see Attachment 2, Typical Hazardous Chemical Labels).
- 4.5.6 Labels on containers exposed to the weather shall be such that the reading material is clear and conspicuous at all times and shall not be defaced or obliterated by rain, snow, or other adverse elements of the weather.
- 4.5.7 If a labeled container is covered by a secondary container or a covering that remains in place while the contents of the container are withdrawn or used, the required labels shall also appear on the secondary container or covering.
- 4.5.8 Containers of mixtures shall be labeled with the chemical name listed on the SDS for each toxic or hazardous substance in the mixture. It is recommended that containers of mixtures also be labeled with the common name of the mixture.
- 4.5.9 All portable containers into which hazardous chemicals are transferred and which are intended only for the immediate use of the employee who performs the transfer should also be identified as to their contents. (Examples: acetone, gasoline, etc.)
- 4.5.10 Unlabeled containers found in the workplace shall be tested and labeled accordingly or disposed of properly.
- 4.5.11 Labels shall be legible, in English. However, for non-English speaking employees, information shall be presented in their language as well.
- 4.5.12 Secondary containers (those filled from a large container and taken to a work area or job site) must have an extra copy of the manufacturer's label or a generic label that lists the contents and appropriate hazard warnings. This is the responsibility of the person filling the secondary container
- 4.5.13 The person receiving the shipment is responsible to ensure that each container of hazardous chemical(s) has been provided with this labeling information. Hazardous chemicals that do not contain adequate labeling will not be accepted by the receiving person. In the event that hazardous chemicals that do not contain adequate labeling are inadvertently received, they are not to be handled until the identity of the material and appropriate hazard warnings are provided. If the hazardous chemical is regulated by a chemical-specific health standard, then it must be labeled in accordance with the requirements of that standard.
- 4.5.14 As long as the hazardous chemicals are maintained in their original, properly labeled container and their composition is not altered, there is no need for additional labeling. In the event that the chemical is transferred from a labeled container to an unlabeled portable container, the user must label this secondary container unless the container is intended for immediate use of the employee who performs the transfer. In this case, the container must be labeled with the identity of the chemical and the appropriate hazard warnings, as described above.
- 4.6 SDS (Safety Data Sheet) File
 - 4.6.1 An SDS shall be requested from the manufacturer or distributor prior to ordering a chemical product. The purchasing agent (or individual responsible for ordering a material) shall forward a copy of the SDS to the Location HSE Manager (if there is no Location HSE Manager on site, the SDS shall be forwarded to the Area HSE Manager for review). The purchasing agent (or receiving department) shall also maintain a copy of the SDS in a binder or file of SDS's being reviewed.



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

- 4.6.2 The Location HSE Manager (or HSE representative if project scope does not require an HSE Manager) shall review the SDS prior to the material being ordered.
- 4.6.3 If the Location HSE Manager provides approval for the material, then the material shall be ordered. The Location HSE Manager will supply the SDS product evaluation form AMS-710-01-FM-00402 to the purchasing agent stating that the material has been approved and the Location HSE Manager shall place the SDS in a file or binder of approved SDS's.
- 4.6.4 If, based on the information in the SDS, the Location HSE Manager feels the product should not be used on the site, Site Management shall be advised to find an alternative material. If an alternative material is selected then the rejected SDS shall be placed in a file or binder for rejected SDS's. If no suitable alternative is available, then the Location HSE Manager shall provide conditional approval for the material with the understanding that the material will require special training, engineering controls, protective equipment, etc. as appropriate.
- 4.6.5 A request for an SDS shall also appear on the purchase order for any hazardous chemicals other than those excluded by Title 29 CFR Part 1926.59 (b)(6) (i-xii).
- 4.6.6 When a material arrives on site, the SDS shall be reviewed to ensure that it is the most recent issue. The SDS shall be marked with the date that the material was received. A copy of the SDS shall be maintained in the Location HSE Manager's master SDS file.
- 4.6.7 Chemical products ordered/received shall be accompanied by and SDS and Purchasing shall ensure all products/chemicals that are received shall include SDS when they take delivery or order products/chemicals.
- 4.6.8 SDS's shall be reviewed to ensure that they contain the required information:
 - 4.6.8.1 The identity used on the label, except as provided for in trade secret exemptions; and,
 - 4.6.8.2 The chemical and common name of the hazardous components which comprise 1% or greater of the composition except that chemicals identified as carcinogens shall be listed if the concentrations are 0.1% or greater.
 - 4.6.8.3 Chemical and common names of ingredients which have been determined to be health hazards and which comprise less than 1% (0.1% for carcinogens) of the mixture, if there is evidence that the ingredients may be released from the mixture in concentrations which would exceed OSHA PEL's or ACGIH TLV's or could present a health hazard to employees.
 - 4.6.8.4 The chemical and common names of ingredients which have been determined to present a physical hazard when present in the mixture.
 - 4.6.8.5 Physical and chemical characteristics of the hazardous chemical.
 - 4.6.8.6 Physical hazards of the hazardous chemical.
 - 4.6.8.7 The health hazards of the hazardous chemical.
 - 4.6.8.8 The primary routes of entry.
 - 4.6.8.9 The OSHA PEL and/or the most current ACGIH TLV and any other exposure limits established.
 - 4.6.8.10 Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs or by OSHA.
 - 4.6.8.11 Any generally applicable precautions for safe handling and use.
 - 4.6.8.12 Any generally applicable control measures.



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

- 4.6.8.13 Emergency and first aid procedures.
- 4.6.8.14 Date of preparation of the SDS or when it was changed.
- 4.6.8.15 The name, address, and telephone number of the chemical manufacturer, importer, employer, or other responsible party preparing or distributing the SDS, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.
- 4.6.8.16 If the material is no longer being used on the site, the SDS shall be marked with the date the material was removed from service and filed or bound with other "SDS's for materials no longer in use". These SDS's are viewed as a type of exposure records and shall be maintained for 30 years following completion of a project.
- 4.6.8.17 SDS quality review: If an SDS is illegible or has pages or portions of pages missing, the SDS shall be replaced.
- 4.6.8.18 Definitions for terms used in Safety Data Sheets are contained in AMS-710-01-WI-00401 Definitions and Glossary of Terms for Safety Data Sheets.
- 4.6.8.19 Materials shall not be used at the site unless an SDS is available on site and has been included in the chemical inventory.
- 4.6.8.20 Employees may request a personal copy of an SDS through the local Site HSE Manager (AMS-710-01-FM-00407).

4.7 Trade Secret

Manufacturers are allowed to withhold some information concerning the identity of chemicals on the SDS if that information is classified as a Trade Secret. However, medical personnel and health care professionals have steps by which they may request the information for emergency or evaluation purposes. If assistance is required due to the trade secret provision being used on an SDS, contact Corporate HSE.

4.8 Training

- 4.8.1 Employees shall be provided training on hazardous chemicals in their work area at the time of their initial assignment and whenever a new hazard is introduced into their work area. This shall include all new employees, employees transferred to new areas, and employees assigned non-routine tasks. In addition, each supervisor must review any significant incidents involving hazardous substances in safety meetings. Employees shall be informed of:
 - 4.8.1.1 The requirements of the Hazard Communication standard
 - 4.8.1.2 Any operation in their work area where hazardous chemicals are present; and
 - 4.8.1.3 The location and availability of the written Hazard Communication Program, including the required list of hazardous chemicals and SDS's.
- 4.8.2 Supervision shall continue on-the-job instruction to employees on Hazard Communication as necessary to ensure proper compliance with these procedures.
- 4.8.3 Employee training shall include at least:
 - 4.8.3.1 Methods and observations that may be used to detect the presence or release of a hazardous chemical in the workplace (this may include the use of monitoring devices, visual appearance, or odor, etc.);
 - 4.8.3.2 The physical and health hazards of the chemicals in the work area;
 - 4.8.3.3 The measures employees can take to protect themselves from these hazards including specific procedures implemented to protect employees from exposure to hazardous chemicals,



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

- 4.8.3.4 Specific details from the site's written Hazard Communication plan, including labeling information, SDS's, and how to use the appropriate hazard information; and
- 4.8.3.5 Safe work practices, emergency responses and the use of personal protective equipment.
- 4.8.3.6 When new information about the hazards of a chemical is discovered.
- 4.8.3.7 Whenever a new physical or health hazard that the employees have not previously been informed of is introduced into the workplace.
- 4.8.4 Training shall be documented.
- 4.8.5 A written examination following the training shall serve as documentation that the employee understood the information provided during the training session.
- 4.8.6 Visitors shall be provided the following information:
 - Hazardous chemicals to which they may be exposed
 - Precautions the employees may take to lessen the possibility of exposure
 - Location of Safety Data Sheets
 - An explanation of the labelling system used at the facility / site
- 4.9 Subcontractor
 - 4.9.1 All Sub-contractors using products requiring an SDS, will be required to provide the SDS to the Safety / HAZCOM Coordinator within one (1) week prior to their arrival. In an emergency situation, the SDS will be provided to the Safety / HAZCOM Coordinator before any work begins.
 - 4.9.2 The HAZCOM Coordinator will provide the sub-contractors with the SDS's for the company's products or materials in the vicinity where the Sub-contractors will be performing their work functions.
 - 4.9.3 It will be the Sub-contractor's responsibility to ensure that their employees are aware of the hazards associated with the materials in the area.
 - 4.9.4 All Sub-contractors will be required to abide by all EPA, OSHA, state and local labor and environmental regulations, in addition to the policies of APTIM whichever is more stringent.
 - 4.9.5 In no event will a Sub-contractor jeopardize their employees or the employees of APTIM by utilizing hazardous materials or work operations that are not safely handled or administered.
- 4.10 Non-Routine Tasks
 - 4.10.1 Prior to performance of non-routine tasks, a hazard assessment shall be conducted. Management personnel are responsible for contacting the Site HSE Manager before any non-routine task is undertaken in their respective work area or anywhere else that employees have the potential for exposure to a hazardous material. This is necessary to evaluate and communicate hazards to the affected employees.
 - 4.10.2 Non-routine tasks will vary from site to site; therefore, the details of the hazard assessment to be conducted shall be specified in the site specific written program. The written program shall also indicate the method of transmitting the information concerning the hazards to the employees, vendors, subcontractors, and client personnel affected.
- 4.11 Coordination with Other Contractors
 - 4.11.1 Arrangements shall be established with contractors on multi-employer sites for the transfer of information concerning chemicals. The details of this arrangement shall be specified in the site specific written Hazard Communication program.



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

4.11.2 During Construction Management, subcontractors will be required to prepare and implement their own Hazard Communication Program that meets the requirements of Title 29 CFR (Code of Federal Regulation) Part 1926.59. In addition, a copy of each contractor's chemical inventory and the SDS for each material or chemical on the inventory shall be submitted to the managing contractors HSE Office. This will provide a centralized location from which an SDS may be obtained. Subcontractors shall maintain their own SDS files as required by Title 29 CFR (Code of Federal Regulation) Part 1926.59

4.12 Auditing

4.12.1 Auditing to ensure compliance with the Hazard Communication Procedure will be conducted as follows:

- Supervision must make daily observations to ensure compliance.
- Annual audits for compliance with this procedure will be conducted by the Hazard Communication Coordinator. A copy of these audits will be sent to Management. If necessary, appropriate corrective action will be implemented as soon as practical.

4.12.2 A review of this procedure will be conducted and documented by management every three years or when new regulations are promulgated.

5.0 REFERENCES

| | |
|---------------------|--|
| AMS-710-01-WI-00401 | Definitions and Glossary of Terms for Safety Data Sheets |
| NIOSH | The Registry of Toxic Effects of chemical Substances |

6.0 TERMINOLOGY

| <u>Term</u> | <u>Definition</u> |
|-------------------|--|
| ACGIH | American Conference of Governmental Industrial Hygienists is an organization of industrial hygienists devoted to the administrative and technical aspects of occupational and environmental health. Each year, ACGIH publishes the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. |
| Carcinogen | A substance or agent producing or inciting cancer. These substances are listed by the National Toxicology Program (NTP) in its Annual Report on Carcinogens, the International Agency for Research on Cancer (IARC) in its Monographs, and by the Occupational Safety and Health Administration in 29 CFR Part 1926 Subpart Z, Toxic and Hazardous Substances. |
| Chemical | Any element, chemical compound or mixture of elements and/or compounds. Examples: cleaning compounds, lubricants, paints, fuels, welding rods, and base metals. |
| Consumer Products | Any product or hazardous substance meeting the definition of the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 11261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended. |



Hazard Communication

| | | |
|----------------------------|------------------|-----------------------|
| AMS Number: | Revision: | Approval Date: |
| AMS-710-01-PR-00400 | 0 | 12/20/2017 |

| | |
|--------------------|---|
| Hazardous Chemical | Any chemical that is a physical hazard or a health hazard. |
| SDS | Safety Data Sheet - a document required by the Hazard Communication Standard by which information concerning the hazards of materials and chemicals is supplied to employees who may come into contact with those materials. The content of the SDS is specified in section (g) (2) of Title 29 CFR Part 1926.59. |
| OSHA | The Occupational Safety and Health Administration. A division within the Department of Labor charged with implementing the provisions of The Occupational Safety and Health Act of 1970. |
| PEL | Permissible Exposure Limit. Limit established by the Occupational Safety and Health Administration (OSHA) concerning the airborne concentration of a contaminant to which an employee may be exposed legally during the work shift or some portion of that shift. |
| Site | Any location, facility or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities and/or project sites. |
| TLV | Threshold Limit Values (and Biological Exposure Indices) are guidelines developed by the ACGIH to assist in the control of health hazards. The TLV's refer to airborne concentrations of substances, and it is believed represent conditions under which nearly all workers may be repeatedly exposed, day after day, without adverse effect. |

7.0 EXHIBITS

| | |
|-------------|---|
| Exhibit 7.1 | AMS-710-01-FM-00401 – Chemical Inventory Report |
| Exhibit 7.2 | AMS-710-01-FM-00402 – SDS/Product Evaluation |
| Exhibit 7.3 | AMS-710-01-FM-00403 – Hazard Communication Written Program—Projects |
| Exhibit 7.4 | AMS-710-01-FM-00404 – Hazard Communication Written Program—Fixed Facilities |
| Exhibit 7.5 | AMS-710-01-FM-00405 – Hazardous Substance Emergency Information |
| Exhibit 7.6 | AMS-710-01-FM-00406 – Hazardous Substance Emergency Information—Spanish |
| Exhibit 7.7 | AMS-710-01-FM-00407 – Employee Request for Safety Data Sheet |
| Exhibit 7.8 | AMS-720-01-FM-00020 – Business Glossary |
| Exhibit 7.9 | AMS-720-01-FM-00021 – Technical Glossary |

8.0 ATTACHMENTS

None

ATTACHMENT 3

INCIDENT REPORTING FORMS

PROCEDURE

Procedure Number:

AMS-710-05-PR-02200

Revision:

2

Procedure Owner:

HSE

Issuing Authority:

VP HSE

Approval Date:

2/27/2020



INCIDENT REPORTING

| | | | |
|------------|---|-------------------------|-------------|
| 2 | Updated sections to match new APTIM procedure template, removed section 8.0 Deliverables and Inputs table, added sections 4.3.1 and 4.5.6.1. Removed Incident Investigation reference. Removed Attachments. | M. Karr | 2/27/2020 |
| 1 | Added section 4.1.6 - 4.1.9 to give more clarity on existing requirements. Added 4.5.6 regarding applicable regulatory reporting requirements. Added "Client" in all sections under 4.2 as a potential recipient of incident notification. | M. Hetzler | 5/31/2018 |
| 0 | Revised 3.0, 4.2, 4.3, 4.4, 4.5, 4.6, and 6.0. Removed Exhibits 7.1, 7.2, 7.3 after revising section 4.3 to eliminate internal duplication. Revisions also align with APTIM processes, general position titles, and the implementation of AIM. Title has been updated from Incident Notification to Incident Reporting. Incorporated pertinent content from AMS-710-05-PR-02300 Incident Investigation. Incident Investigation PR is void with issuance of this PR. | M. Hetzler | 2/20/2018 |
| INT | Issued for interim use | M. Hadacek & S. Lachney | 7/30/2017 |
| Rev | Changes | Approved | Date |

Parent Document:

N/A



Procedure Number: **AMS-710-05-PR-02200**

Revision: **2**

Approval Date: **2/27/2020**

INCIDENT REPORTING

INCIDENT REPORTING

1.0 PURPOSE

The purpose of this Procedure is to establish the minimum requirements for Incident Reporting on APTIM sites.

Deliverables are to be listed in a table as shown below:

| Deliverable | Producer | Customer |
|----------------------------------|---------------------------------------|-----------------|
| Report of Incident | APTIM Employee or APTIM Subcontractor | Supervisor |
| Incident Report | HSE Representative | AIM |
| Notice of Violation (NOV) Report | HSE Representative | AIM |
| Near Miss/ Great Catch Report | HSE Representative | AIM |

2.0 SCOPE

This procedure applies to APTIM employees as well as non-APTIM personnel that are supervised on a day-to-day basis by APTIM personnel. Day-to-day supervision occurs when in addition to specifying the output, product or result to be accomplished by the person's work, APTIM supervises the details, means, methods and processes by which the work is to be accomplished.

3.0 RESPONSIBILITIES

The following personnel have responsibilities defined in this procedure:

- APTIM Managers
- APTIM Supervisors
- APTIM Employees
- APTIM Subcontractors
- APTIM Visitors
- APTIM HSE Managers
- APTIM HSE Representatives
- APTIM Legal
- Root Cause Analysis Team Leader

4.0 PROCEDURE

Each site shall make every attempt to prevent the possibility of incidents to employees and the environment when performing work activities. This can reasonably be achieved through compliance with APTIM Health, Safety, and Environmental procedures, training of employees to properly perform their job activities, and employee involvement in safe work activities.

INCIDENT REPORTING

4.1 General

- 4.1.1 Employees and Subcontractors are required to report all incidents to their respective APTIM supervisor, regardless of severity.
- 4.1.2 When an incident occurs, the primary focus shall be obtaining treatment for injured people and securing the scene to allow the incident investigation to proceed and prevent additional hazards.
- 4.1.3 Once the injured employee(s) have been cared for and the scene has been secured or the spill is controlled, an incident investigation shall be initiated in accordance with section 4.3.
- 4.1.4 All incidents will be documented on an Incident Report Form (AMS-710-05-FM-02401) or Near Miss / Great Catch Form (AMS-710-05-FM-02301) and entered into the APTIM Incident Management (AIM) system.
- 4.1.5 The Incident Report Form and AIM record will both be used to facilitate reporting of incidents. However, due to the time required to complete paperwork and data entry, alternative methods of reporting shall be required in some instances. Reporting requirements are outlined in section 4.2.
- 4.1.6 Identification of evidence immediately following an incident may include a listing of people, equipment, and materials involved and a recording of environmental factors such as weather, illumination, temperature, noise, ventilation, and physical factors such as fatigue, age, and medical conditions.
- 4.1.7 Witness interview(s) and statements must be collected. Locating witness, limiting interaction between witnesses (ensuring unbiased testimony), obtaining appropriate interview locations, and use of trained interviewers should be detailed. The need for follow-up interviews should also be considered.
- 4.1.8 Corrective actions should be identified, logged in the AIM system, and updated until completion.
- 4.1.9 Lessons learned should be reviewed and communicated to applicable groups. Changes to processes must be placed into effect to prevent reoccurrence or similar events.

4.2 Incident Reporting Requirements

- 4.2.1 Level I Incidents shall be reported as follows:
 - 4.2.1.1 When an incident occurs site personnel shall immediately notify, either verbally or in writing, the Site Manager and HSE Representative.
 - 4.2.1.2 Within 24 hours the Site Manager or HSE Representative shall notify, either verbally or in writing, Strategic Business Unit (SBU) Management and SBU HSE Management.

INCIDENT REPORTING

- 4.2.1.3 Within 24 hours site personnel shall complete Section 1 of the Incident Report Form and ensure the same data is entered into AIM. This represents the minimum initial incident data.
- 4.2.1.4 Where applicable, the incident must be reported to the client within the required timeframe.
- 4.2.1.5 The incident investigation shall be completed within five business days of the incident date. For more complex incident investigations, additional time may be granted by the respective HSE Lead.
- 4.2.1.6 The AIM incident record shall be closed in AIM once the investigation is completed and all required documentation has been obtained.
- 4.2.2 Level II Incidents shall be reported as follows:
 - 4.2.2.1 When an incident occurs site personnel shall immediately notify, either verbally or in writing, the Site Manager and HSE Representative.
 - 4.2.2.2 Within 2 hours the Site Manager or HSE Representative shall notify, either verbally or in writing, SBU Management and SBU HSE Lead.
 - 4.2.2.3 Within 24 hours site personnel shall complete Section 1 of the Incident Report Form and ensure the same data is entered into AIM. This represents the minimum initial incident data.
 - 4.2.2.4 Where applicable, the incident must be reported to the client within the required timeframe.
 - 4.2.2.5 The incident investigation shall be completed within five business days of the incident date. For more complex incident investigations, additional time may be granted by the respective SBU HSE Lead.
 - 4.2.2.6 The AIM incident record shall be closed in AIM once the investigation is completed and all required documentation has been obtained.
- 4.2.3 Level III Incidents shall be reported as follows:
 - 4.2.3.1 When an incident occurs site personnel shall immediately notify, either verbally or in writing, the Site Manager and HSE Representative.
 - 4.2.3.2 Within 2 hours the Site Manager or HSE Representative shall notify, either verbally or in writing, SBU Management and SBU HSE Management. Additional notifications shall be made to General Counsel, Human Resources, Executive Management, and others as required.

INCIDENT REPORTING

- 4.2.3.3 Within 24 hours site personnel shall complete Section 1 of the Incident Report Form and ensure the same data is entered into AIM. This represents the minimum initial incident data.
- 4.2.3.4 Where applicable, the incident must be reported to the client within the required timeframe.
- 4.2.3.5 The incident investigation shall be completed within ten business days of the incident date. For more complex incident investigations, additional time may be granted by the respective SBU HSE Lead.
- 4.2.3.6 The AIM incident record shall be closed in AIM once the investigation is completed and all required documentation has been obtained.
- 4.2.4 Level IV Incidents shall be reported as follows:
 - 4.2.4.1 Level IV incidents will be reported in accordance with the Crisis Management Procedure (AMS-100-00-PR-00080).
 - 4.2.4.2 Where applicable, the incident must be reported to the client within the required timeframe.
 - 4.2.4.3 The incident shall be recorded in AIM and closed upon completion of all requirements in the Crisis Management Procedure (AMS-100-00-PR-00080).
- 4.2.5 Near Misses (NM) and Great Catches (GC)
 - 4.2.5.1 Within 24 hours site personnel shall complete the Near Miss / Great Catch Form (AMS-710-05-FM-02301) and ensure the same data is entered into AIM. This represents the minimum initial incident data.
 - 4.2.5.2 The AIM incident record shall be closed in AIM once the investigation is completed, if applicable, and all required documentation has been obtained.
 - 4.2.5.3 If at any time an employee observes any condition or practice in which danger exists that could reasonably be expected to cause death or serious harm to people or the environment, he/she shall immediately stop the work, contact a supervisor, and ensure the condition is corrected before work continues.
- 4.2.6 The designated HSE Representative for each site/facility shall maintain a list in the Site Specific HSE Plan identifying each appropriate individual to be notified by name, location, and phone number for the notifications.
- 4.3 Cause Analysis of Incidents**
 - 4.3.1 Workplace incidents including injuries, illnesses, near misses, and stop work interventions should be investigated to identify the root cause in order to prevent future occurrences.

INCIDENT REPORTING

4.3.2 Incidents categorized as Level 2 or above may require a formal Root Cause Analysis (RCA) as directed by SBU HSE Lead.

4.3.2.1 The process defined in AMS-720-01-PR-00600 Root Cause Analysis Procedure, shall be followed for all RCAs performed for incidents.

4.3.2.2 Taproot is the preferred RCA tool for HSE Incidents. Other methods/tools referenced in AMS-720-01-PR-00600 may be used as appropriate.

4.3.3 RCA Team leaders must be trained in RCA processes used.

4.3.4 Prior to starting an RCA, the RCA Team leader shall coordinate with Legal and follow protocols defined by Legal.

4.3.4.1 RCA related correspondence and reports shall be provided to Legal in accordance with protocols established by Legal.

4.4 Record Retention

4.4.1 All applicable forms and documents shall be maintained in the site HSE Department files for the duration of the project.

4.4.2 All incidents with forms and supporting documentation shall be entered into AIM for record keeping purposes. Supporting documentation may include, but is not limited to, the following: initial investigation details/documents such as: photographs, sketches, training records, JSA, risk assessment, method statement, standard operating procedure, maintenance records, and or other pertinent information.

4.4.3 Personally Identifiable Information (PII) shall not be included in the AIM incident record in any form (i.e. text or attached files). Any correspondence including PII shall be provided to and maintained by the respective Case Manager / Workers' Comp personnel.

4.5 Correspondence with Regulatory Bodies or non-APTIM Legal Counsel

4.5.1 When contacted or visited by a regulatory authority or any outside legal counsel, the site personnel shall immediately notify, either verbally or in writing, the Site Manager and HSE Representative. Examples of regulatory authorities may include, but is not limited to, the following:

- Occupational Health and Safety Administration (OSHA)
- Department of Transportation (DOT)
- Environment Protection Authority (EPA)

4.5.2 In the case of unplanned visits, Site personnel shall accommodate visitors and gain an understanding of the scope of the visit.

INCIDENT REPORTING

- 4.5.3 In all circumstances, site personnel shall consult with APTIM Legal prior to providing documentation or written responses to any requests from a regulatory body or non-APTIM Legal Counsel. In addition, the Site Manager or HSE Representative shall also notify SBU Management and HSE Management.
- 4.5.4 APTIM's policy is to meet the requirements of all rules and regulations while ensuring we handle each visit or request with the appropriate level of diligence. If unsure about how to proceed, personnel should contact APTIM Legal and/or the designated HSE Representative.
- 4.5.5 Within 24 hours site personnel shall complete Section 1 and the NOV/Agency Visit Section of the Incident Report Form and ensure the same data is entered into AIM. This represents the minimum initial incident data.
- 4.5.6 Where required, incidents must be reported to applicable regulatory agency(s) within the required timeframe.
- 4.5.6.1 HSE and Legal will coordinate to make required notifications to OSHA within the prescribed timelines. (In-patient hospitalizations, amputations, or eye loss within 24 hours and workplace fatalities within 8 hours)

4.6 Training

- 4.6.1 Site personnel shall receive incident notification requirements as part of their site-specific orientation.
- 4.6.2 Supervision shall receive incident investigation training in accordance with AMS-710-05-PR-01900 HSE Education and Training.

5.0 TERMINOLOGY

| Term | Definition |
|--|--|
| APTIM Employees | Persons who are full time or part time employed by APTIM. |
| APTIM Subcontractor | Subcontractors whose employees' daily work is supervised by APTIM (i.e., details, means, methods and processes by which the work is to be accomplished). |
| Environmental Spill | Any release, in any amount, that contaminates soil, surface water, groundwater, and/or air. |
| Equipment Damage/Property Damage (ED/PD) | An incident with vehicles or heavy equipment that occurs on site while off a designated roadway, or an incident with a parked vehicle. Examples include bulldozer clipping another piece of equipment, backhoe handling debris that breaks a window, pickup bending a bumper on a stump, vandalism, and parked company vehicle hit by non-company vehicle. |
| Fatal Incidents | Fatalities (deaths) occurring directly as a result of a work-related incident, including those that occur sometime after the |

INCIDENT REPORTING

| | |
|---------------------------------|---|
| | <p>incident as a direct result of the injuries sustained. Excluded are fatalities arising from natural causes, unless there is evidence of a failure in the application of health and safety procedures (e.g., inadequate provision of emergency first aid).</p> |
| Great Catch (GC) | <p>Condition identified/observed prior to any incident occurring which may have resulted in property damage or personal injury, but where given a slight shift in time or position, damage to property and/or personal injury could have easily occurred.</p> |
| High Potential Incidents (HiPo) | <p>Incidents that have the potential to cause a fatality or serious injuries irrespective of whether the event resulted in an actual incident. The list below does not include every incident imaginable, but is intended to provide a few examples of potential incidents that would be considered to be serious injuries:</p> <ul style="list-style-type: none"> • Amputation • Serious or multiple fractures • Loss of sight in one or both eyes • Serious burns <p>Any other injury or incident that has/had the potential to result in unconsciousness, resuscitation, or admission to hospital for more than 24 hours</p> |
| Incident | <p>An unplanned event that either caused or may have caused personal injury, property damage, impact on the environment, or interference with production.</p> |
| Level I Minor Incident | <p>Any event that causes or has the potential to cause only minor damage and/or citation or an injury/illness requiring only first aid treatment. This level includes incidents in which the employee has a non-work related event requiring utilization of first aid supplies.</p> <ul style="list-style-type: none"> • A small fire not requiring assistance to extinguish. • Motor Vehicle Incident with damage less than \$5K • Fall into water or resulting in deployment of lanyard. • Environmental spill less than 25 gallons; <ul style="list-style-type: none"> ○ That does not violate any reportable quantity ○ And does not contact a navigable waterway. <p>“Report Only” incidents: minor incidents in which injury occurred but no medical treatment of any kind was rendered.</p> |
| Level II Serious Incident | <p>Any event that required or had the potential to require emergency services for treatment of an injury or control of hazards to personnel or the environment to include:</p> <ul style="list-style-type: none"> • Recordable injuries/illnesses • Restricted workday injuries/illnesses • Any incident that causes damage to equipment requiring extensive repair or causes a disruption in work progress • Serious environmental consequences (any quantity of release to the environment requiring reporting to |

INCIDENT REPORTING

| | |
|---|---|
| | <p>relevant governmental agencies).</p> <ul style="list-style-type: none"> • Reputation or community relations affected • Environmental spill of 25 to 1000 gallons; <ul style="list-style-type: none"> ○ That does not contact a navigable waterway ○ And does not require regulatory notification • High potential incidents as defined above • Could affect reputation or community relations |
| <p style="text-align: center;">Level III Major Incident</p> | <p>Any event causing or having the potential to cause multiple injured/ill personnel requiring emergency services, permanently disabling injuries/illness, lost workday injuries/illnesses, fatalities, property damage in excess of \$50K, disruption of critical plant systems, or environmental impacts requiring regulatory notifications to include:</p> <ul style="list-style-type: none"> • Injuries/illnesses that cause lost work time • Fatality • Hospital admittance (excluding emergency room outpatient care) • Major fire or chemical spill, greater than 1 000 gallons, or a spill of any amount that contacts a navigable waterway, • Radiation exposure • Lost radioisotope • Bomb threat, weapons discharge, terrorist act, NGO confrontation • ISOS evacuation • Any injury or illness meeting the definition of lost time • Any incident causing damage to equipment or resources that will disrupt work activities • Environmental spill that reaches the environment outside the site's boundaries. • Any incident requiring use of outside services (e.g., spill response contractor) • Any incident receiving news coverage |
| <p style="text-align: center;">Level IV Crisis</p> | <p>Any event requiring initiation of the Crisis Management Plan (AMS-100-00-PR-00080). The Trigger point for any natural crisis is loss of life, hospitalization of multiple personnel, significant destructive impact to work activities, or a delay in the resumption of work activities for 24 hours or more. In addition to the Natural Crisis, many of the countries in which APTIM operates have actual or potential areas of risk due to political instability, war, terrorism, or high crime rates, these include:</p> <ul style="list-style-type: none"> • Airline Incident - The trigger point is any airline incident with APTIM employees or assets involved. • Bomb Threat - The trigger point is any direct or indirect bomb threat against employees, the facility, or its assets. • War or Military Conflict - The trigger point is any war or military conflict that directly or indirectly affects personnel and assets. |

INCIDENT REPORTING

| | |
|------------------------|---|
| | <ul style="list-style-type: none"> • Acts of Terrorism - The trigger point is any act of terrorism that directly or indirectly affects personnel and assets. • Civil Disturbances (including demonstrations, protests, and other confrontations) - The trigger point is any civil disturbance that directly or indirectly affects personnel and assets. • Kidnap and Ransom - trigger point is any act of kidnap and/or ransom demand that directly or indirectly affects personnel and assets. • Extortion Demands – The trigger point is any act of extortion made against APTIM personnel to perform acts of kidnapping, injury, and assassination. • Detention by Host Government - The trigger point is any act of detention by a host government that directly or indirectly affects personnel and assets. |
| Motor Vehicle Incident | An incident with a street legal vehicle on a designated roadway that is being actively operated, i.e., not parked. This includes incidents with moving vehicles in parking lots. |
| Near Miss (NM) | Incident where no property was damaged, and no personal injury was sustained. However, given a slight shift in time or position, damage to property and/or personal injury could have occurred. A Near Miss differs from a Great Catch due to the fact that there has been a release of energy (i.e. an incident). |
| Site | Any location, facility, or project where APTIM is performing work. Sites may include, but are not limited to, laboratories, offices, shops, owned facilities, leased facilities, and/or project sites. |

6.0 REFERENCES

6.1 Required Forms/Checklists

| | |
|---------------------|------------------------------|
| AMS-710-05-FM-02301 | Near Miss / Great Catch Form |
| AMS-710-05-FM-02401 | Incident Report Form |

6.2 Other Internal References

| | |
|---------------------|-------------------------------|
| AMS-100-00-PR-00080 | Crisis Management Plan |
| AMS-710-05-PR-01900 | HSE Education and Training |
| AMS-720-01-PR-00600 | Root Cause Analysis Procedure |

6.3 Other External References

| |
|------|
| None |
|------|

INCIDENT REPORTING

7.0 ATTACHMENTS

| Attachment | Attachment Title |
|-------------------|---|
| Attachment 7.1 | Incident Reporting Process Flow Diagram |



Procedure Number: AMS-710-05-PR-02200

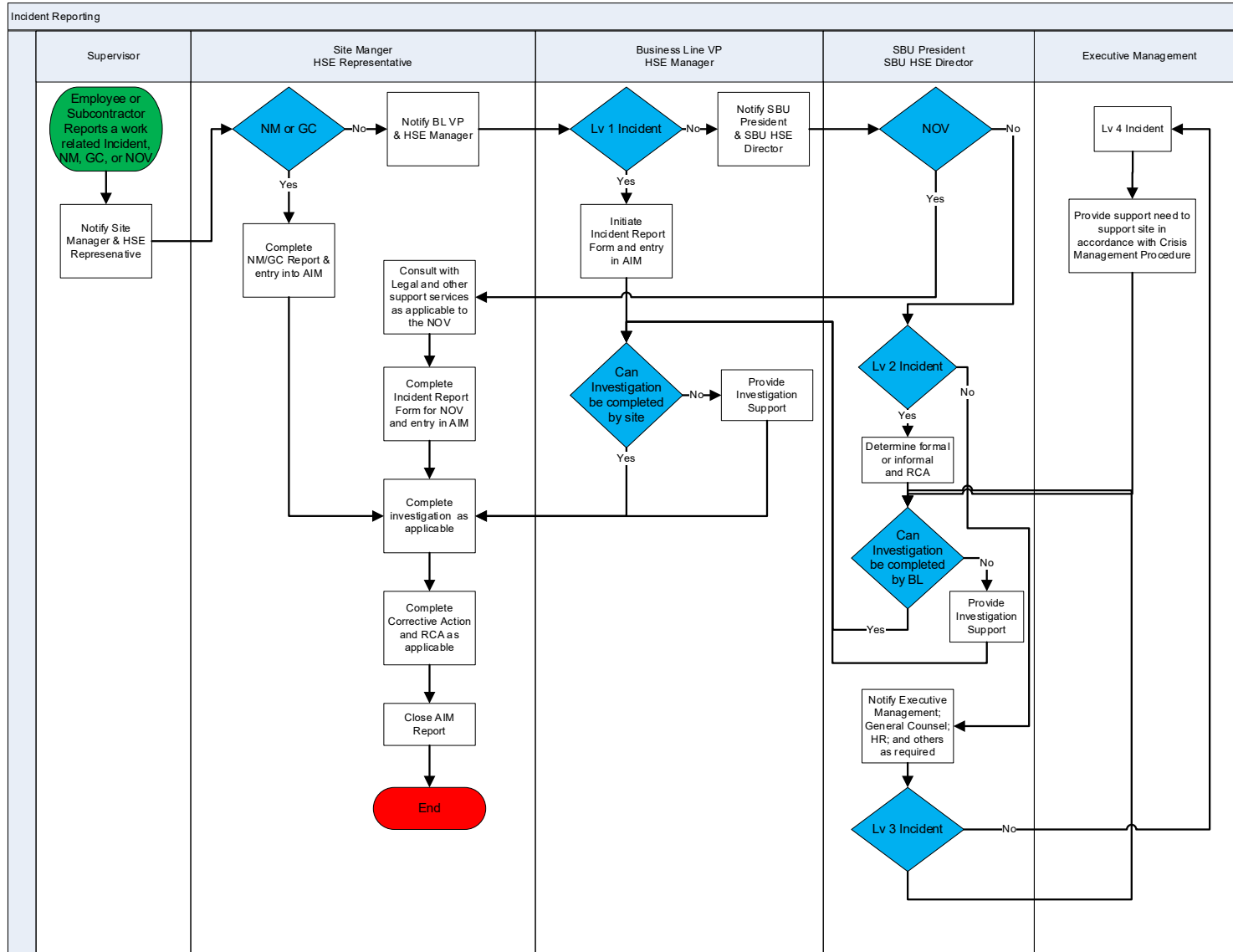
Revision: 2

Approval Date: 2/27/2020

INCIDENT REPORTING

ATTACHMENT 7.1 INCIDENT REPORTING PROCESS FLOW DIAGRAM

INCIDENT REPORTING





APTIM INCIDENT REPORT

| General Information – Applicable to All Incidents | | | *Required Fields |
|--|---|--|---|
| *Type of Incident: | | | |
| <input type="checkbox"/> Information Only | <input type="checkbox"/> Illness | <input type="checkbox"/> NOV/Agency Visit | <input type="checkbox"/> Vehicle Incident |
| <input type="checkbox"/> First Aid | <input type="checkbox"/> Complaint | <input type="checkbox"/> Property Damage | <input type="checkbox"/> Non-Work |
| <input type="checkbox"/> Injury | <input type="checkbox"/> Spill | <input type="checkbox"/> Fire | |
| *Incident Category: Tier I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV <input type="checkbox"/> | *Severity Consequence Matrix: Low <input type="checkbox"/> Medium <input type="checkbox"/> High <input type="checkbox"/> | *Incident Date: | |
| *Project Number: | *Project Name | *Incident Time: | |
| *Did incident occur on employer premises? Yes <input type="checkbox"/> No <input type="checkbox"/> | If not on premises, where at? | *Date Incident Reported | |
| *High Potential Incident? Yes <input type="checkbox"/> No <input type="checkbox"/> | Work Shift: Day <input type="checkbox"/> Night <input type="checkbox"/> | Part of Shift: Before <input type="checkbox"/> During <input type="checkbox"/> After <input type="checkbox"/> | |
| *Injured/Primary Party Name: | Injured/Primary Party Employee Number: | Injured/Primary Party Title: | |
| *Employee Type: | *Employer (if other than APTIM): | Employee Supervisor: | |
| Drug/Alcohol Test Administered? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, type: | | *Specific Location (Loading Dock, etc.): | |
| *Brief Description of the Incident: | | | |
| *Detailed Description of What Happened: | | | |
| Immediate Actions Taken: | | | |
| Time Employee Began Work: | What was the task being performed? | | |
| Experience with this task? Months Years | How often does Employee perform this task? | Working with what part/model number? | |
| Injury/Illness – If Applicable | | | |
| *Injury/Illness Description: (Body Part/Nature of Injury, DO NOT Diagnose or Give Diagnosis Unless Documented by HC Professional) | | | |
| Was injured treated in an emergency room? Yes <input type="checkbox"/> No <input type="checkbox"/> | | Was injured hospitalized overnight as an inpatient? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| Was employee sent off site for treatment? Yes <input type="checkbox"/> No <input type="checkbox"/> | | *Was medical treatment provided on site? Yes <input type="checkbox"/> No <input type="checkbox"/> | |
| Was employee seen by a licensed health care provider? (i.e. clinic, ER, doctor, nurse, physician’s assistant) Yes <input type="checkbox"/> No <input type="checkbox"/> | | | |
| Treatment provided: | | Provided By: (Name) | |
| Hospital/Treatment Facility: | | Physician/Health Care Professional: (Name) | |
| Hospital/Treatment Facility Address (Street, City, State, Zip): | | | |



APTIM INCIDENT REPORT

| | | | | | | |
|--|--|--|--|---|--|--|
| Does employee have lost days? Yes <input type="checkbox"/> No <input type="checkbox"/> | | How many days? Est <input type="checkbox"/> Actual <input type="checkbox"/> | Time period: | | | |
| Does employee have restrictions? Yes <input type="checkbox"/> No <input type="checkbox"/> | | Describe: | When are they to be lifted? | | | |
| *Classification: | <input type="checkbox"/> First Aid | <input type="checkbox"/> Medical Treatment – Recordable | <input type="checkbox"/> Restricted Work Duty - Recordable | | | |
| | <input type="checkbox"/> Lost Time – Recordable | <input type="checkbox"/> Occupational Illness – Recordable | <input type="checkbox"/> Non Work Related <input type="checkbox"/> | | | |
| Fatality <input type="checkbox"/> | | | | | | |
| *Reasoning for Injury Classification: | | | | | | |
| *What was the employee doing just before the incident occurred? | | | | | | |
| *How did the accident occur? | | | | | | |
| *What object(s) or substance(s) directly harmed the employee? | | | | | | |
| *What was the injury or illness? | | | | | | |
| * Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill. (OSHA 300 Column F) | | | | | | |
| *Body Part: | | *Side of Body: | | | | |
| <table style="width:100%; border:none;"> <tr> <td style="vertical-align: top;"> <p>*Accident Type:</p> <input type="checkbox"/> Absorption Ingestion Or Inhalation Noc <input type="checkbox"/> Burn,Contact W/Welding Objects <input type="checkbox"/> Burn,Inhale,Contact W Chemicals <input type="checkbox"/> Burn,Scald,Cont. W/Dust,Gases,Fumes,Vapor <input type="checkbox"/> Burn,Scald,Contact Abnormal Air Pressure <input type="checkbox"/> Burn,Scald,Contact Electric Current <input type="checkbox"/> Burn,Scald,Contact Fire/Flame <input type="checkbox"/> Burn,Scald,Contact Steam/Cold Objects <input type="checkbox"/> Burn,Scald,Contact Steam/Hot Fluid <input type="checkbox"/> Burn,Scald,Contact W Hot Object <input type="checkbox"/> Burn,Scald,Contact W Temp. Extremes <input type="checkbox"/> Burn,Scald,Contact With Radiation <input type="checkbox"/> Burn,Scald-Miscellaneous <input type="checkbox"/> Caught In Or Between-Collapsing Material <input type="checkbox"/> Caught In Or Between-Machine <input type="checkbox"/> Caught In Or Between-Miscellaneous <input type="checkbox"/> Caught In Or Between-Object Handled <input type="checkbox"/> Crash Of Rail Vehicle <input type="checkbox"/> Crash Of Water Vehicle <input type="checkbox"/> Cut By Hand Tool,Utensil Not Powered <input type="checkbox"/> Cut By Powered Hand Tool,Appliance <input type="checkbox"/> Cut/Puncture By Broken Glass <input type="checkbox"/> Cut/Puncture By Object Being Lifted <input type="checkbox"/> Cut/Puncture/Scrape By Misc. <input type="checkbox"/> Exposure to mechanical vibration <input type="checkbox"/> Exposure to mental stress factors </td> <td style="vertical-align: top;"> <input type="checkbox"/> Exposure to particles or contaminants <input type="checkbox"/> Exposure to radiation <input type="checkbox"/> Exposure to sharp, sudden sound <input type="checkbox"/> Exposure to variations in pressure - other than sound <input type="checkbox"/> Fall Or Slip-From Different Level <input type="checkbox"/> Fall Or Slip-From Ladder Or Scaffolding <input type="checkbox"/> Fall Or Slip-From Liquid Or Grease Spill (Same Level) <input type="checkbox"/> Fall Or Slip-Into Openings <input type="checkbox"/> Fall Or Slip-Miscellaneous <input type="checkbox"/> Fall Or Slip-On Ice Or Snow (Same Level) <input type="checkbox"/> Fall Or Slip-On Same Level <input type="checkbox"/> Fall Or Slip-On Stairs <input type="checkbox"/> Fall Or Slip-Slipped,Did Not Fall <input type="checkbox"/> Foreign Body In Eye <input type="checkbox"/> Long term contact with chemical or substance <input type="checkbox"/> Long term exposure to sounds <input type="checkbox"/> Misc Cases-Animal Or Insect <input type="checkbox"/> Misc Cases-Explosion Or Flareback <input type="checkbox"/> Misc Cases-Robbery/Criminal Assault <input type="checkbox"/> Mold <input type="checkbox"/> Motor Vehicle - Collision With Fixed Object <input type="checkbox"/> Motor Vehicle Collision W/Another Vehicle <input type="checkbox"/> Motor Vehicle-Crash Of Air Plane <input type="checkbox"/> Motor Vehicle-Miscellaneous <input type="checkbox"/> Natural Disasters <input type="checkbox"/> Repetitive Motion <input type="checkbox"/> Rubbed Or Abraded By Repetitive Motion </td> <td style="vertical-align: top;"> <input type="checkbox"/> Single contact with chemical or substance - excludes insect and spider bites and stings <input type="checkbox"/> Slide or Cave-In <input type="checkbox"/> Strain By Holding Or Carrying <input type="checkbox"/> Strain By Pushing Or Pulling <input type="checkbox"/> Strain Or Inj By Continual Noise <input type="checkbox"/> Strain Or Inj By Jumping <input type="checkbox"/> Strain Or Inj By Lifting <input type="checkbox"/> Strain Or Inj By Reaching <input type="checkbox"/> Strain Or Inj By Twisting <input type="checkbox"/> Strain Or Inj By Using Tool Or Machine <input type="checkbox"/> Strain Or Inj By Welding Or Throwing <input type="checkbox"/> Striking Against Moving Parts Of Machine <input type="checkbox"/> Striking Against Object Being Lifted/Han <input type="checkbox"/> Striking Against Sand/Scrap/Oper. <input type="checkbox"/> Striking Against Stationary Object <input type="checkbox"/> Striking/Stepping On Miscellaneous <input type="checkbox"/> Striking/Stepping On Sharp Objects <input type="checkbox"/> Struck Or Inj By Falling Or Flying Objec <input type="checkbox"/> Struck Or Inj By Fellow Worker,Patien <input type="checkbox"/> Struck Or Inj By Hand Tool/Machine <input type="checkbox"/> Struck Or Inj By Motor Vehicle <input type="checkbox"/> Struck Or Inj By Object Handled By Other <input type="checkbox"/> Struck Or Inj By Object Lifted/Handled <input type="checkbox"/> Struck Or Injured By-Moving Parts <input type="checkbox"/> Terrorism <input type="checkbox"/> Other: </td> </tr> </table> | | | | <p>*Accident Type:</p> <input type="checkbox"/> Absorption Ingestion Or Inhalation Noc <input type="checkbox"/> Burn,Contact W/Welding Objects <input type="checkbox"/> Burn,Inhale,Contact W Chemicals <input type="checkbox"/> Burn,Scald,Cont. W/Dust,Gases,Fumes,Vapor <input type="checkbox"/> Burn,Scald,Contact Abnormal Air Pressure <input type="checkbox"/> Burn,Scald,Contact Electric Current <input type="checkbox"/> Burn,Scald,Contact Fire/Flame <input type="checkbox"/> Burn,Scald,Contact Steam/Cold Objects <input type="checkbox"/> Burn,Scald,Contact Steam/Hot Fluid <input type="checkbox"/> Burn,Scald,Contact W Hot Object <input type="checkbox"/> Burn,Scald,Contact W Temp. Extremes <input type="checkbox"/> Burn,Scald,Contact With Radiation <input type="checkbox"/> Burn,Scald-Miscellaneous <input type="checkbox"/> Caught In Or Between-Collapsing Material <input type="checkbox"/> Caught In Or Between-Machine <input type="checkbox"/> Caught In Or Between-Miscellaneous <input type="checkbox"/> Caught In Or Between-Object Handled <input type="checkbox"/> Crash Of Rail Vehicle <input type="checkbox"/> Crash Of Water Vehicle <input type="checkbox"/> Cut By Hand Tool,Utensil Not Powered <input type="checkbox"/> Cut By Powered Hand Tool,Appliance <input type="checkbox"/> Cut/Puncture By Broken Glass <input type="checkbox"/> Cut/Puncture By Object Being Lifted <input type="checkbox"/> Cut/Puncture/Scrape By Misc. <input type="checkbox"/> Exposure to mechanical vibration <input type="checkbox"/> Exposure to mental stress factors | <input type="checkbox"/> Exposure to particles or contaminants <input type="checkbox"/> Exposure to radiation <input type="checkbox"/> Exposure to sharp, sudden sound <input type="checkbox"/> Exposure to variations in pressure - other than sound <input type="checkbox"/> Fall Or Slip-From Different Level <input type="checkbox"/> Fall Or Slip-From Ladder Or Scaffolding <input type="checkbox"/> Fall Or Slip-From Liquid Or Grease Spill (Same Level) <input type="checkbox"/> Fall Or Slip-Into Openings <input type="checkbox"/> Fall Or Slip-Miscellaneous <input type="checkbox"/> Fall Or Slip-On Ice Or Snow (Same Level) <input type="checkbox"/> Fall Or Slip-On Same Level <input type="checkbox"/> Fall Or Slip-On Stairs <input type="checkbox"/> Fall Or Slip-Slipped,Did Not Fall <input type="checkbox"/> Foreign Body In Eye <input type="checkbox"/> Long term contact with chemical or substance <input type="checkbox"/> Long term exposure to sounds <input type="checkbox"/> Misc Cases-Animal Or Insect <input type="checkbox"/> Misc Cases-Explosion Or Flareback <input type="checkbox"/> Misc Cases-Robbery/Criminal Assault <input type="checkbox"/> Mold <input type="checkbox"/> Motor Vehicle - Collision With Fixed Object <input type="checkbox"/> Motor Vehicle Collision W/Another Vehicle <input type="checkbox"/> Motor Vehicle-Crash Of Air Plane <input type="checkbox"/> Motor Vehicle-Miscellaneous <input type="checkbox"/> Natural Disasters <input type="checkbox"/> Repetitive Motion <input type="checkbox"/> Rubbed Or Abraded By Repetitive Motion | <input type="checkbox"/> Single contact with chemical or substance - excludes insect and spider bites and stings <input type="checkbox"/> Slide or Cave-In <input type="checkbox"/> Strain By Holding Or Carrying <input type="checkbox"/> Strain By Pushing Or Pulling <input type="checkbox"/> Strain Or Inj By Continual Noise <input type="checkbox"/> Strain Or Inj By Jumping <input type="checkbox"/> Strain Or Inj By Lifting <input type="checkbox"/> Strain Or Inj By Reaching <input type="checkbox"/> Strain Or Inj By Twisting <input type="checkbox"/> Strain Or Inj By Using Tool Or Machine <input type="checkbox"/> Strain Or Inj By Welding Or Throwing <input type="checkbox"/> Striking Against Moving Parts Of Machine <input type="checkbox"/> Striking Against Object Being Lifted/Han <input type="checkbox"/> Striking Against Sand/Scrap/Oper. <input type="checkbox"/> Striking Against Stationary Object <input type="checkbox"/> Striking/Stepping On Miscellaneous <input type="checkbox"/> Striking/Stepping On Sharp Objects <input type="checkbox"/> Struck Or Inj By Falling Or Flying Objec <input type="checkbox"/> Struck Or Inj By Fellow Worker,Patien <input type="checkbox"/> Struck Or Inj By Hand Tool/Machine <input type="checkbox"/> Struck Or Inj By Motor Vehicle <input type="checkbox"/> Struck Or Inj By Object Handled By Other <input type="checkbox"/> Struck Or Inj By Object Lifted/Handled <input type="checkbox"/> Struck Or Injured By-Moving Parts <input type="checkbox"/> Terrorism <input type="checkbox"/> Other: |
| <p>*Accident Type:</p> <input type="checkbox"/> Absorption Ingestion Or Inhalation Noc <input type="checkbox"/> Burn,Contact W/Welding Objects <input type="checkbox"/> Burn,Inhale,Contact W Chemicals <input type="checkbox"/> Burn,Scald,Cont. W/Dust,Gases,Fumes,Vapor <input type="checkbox"/> Burn,Scald,Contact Abnormal Air Pressure <input type="checkbox"/> Burn,Scald,Contact Electric Current <input type="checkbox"/> Burn,Scald,Contact Fire/Flame <input type="checkbox"/> Burn,Scald,Contact Steam/Cold Objects <input type="checkbox"/> Burn,Scald,Contact Steam/Hot Fluid <input type="checkbox"/> Burn,Scald,Contact W Hot Object <input type="checkbox"/> Burn,Scald,Contact W Temp. Extremes <input type="checkbox"/> Burn,Scald,Contact With Radiation <input type="checkbox"/> Burn,Scald-Miscellaneous <input type="checkbox"/> Caught In Or Between-Collapsing Material <input type="checkbox"/> Caught In Or Between-Machine <input type="checkbox"/> Caught In Or Between-Miscellaneous <input type="checkbox"/> Caught In Or Between-Object Handled <input type="checkbox"/> Crash Of Rail Vehicle <input type="checkbox"/> Crash Of Water Vehicle <input type="checkbox"/> Cut By Hand Tool,Utensil Not Powered <input type="checkbox"/> Cut By Powered Hand Tool,Appliance <input type="checkbox"/> Cut/Puncture By Broken Glass <input type="checkbox"/> Cut/Puncture By Object Being Lifted <input type="checkbox"/> Cut/Puncture/Scrape By Misc. <input type="checkbox"/> Exposure to mechanical vibration <input type="checkbox"/> Exposure to mental stress factors | <input type="checkbox"/> Exposure to particles or contaminants <input type="checkbox"/> Exposure to radiation <input type="checkbox"/> Exposure to sharp, sudden sound <input type="checkbox"/> Exposure to variations in pressure - other than sound <input type="checkbox"/> Fall Or Slip-From Different Level <input type="checkbox"/> Fall Or Slip-From Ladder Or Scaffolding <input type="checkbox"/> Fall Or Slip-From Liquid Or Grease Spill (Same Level) <input type="checkbox"/> Fall Or Slip-Into Openings <input type="checkbox"/> Fall Or Slip-Miscellaneous <input type="checkbox"/> Fall Or Slip-On Ice Or Snow (Same Level) <input type="checkbox"/> Fall Or Slip-On Same Level <input type="checkbox"/> Fall Or Slip-On Stairs <input type="checkbox"/> Fall Or Slip-Slipped,Did Not Fall <input type="checkbox"/> Foreign Body In Eye <input type="checkbox"/> Long term contact with chemical or substance <input type="checkbox"/> Long term exposure to sounds <input type="checkbox"/> Misc Cases-Animal Or Insect <input type="checkbox"/> Misc Cases-Explosion Or Flareback <input type="checkbox"/> Misc Cases-Robbery/Criminal Assault <input type="checkbox"/> Mold <input type="checkbox"/> Motor Vehicle - Collision With Fixed Object <input type="checkbox"/> Motor Vehicle Collision W/Another Vehicle <input type="checkbox"/> Motor Vehicle-Crash Of Air Plane <input type="checkbox"/> Motor Vehicle-Miscellaneous <input type="checkbox"/> Natural Disasters <input type="checkbox"/> Repetitive Motion <input type="checkbox"/> Rubbed Or Abraded By Repetitive Motion | <input type="checkbox"/> Single contact with chemical or substance - excludes insect and spider bites and stings <input type="checkbox"/> Slide or Cave-In <input type="checkbox"/> Strain By Holding Or Carrying <input type="checkbox"/> Strain By Pushing Or Pulling <input type="checkbox"/> Strain Or Inj By Continual Noise <input type="checkbox"/> Strain Or Inj By Jumping <input type="checkbox"/> Strain Or Inj By Lifting <input type="checkbox"/> Strain Or Inj By Reaching <input type="checkbox"/> Strain Or Inj By Twisting <input type="checkbox"/> Strain Or Inj By Using Tool Or Machine <input type="checkbox"/> Strain Or Inj By Welding Or Throwing <input type="checkbox"/> Striking Against Moving Parts Of Machine <input type="checkbox"/> Striking Against Object Being Lifted/Han <input type="checkbox"/> Striking Against Sand/Scrap/Oper. <input type="checkbox"/> Striking Against Stationary Object <input type="checkbox"/> Striking/Stepping On Miscellaneous <input type="checkbox"/> Striking/Stepping On Sharp Objects <input type="checkbox"/> Struck Or Inj By Falling Or Flying Objec <input type="checkbox"/> Struck Or Inj By Fellow Worker,Patien <input type="checkbox"/> Struck Or Inj By Hand Tool/Machine <input type="checkbox"/> Struck Or Inj By Motor Vehicle <input type="checkbox"/> Struck Or Inj By Object Handled By Other <input type="checkbox"/> Struck Or Inj By Object Lifted/Handled <input type="checkbox"/> Struck Or Injured By-Moving Parts <input type="checkbox"/> Terrorism <input type="checkbox"/> Other: | | | | |
| *Agency/Source of Injury: | | | | | | |
| <input type="checkbox"/> Awkward Position of Wrist, Neck, Back, Arms | <input type="checkbox"/> Forklift-powered industrial truck | <input type="checkbox"/> Materials on Floor | | | | |
| <input type="checkbox"/> Blade | <input type="checkbox"/> Hand Tools | <input type="checkbox"/> Non-Adjustable Work Station | | | | |
| <input type="checkbox"/> Box | <input type="checkbox"/> Hand Truck | <input type="checkbox"/> Non-Living Animals | | | | |
| <input type="checkbox"/> Chemicals-Dust | <input type="checkbox"/> Hot Oil | <input type="checkbox"/> Poor Condition of Safety Equipment | | | | |
| | <input type="checkbox"/> Housekeeping | <input type="checkbox"/> Poor Lighting | | | | |



APTIM INCIDENT REPORT

- | | | |
|--|--|---|
| <input type="checkbox"/> Chemicals-liquid or gas | <input type="checkbox"/> Human Source | <input type="checkbox"/> Poor Ventilation |
| <input type="checkbox"/> Defective Motor Vehicle Equipment | <input type="checkbox"/> Ice or Snow on Walking Surface | <input type="checkbox"/> Power Hand Tool |
| <input type="checkbox"/> Drum | <input type="checkbox"/> Improper Design or Poor Design | <input type="checkbox"/> Repetitive Motion or Forceful Motion |
| <input type="checkbox"/> Electrical | <input type="checkbox"/> Improper method | <input type="checkbox"/> Roll |
| <input type="checkbox"/> Electrical Cord | <input type="checkbox"/> Improper Piling or Storing | <input type="checkbox"/> Slippery Floors |
| <input type="checkbox"/> Electrical Outlet | <input type="checkbox"/> Improper Tool | <input type="checkbox"/> Steam |
| <input type="checkbox"/> Energy –Electrical | <input type="checkbox"/> Keyboard | <input type="checkbox"/> Unguarded Equipment |
| <input type="checkbox"/> Energy – Hydraulic | <input type="checkbox"/> Lack of Safety Awareness | <input type="checkbox"/> Unsafe Act |
| <input type="checkbox"/> Energy – Pneumatic | <input type="checkbox"/> Ladder | <input type="checkbox"/> Unsafe Condition Caused by Contractor or Customer |
| <input type="checkbox"/> Ergonomics-repetitive motion | <input type="checkbox"/> Lifting | <input type="checkbox"/> Unsafe Equip or Material of Contractor or Customer |
| <input type="checkbox"/> Excessive Pinch Grip | <input type="checkbox"/> Live Animals | <input type="checkbox"/> Vehicles |
| <input type="checkbox"/> Excessive Use of The Power Grip | <input type="checkbox"/> Machine Guarding | <input type="checkbox"/> Other: |
| <input type="checkbox"/> Faulty Layout of Plant Facilities | <input type="checkbox"/> Manual Materials Handling-lifting | |

***Nature of Injury:**

- | | | |
|---|---|--|
| <input type="checkbox"/> Amputation | <input type="checkbox"/> Dislocation | <input type="checkbox"/> Lung Problem, Toxic Agent Related |
| <input type="checkbox"/> Angina Pectoris (Chest Pain/Decr Blood) | <input type="checkbox"/> Electric Shock | <input type="checkbox"/> Myocardial Infarction- (Heart Attack) |
| <input type="checkbox"/> Asbestos- (Asbestos Fibers) | <input type="checkbox"/> Enucleation- (Removal Of An Organ) | <input type="checkbox"/> No Physical Injury |
| <input type="checkbox"/> Asphyxiation-(Suffocation) | <input type="checkbox"/> Exhaustion | <input type="checkbox"/> Poisoning and toxic effects |
| <input type="checkbox"/> Bite, Sting | <input type="checkbox"/> Foreign Body, Sliver, Chip, Dust | <input type="checkbox"/> Radiation |
| <input type="checkbox"/> Black Lung- (Coal Dust) | <input type="checkbox"/> Fracture, Chip | <input type="checkbox"/> Respiratory Disorders- (Gases,Fumes,Chem) |
| <input type="checkbox"/> Burn - Hot, Cold, Chemical, Radiation, Frostbite | <input type="checkbox"/> Hearing Loss | <input type="checkbox"/> Rupture |
| <input type="checkbox"/> Byssinosis- (Cotton Dust) | <input type="checkbox"/> Heat Prostration- (Overcome By Heat) | <input type="checkbox"/> Silicosis- (Silicon Fibers) |
| <input type="checkbox"/> Carpal Tunnel Syndrome | <input type="checkbox"/> Hepatitis C | <input type="checkbox"/> Sprain, Strain, Torn |
| <input type="checkbox"/> Concussion | <input type="checkbox"/> Infection | <input type="checkbox"/> Suffocation |
| <input type="checkbox"/> Contusion | <input type="checkbox"/> Infectious and Parasitic Diseases | <input type="checkbox"/> Syncope |
| <input type="checkbox"/> Crushing | <input type="checkbox"/> Inflammation | <input type="checkbox"/> Vascular- (Blood Vessels) |
| <input type="checkbox"/> Cut, Laceration, Puncture | <input type="checkbox"/> Internal Injury, Hernia | <input type="checkbox"/> VDT Disease |
| <input type="checkbox"/> Dermatitis | <input type="checkbox"/> Loss of Consciousness | <input type="checkbox"/> Vision Loss |
| | <input type="checkbox"/> Lung Problem, Dust Related | <input type="checkbox"/> Other: |

Vehicle Incident – If Applicable

| | | | |
|--|-------------------------------|--|---|
| *Vehicle Make: | *Vehicle Model: | Vehicle Year: | Vehicle ID: |
| Vehicle Type: Car <input type="checkbox"/> Truck <input type="checkbox"/> Other <input type="checkbox"/> | VIN: | License Plate #: | |
| Road Type: | Driving Conditions: | Traffic Area: | |
| Action of Company Vehicle: Being Passed <input type="checkbox"/> Moving Forward <input type="checkbox"/> Passing Others <input type="checkbox"/> Reversing <input type="checkbox"/> Stationary <input type="checkbox"/> Turning <input type="checkbox"/> | | | |
| Company Vehicle Collision With: Animal <input type="checkbox"/> Non-Collision <input type="checkbox"/> Object <input type="checkbox"/> Other Vehicle <input type="checkbox"/> Pedestrian <input type="checkbox"/> Struck by Other Vehicle <input type="checkbox"/> | | | |
| Damage to Company Vehicle: | | <input type="checkbox"/> Front | <input type="checkbox"/> Side-Driver |
| <input type="checkbox"/> Roof | <input type="checkbox"/> Rear | <input type="checkbox"/> Undercarriage | <input type="checkbox"/> Side-Passenger |
| <input type="checkbox"/> Trailer | | | |
| Citation issued to company driver? Yes <input type="checkbox"/> No <input type="checkbox"/> | | Third party involved? Yes <input type="checkbox"/> No <input type="checkbox"/> | |

Spill – If Applicable

| | | |
|---|---|--|
| *Material Spilled: | *Amount: | *Units: |
| Processes: | Equipment: | Outcome Result: |
| Business interruption? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, how long? | *Spill go off site? Yes <input type="checkbox"/> No <input type="checkbox"/> | *Reportable? Yes <input type="checkbox"/> No <input type="checkbox"/> |
| Affected Media: <input type="checkbox"/> Soil <input type="checkbox"/> Water <input type="checkbox"/> Air <input type="checkbox"/> Fauna <input type="checkbox"/> Flora <input type="checkbox"/> Public <input type="checkbox"/> Employee | | |
| Causation: | <input type="checkbox"/> Refueling | <input type="checkbox"/> Handling |
| <input type="checkbox"/> Cleanup | <input type="checkbox"/> Excavation | <input type="checkbox"/> Human Activities |
| <input type="checkbox"/> Maintenance | <input type="checkbox"/> Construction | <input type="checkbox"/> Maintenance |
| Site Activity: | <input type="checkbox"/> Land Clearing | <input type="checkbox"/> Air Monitoring |
| <input type="checkbox"/> Office | <input type="checkbox"/> Operation | <input type="checkbox"/> Other |
| Number of Employees Affected: | Soil sample collected? Yes <input type="checkbox"/> No <input type="checkbox"/> | Water sample collected? Yes <input type="checkbox"/> No <input type="checkbox"/> |



APTIM INCIDENT REPORT

| Fire – If Applicable | | | |
|--|---|---|--|
| *Ignition Source: | | *Item/Equipment: | |
| *Method Used to Extinguish: | | | |
| <input type="checkbox"/> AFFF | <input type="checkbox"/> Extinguisher | <input type="checkbox"/> Fire Blanket | <input type="checkbox"/> Fire Department |
| <input type="checkbox"/> Hydrant | <input type="checkbox"/> Mobile Equip | <input type="checkbox"/> Sprinkler System | <input type="checkbox"/> Fire Hose Reel |
| | | <input type="checkbox"/> Suppression Sys | <input type="checkbox"/> Fire Tender |
| | | <input type="checkbox"/> Water truck | <input type="checkbox"/> Other |
| Business interruption? Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, how long? | | *Facility Evacuated? Yes <input type="checkbox"/> No <input type="checkbox"/> | *Reportable? Yes <input type="checkbox"/> No <input type="checkbox"/> |
| NOV/Agency Visit – If Applicable | | | |
| *Type: Scheduled <input type="checkbox"/> Unscheduled <input type="checkbox"/> Response to Complaint <input type="checkbox"/> | | *Issuing Agency: | Agency Contact: |
| *Agency Findings/Observations: | | | |
| | | | |
| Number of Citations: | *Date of Citation: | Date Response Due: | Date Responded: |
| Complaint – If Applicable | | | |
| *Complaint Type: Customer Service <input type="checkbox"/> Appearance <input type="checkbox"/> Environmental <input type="checkbox"/> Other <input type="checkbox"/> | | | |
| *Complaint Details: | | | |
| | | | |
| Name of Complainant: | | Complainant Contact Number: | |
| Causal Analysis – If Applicable | | | |
| What was the immediate cause(s) of the incident? (Describe all unsafe conditions / unsafe acts in detail): | | | |
| | | | |
| Unsafe Condition (Check All That Apply) | | | |
| <input type="checkbox"/> Action of Fellow Associate | <input type="checkbox"/> Ergonomically Poor Methods | <input type="checkbox"/> Inadequate Housekeeping | <input type="checkbox"/> Inexperience |
| <input type="checkbox"/> Chemical or Physical Hazards | <input type="checkbox"/> Improper Body Positioning | <input type="checkbox"/> Inadequate Isolation (LOTO) | <input type="checkbox"/> Noise |
| <input type="checkbox"/> Congested Work Area | <input type="checkbox"/> Improper Housekeeping | <input type="checkbox"/> Inadequate Lighting | <input type="checkbox"/> Physical Condition |
| <input type="checkbox"/> Defective/Inadequate Tools | <input type="checkbox"/> Improper Tool/Equipment | <input type="checkbox"/> Inadequate PPE Provided | <input type="checkbox"/> Slippery Floors/Walkways |
| <input type="checkbox"/> Dress/Hair Violation | <input type="checkbox"/> Inadequate Clearance | <input type="checkbox"/> Inadequate Ventilation | <input type="checkbox"/> Temperature Extremes |
| <input type="checkbox"/> Equip Provided But Not Used | <input type="checkbox"/> Inadequate Guarding | <input type="checkbox"/> Inadequate Warning Systems | <input type="checkbox"/> Other |
| Unsafe Act (Check All That Apply) | | | |
| <input type="checkbox"/> Disconnecting or Impeding Safety Device Operation | <input type="checkbox"/> Horseplay | <input type="checkbox"/> Inattention/Lack of Awareness | <input type="checkbox"/> Poor Job Planning |
| <input type="checkbox"/> Failure to Follow Procedures or Standards | <input type="checkbox"/> Ignoring Safety Rules | <input type="checkbox"/> JSA Not Followed | <input type="checkbox"/> Servicing of Adjusting Equipment While in Operation |



APTIM INCIDENT REPORT

| | | | |
|---|---|---|--|
| <input type="checkbox"/> Failure to Identify Hazard or Risk | <input type="checkbox"/> Improper Body Mechanics or Position for Task | <input type="checkbox"/> Not Wearing/Improperly Wearing PPE | <input type="checkbox"/> Using Wrong or Defective Tools/Equipment |
| <input type="checkbox"/> Haste or Shortcuts | <input type="checkbox"/> Improper Method of Performing Job | <input type="checkbox"/> Operating Equipment Improperly | <input type="checkbox"/> Other |
| What was the underlying cause(s) of the incident? (Describe all personal factors / job factors in detail): | | | |
| | | | |
| Job Factors (Check All That Apply) | | | |
| <input type="checkbox"/> Communication - Horizontal | <input type="checkbox"/> Failure to Correct Reported Hazard | <input type="checkbox"/> Inadequate Workstation / Equipment Maintenance | <input type="checkbox"/> Poor Previous Incident Reporting/Investigations |
| <input type="checkbox"/> Communication – Job Turnover | <input type="checkbox"/> Inadequate Engineering or Workstation Design | <input type="checkbox"/> Infrequently Performing the Activity | <input type="checkbox"/> Work Planning / Preventative Maintenance |
| <input type="checkbox"/> Communications - Vertical | <input type="checkbox"/> Inadequate Initial or Refresher Training/Instruction | <input type="checkbox"/> Lack of or Incomplete Work Methods | <input type="checkbox"/> Other |
| <input type="checkbox"/> Contractor Pre-Qualification Process | <input type="checkbox"/> Inadequate Policies, Standards or Procedures | <input type="checkbox"/> Materials / Equipment Purchasing/Vendor Issues | |
| <input type="checkbox"/> Duration of Activity Too Long | <input type="checkbox"/> Inadequate Supervision for the Activity | <input type="checkbox"/> Non-Approved Contractor | |
| Personal Factors (Check All That Apply) | | | |
| <input type="checkbox"/> External Motivation | <input type="checkbox"/> Inexperience | <input type="checkbox"/> Physical Capability Issue | <input type="checkbox"/> Time/Cost Restraints |
| <input type="checkbox"/> Fears or Phobias | <input type="checkbox"/> Internal Motivation | <input type="checkbox"/> Physical Stress/Fatigue | <input type="checkbox"/> Under Influence of Alcohol |
| <input type="checkbox"/> Frustration | <input type="checkbox"/> Lack of Knowledge/Skill | <input type="checkbox"/> Poor Judgment | <input type="checkbox"/> Under Influence of Drugs |
| <input type="checkbox"/> Inattention | <input type="checkbox"/> Mental Stress | <input type="checkbox"/> Poor Reaction Time | <input type="checkbox"/> Other |
| What failure in the safety management system resulted in the immediate and underlying causes of the incident? | | | |
| <input type="checkbox"/> Cutting Corners | <input type="checkbox"/> Poor Quality Safety Equipment | <input type="checkbox"/> Violation of Company Policy | |
| <input type="checkbox"/> Inadequate Supervision of Employees | <input type="checkbox"/> Poor Workplace Training | <input type="checkbox"/> Other | |

USACE PRIME CONTRACTOR Monthly Record of Work-Related Injuries/Illnesses & Exposure

US Army Corps of Engineers



Month _____
Year _____

In accordance with the provisions of EM 385-1-1, Section 01 Program Management, Paragraph 01.D Mishap Reporting and Investigation, sub-paragraphs 01.D.05, you (APTIM) shall provide a monthly record of all exposure and accident experience incidental to the work (this includes exposure and accident experience of APTIM and its sub-contractor(s)). As a minimum, these records shall include exposure work hours and a record of occupational injuries and illnesses that include the data elements listed below. Definitional criteria for each data element is found in 29 CFR Part 1904. If the maintenance of OSHA 300 Logs are required by OSHA, most of this information can be obtained from those logs. If data on log provided below is revised after it is submitted to USACE, APTIM shall provide a revised report to the GDA. You must complete the USACE ENG Form 3394, Report of Accident Investigation Report for all recordable accidents. If you're not sure whether a case is recordable, call your local Safety and Occupational Health Office for help.

| | |
|-------------------------------------|-------------------|
| USACE Command | _____ |
| Contractor Name | _____ |
| Contract Number | _____ |
| Project Title | _____ |
| City | _____ State _____ |
| USACE Office Overseeing Work | |

| Identify the person | | | | Describe The Case | | Classify the case | | | | | | | | | | | | | | | |
|---------------------|-----------------------|------|--------|---|--------------------------|--|--|--|-------|---------------------|-----------------------------|---|---------------------------------------|--|--------|---------------|-----------------------|-----------|--------------|---------------------|---|
| (A) | (B1) | (B2) | (B3) | (C) | (D) | (E) | (F) | Using these categories, check ONLY the most serious result for each case: | | | | Enter the number of days the injured or ill worker was: | | Check the "injury" column or choose one type of illness: | | | | | | | |
| Company Name | Prime or Sub (P or S) | Age | Gender | Date Employee Began Work on Job Covered by Contract | Job Title (e.g., Welder) | Date of injury or onset of illness (mo./day) | Where the event occurred (e.g. Loading dock north end) | Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch) | Death | Days away from work | Remained at work | | On job transfer or restriction (days) | Away from work (days) | (M) | | | | | | |
| | | | | | | | | | | | Job transfer or restriction | Other recordable cases | | | Injury | Skin Disorder | Respiratory Condition | Poisoning | Hearing Loss | All other illnesses | |
| | | | | | | | | | (G) | (H) | (I) | (J) | (K) | (L) | (1) | (2) | (3) | (4) | (5) | (6) | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| For Government Use Only | | | |
|--|--|--|--|
| TYPE OF WORK ACTIVITY (Choose One): Construction <input type="checkbox"/> Opn & Main. <input type="checkbox"/> Eng. Services <input type="checkbox"/> Dredging <input type="checkbox"/> Rsch. & Dev. <input type="checkbox"/> Emerg. Opns. <input type="checkbox"/> Other <input type="checkbox"/> | | Type of Contract (Choose One): Environmental Remed. <input type="checkbox"/> Superfund <input type="checkbox"/> FUDS <input type="checkbox"/> IRP <input type="checkbox"/> FUSRAP <input type="checkbox"/> Ordinance/Expl. Cleanup <input type="checkbox"/> Environmental Other <input type="checkbox"/> | |
| | | Civil Works <input type="checkbox"/> Military Programs <input type="checkbox"/> Other <input type="checkbox"/> | |

| Exposure Hours | | Certification of Record | |
|----------------|-------|-------------------------|--|
| Month | _____ | Name of Person | |
| Year to Date | _____ | Submit. Record | |
| | | Signature | |
| | | Date | |

USACE Summary of Contractor Work-Related Injuries and Illnesses



Month Submitted _____

Year _____

US Army Corps of Engineers

Review the Record and verify that the entries are complete & accurate before completing this summary.

Using the Record, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the record. If you had no cases write "0". This summary is a cumulative record of the injury/illness experience for the year

Number of Cases

| Total number of deaths | Total number of cases with days away from work | Total number of cases with job transfer or restriction | Total number of other recordable cases |
|------------------------|--|--|--|
| 0 | 0 | 0 | 0 |
| (G) | (H) | (I) | (J) |

Number of Days

| Total days of job transfer or restriction | Total days away from work |
|---|---------------------------|
| 0 | 0 |
| (K) | (L) |

Injury and Illness Types

| Total number of... | | | |
|---------------------------|---|-------------------------|---|
| (M) | | | |
| (1) Injury | 0 | (4) Poisoning | 0 |
| (2) Skin Disorder | 0 | (5) Hearing Loss | 0 |
| (3) Respiratory Condition | 0 | (6) All other illnesses | 0 |

Establishment information

Establishment name _____

Street _____

City _____

State _____

Zip _____

Industry description (e.g., Manufacture of motor truck trailers) _____

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

or _____

North American Industrial Classification (NAICS) if known (e.g. 336212)

Employment information

Annual average number of employees _____

Total hours worked by all employees last year _____

| | | | | | | | |
|---|--|---|--|---|---|--------------------------|---|
| <i>(For Safety Staff only)</i> | REPORT NO. | EROC CODE | UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT <i>(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)</i> | | | | REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2) |
| 1. ACCIDENT CLASSIFICATION | | | | | | | |
| PERSONNEL CLASSIFICATION | | INJURY/ILLNESS/FATAL | | PROPERTY DAMAGE | | MOTOR VEHICLE INVOLVED | |
| GOVERNMENT <input type="checkbox"/> CIVILIAN <input type="checkbox"/> MILITARY | | <input type="checkbox"/> | | <input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER | | <input type="checkbox"/> | |
| <input type="checkbox"/> CONTRACTOR | | <input type="checkbox"/> | | <input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER | | <input type="checkbox"/> | |
| <input type="checkbox"/> PUBLIC | | <input type="checkbox"/> FATAL <input type="checkbox"/> OTHER | | XXXXXXXXXX | | XXXX | |
| 2. PERSONAL DATA | | | | | | | |
| a. Name <i>(Last, First, MI)</i> | | b. AGE | c. SEX <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE | | d. SOCIAL SECURITY NUMBER | | |
| e. GRADE | | f. JOB SERIES/TITLE | | g. DUTY STATUS AT TIME OF ACCIDENT <input type="checkbox"/> ON DUTY <input type="checkbox"/> TDY <input type="checkbox"/> OFF DUTY | | | |
| h. EMPLOYMENT STATUS AT TIME OF ACCIDENT <input type="checkbox"/> ARMY ACTIVE <input type="checkbox"/> ARMY RESERVE <input type="checkbox"/> VOLUNTEER <input type="checkbox"/> PERMANENT <input type="checkbox"/> FOREIGN NATIONAL <input type="checkbox"/> SEASONAL <input type="checkbox"/> TEMPORARY <input type="checkbox"/> STUDENT <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | | | | | | |
| 3. GENERAL INFORMATION | | | | | | | |
| a. DATE OF ACCIDENT <i>(month/day/year)</i> | b. TIME OF ACCIDENT <i>(Military time)</i> hrs | c. EXACT LOCATION OF ACCIDENT | | | d. CONTRACTOR'S NAME | | |
| e. CONTRACT NUMBER <input type="checkbox"/> CIVIL WORKS <input type="checkbox"/> MILITARY <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | f. TYPE OF CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> SERVICE <input type="checkbox"/> A/E <input type="checkbox"/> DREDGE <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | g. HAZARDOUS/TOXIC WASTE ACTIVITY <input type="checkbox"/> SUPERFUND <input type="checkbox"/> DERP <input type="checkbox"/> IRP <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | | |
| d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR: | | | | | | | |
| 4. CONSTRUCTION ACTIVITIES ONLY <i>(Fill in line and corresponding code number in box from list - see help menu)</i> | | | | | | | |
| a. CONSTRUCTION ACTIVITY # <input style="width:50px;" type="text"/> | | | | b. TYPE OF CONSTRUCTION EQUIPMENT # <input style="width:50px;" type="text"/> | | | |
| 5. INJURY/ILLNESS INFORMATION <i>(Include name on line and corresponding code number in box for items e, f & g - see help menu)</i> | | | | | | | |
| a. SEVERITY OF ILLNESS/INJURY # <input style="width:50px;" type="text"/> | | | b. ESTIMATED DAYS LOST # <input style="width:50px;" type="text"/> | c. ESTIMATED DAYS HOSPITALIZED # <input style="width:50px;" type="text"/> | d. ESTIMATED DAYS RESTRICTED DUTY # <input style="width:50px;" type="text"/> | | |
| e. BODY PART AFFECTED PRIMARY # <input style="width:50px;" type="text"/> SECONDARY # <input style="width:50px;" type="text"/> | | | g. TYPE AND SOURCE OF INJURY/ILLNESS TYPE # <input style="width:50px;" type="text"/> SOURCE # <input style="width:50px;" type="text"/> | | | | |
| f. NATURE OF ILLNESS/INJURY # <input style="width:50px;" type="text"/> | | | | | | | |
| 6. PUBLIC FATALITY <i>(Fill in line and correspondence code number in box - see help menu)</i> | | | | | | | |
| a. ACTIVITY AT TIME OF ACCIDENT # <input style="width:50px;" type="text"/> | | | | b. PERSONAL FLOATATION DEVICE USED? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A | | | |
| 7. MOTOR VEHICLE ACCIDENT | | | | | | | |
| a. TYPE OF VEHICLE <input type="checkbox"/> PICKUP/VAN <input type="checkbox"/> AUTOMOBILE <input type="checkbox"/> TRUCK <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | b. TYPE OF COLLISION <input type="checkbox"/> SIDE SWIPE <input type="checkbox"/> HEAD ON <input type="checkbox"/> REAR END <input type="checkbox"/> BROADSIDE <input type="checkbox"/> ROLL OVER <input type="checkbox"/> BACKING <input type="checkbox"/> OTHER <i>(Specify)</i> _____ | | | c. SEAT BELTS | | |
| | | | | | USED | NOT USED | |
| | | | | | (1) FRONT SEAT | | |
| | | | | | (2) REAR SEAT | | |
| 8. PROPERTY/MATERIAL INVOLVED | | | | | | | |
| a. NAME OF ITEM | | b. OWNERSHIP | | | c. \$ AMOUNT OF DAMAGE | | |
| (1) | | | | | | | |
| (2) | | | | | | | |
| (3) | | | | | | | |
| 9. VESSEL/FLOATING PLANT ACCIDENT <i>(Fill in line and correspondence code number in box from list - see help menu)</i> | | | | | | | |
| a. TYPE OF VESSEL/FLOATING PLANT # <input style="width:50px;" type="text"/> | | | | b. TYPE OF COLLISION/MISHAP # <input style="width:50px;" type="text"/> | | | |
| 10. ACCIDENT DESCRIPTION <i>(Use additional paper, if necessary)</i> | | | | | | | |
| | | | | | | | |

| | | | | | |
|---|--------------------------|--------------------------|---|-----------------------------|--------------------------|
| 11. CAUSAL FACTOR(S) (Read Instruction Before Completing) | | | | | |
| a. (Explain YES answers in item 13) | YES | NO | a. (CONTINUED) | YES | NO |
| DESIGN: Was design of facility, workplace or equipment a factor? | <input type="checkbox"/> | <input type="checkbox"/> | CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident? | <input type="checkbox"/> | <input type="checkbox"/> |
| INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor? | <input type="checkbox"/> | <input type="checkbox"/> | OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident? | <input type="checkbox"/> | <input type="checkbox"/> |
| PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor? | <input type="checkbox"/> | <input type="checkbox"/> | SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task? | <input type="checkbox"/> | <input type="checkbox"/> |
| OPERATING PROCEDURES: Were operating procedures a factor? | <input type="checkbox"/> | <input type="checkbox"/> | PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident? | <input type="checkbox"/> | <input type="checkbox"/> |
| JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred? | <input type="checkbox"/> | <input type="checkbox"/> | DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident? | <input type="checkbox"/> | <input type="checkbox"/> |
| HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident? | <input type="checkbox"/> | <input type="checkbox"/> | b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT? | | |
| ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> YES (If yes, attach a copy.) | <input type="checkbox"/> NO | |

| | | |
|---|--|---|
| 12. TRAINING | | |
| a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? <input type="checkbox"/> YES <input type="checkbox"/> NO | b. TYPE OF TRAINING. <input type="checkbox"/> CLASSROOM <input type="checkbox"/> ON JOB | c. DATE OF MOST RECENT FORMAL TRAINING. (Month) (Day) (Year) |

| | |
|---|--|
| 13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES (See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary) | |
| a. DIRECT CAUSE | |
| | |
| b. INDIRECT CAUSE(S) | |
| | |

| | |
|---|--|
| 14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S). | |
| DESCRIBE FULLY: | |
| | |

| | | | | | |
|--|--|--------------------|--|------------------|--|
| 15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14. | | | | | |
| a. BEGINNING (Month/Day/Year) | | | b. ANTICIPATED COMPLETION (Month/Day/Year) | | |
| c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT | | d. DATE (Mo/Da/Yr) | e. ORGANIZATION IDENTIFIER (Div, Br, Sect) | f. OFFICE SYMBOL | |
| CORPS _____ | | | | | |
| CONTRACTOR _____ | | | | | |

| | | |
|------------------------------------|--|-------------|
| 16. MANAGEMENT REVIEW (1st) | | |
| a. <input type="checkbox"/> CONCUR | b. <input type="checkbox"/> NON CONCUR | c. COMMENTS |
| | | |
| SIGNATURE | TITLE | DATE |
| | | |

| | | |
|--|--|-------------|
| 17. MANAGEMENT REVIEW (2nd - Chief Operations, Construction, Engineering, etc.) | | |
| a. <input type="checkbox"/> CONCUR | b. <input type="checkbox"/> NON CONCUR | c. COMMENTS |
| | | |
| SIGNATURE | TITLE | DATE |
| | | |

| | | |
|---|--|--------------------------------|
| 18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW | | |
| a. <input type="checkbox"/> CONCUR | b. <input type="checkbox"/> NON CONCUR | c. ADDITIONAL ACTIONS/COMMENTS |
| | | |
| SIGNATURE | TITLE | DATE |
| | | |

| | |
|-----------------------------|------|
| 19. COMMAND APPROVAL | |
| COMMENTS | |
| | |
| COMMANDER SIGNATURE | DATE |
| | |

10. ACCIDENT DESCRIPTION (Continuation)

13a. DIRECT CAUSE (Continuation)

13b.

INDIRECT CAUSES *(Continuation)*

14.

ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the discretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. **GOVERNMENT.** Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury), CA-2 (illness) or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) **PROPERTY DAMAGE** - Mark the appropriate box if accident resulted in any damage of \$1000 or more to government property (including motor vehicles).

(3) **VEHICLE INVOLVED** - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) **DIVING ACTIVITY** - Mark if the accident involved an in-house USACE diving activity.

b. **CONTRACTOR.**

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) **PROPERTY DAMAGE** - Mark the appropriate box if accident resulted in any damage of \$1000 or more to contractor property (including motor vehicles).

(3) **VEHICLE INVOLVED** - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) **DIVING ACTIVITY** - Mark if the accident involved a USACE Contractor diving activity.

c. **PUBLIC.**

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

(2) **VOID SPACE** - Make no entry.

(3) **VEHICLE INVOLVED** - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) **VOID SPACE** - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. **NAME** - (MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. **AGE** - Enter age.

c. **SEX** - Mark appropriate box.

d. **SOCIAL SECURITY NUMBER** - (FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. **GRADE** - (FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: O-6; E-7; WG-8; WS-12; GS-11; etc.

f. **JOB SERIES/TITLE** - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-O810/Civil Engineer. For military personnel enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. **DUTY STATUS** - Mark the appropriate box.

(1) **ON DUTY** - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) **TDY** - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) **OFF DUTY** - Person was not on official business at time of accident.

h. **EMPLOYMENT STATUS** - (FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

a. **DATE OF ACCIDENT** - Enter the month, day, and year of accident.

b. **TIME OF ACCIDENT** - Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. **EXACT LOCATION OF ACCIDENT** - Enter facts needed to locate the accident scene, (installation/project name, building number, street, direction and distance from closest landmark, etc.).

d. **CONTRACTOR NAME**

(1) **PRIME** - Enter the exact name (title of firm) of the prime contractor.

(2) **SUBCONTRACTOR** - Enter the name of any subcontractor involved in the accident.

e. **CONTRACT NUMBER** - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. **TYPE OF CONTRACT** - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW) - Mark the box to

identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

- | | |
|-------------------------|----------------------------|
| 1. MOBILIZATION | 14. ELECTRICAL |
| 2. SITE PREPARATION | 15. SCAFFOLDING/ACCESS |
| 3. EXCAVATION/TRENCHING | 16. MECHANICAL |
| 4. GRADING (EARTHWORK) | 17. PAINTING |
| 5. PIPING/UTILITIES | 18. EQUIPMENT/MAINTENANCE |
| 6. FOUNDATION | 19. TUNNELING |
| 7. FORMING | 20. WAREHOUSING/STORAGE |
| 8. CONCRETE PLACEMENT | 21. PAVING |
| 9. STEEL ERECTION | 22. FENCING |
| 10. ROOFING | 23. SIGNING |
| 11. FRAMING | 24. LANDSCAPING/IRRIGATION |
| 12. MASONRY | 25. INSULATION |
| 13. CARPENTRY | 26. DEMOLITION |

b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

- | | |
|------------------------------------|--------------------------------|
| 1. GRADER | 13. DUMP TRUCK (OFF HIGHWAY) |
| 2. DRAGLINE | 14. TRUCK (OTHER) |
| 3. CRANE (ON VESSEL/BARGE) | 15. FORKLIFT |
| 4. CRANE (TRACKED) | 16. BACKHOE |
| 5. CRANE (RUBBER TIRE) | 17. FRONT-END LOADER |
| 6. CRANE (VEHICLE MOUNTED) | 18. PILE DRIVER |
| 7. CRANE (TOWER) | 19. TRACTOR (UTILITY) |
| 8. SHOVEL | 20. MANLIFT |
| 9. SCRAPER | 21. DOZER |
| 10. PUMP TRUCK (CONCRETE) | 22. DRILL RIG |
| 11. TRUCK (CONCRETE/TRANSIT MIXER) | 23. COMPACTOR/VIBRATORY ROLLER |
| 12. DUMP TRUCK (HIGHWAY) | 24. OTHER |

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

- | | |
|------------|--|
| NOI | NO INJURY |
| FAT | FATALITY |
| PTL | PERMANENT TOTAL DISABILITY |
| PPR | PERMANENT PARTIAL DISABILITY |
| LWD | LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK |
| NLW | RECORDABLE CASE WITHOUT LOST WORKDAYS |
| RFA | RECORDABLE FIRST AID CASE |

b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

| GENERAL BODY AREA | CODE | BODY PART NAME |
|------------------------------------|--------------------|----------------------------|
| ARM/WRIST | AB | ARM AND WRIST |
| | AS | ARM OR WRIST |
| TRUNK, EXTERNAL MUSCULATURE | B1 | SINGLE BREAST |
| | B2 | BOTH BREASTS |
| | B3 | SINGLE TESTICLE |
| | B4 | BOTH TESTICLES |
| | BA | ABDOMEN |
| | BC | CHEST |
| | BL | LOWER BACK |
| | BP | PENIS |
| | BS | SIDE |
| | BU | UPPER BACK |
| | BW | WAIST |
| BZ | TRUNK OTHER | |
| HEAD, INTERNAL | C1 | SINGLE EAR INTERNAL |
| | C2 | BOTH EARS INTERNAL |
| | C3 | SINGLE EYE INTERNAL |
| | C4 | BOTH EYES INTERNAL |
| | CB | BRAIN |
| | CC | CRANIAL BONES |
| | CD | TEETH |
| | CJ | JAW |
| | CL | THROAT, LARYNX |
| | CM | MOUTH |
| | CN | NOSE |
| | CR | THROAT, OTHER |
| | CT | TONGUE |
| | CZ | HEAD OTHER INTERNAL |
| ELBOW | EB | BOTH ELBOWS |
| | ES | SINGLE ELBOW |
| FINGER | F1 | FIRST FINGER |
| | F2 | BOTH FIRST FINGERS |
| | F3 | SECOND FINGER |
| | F4 | BOTH SECOND FINGERS |
| | F5 | THIRD FINGER |
| | F6 | BOTH THIRD FINGERS |
| | F7 | FOURTH FINGER |
| | F8 | BOTH FOURTH FINGERS |
| TOE | G1 | GREAT TOE |
| | G2 | BOTH GREAT TOES |
| | G3 | TOE OTHER |
| | G4 | TOES OTHER |

| GENERAL BODY AREA | CODE | BODY PART NAME | GENERAL NATURE CATEGORY | CODE | NATURE OF INJURY NAME | | |
|---|--|---------------------------------|--------------------------|------|---|-----------------|--|
| HEAD, EXTERNAL | H1 | EYES EXTERNAL | | | | | |
| | H2 | BOTH EYES EXTERNAL | | TK | CONCUSSION | | |
| | H3 | EAR EXTERNAL | | TL | LACERATION, CUT | | |
| | H4 | BOTH EARS EXTERNAL | | TP | PUNCTURE | | |
| | HC | CHIN | | TS | STRAIN, MULTIPLE | | |
| | HF | FACE | | TU | BURN, SCALD, SUNBURN | | |
| | HK | NECK/THROAT | | TI | TRAUMATIC SKIN DISEASES/CONDITIONS INCLUDING DERMATITIS | | |
| | HM | MOUTH/LIPS | | | | | |
| | HN | NOSE | | | | | |
| | HS | SCALP | | TR | TRAUMATIC RESPIRATORY DISEASE | | |
| KNEE | KB | BOTH KNEES | | TQ | TRAUMATIC FOOD POISONING | | |
| | KS | KNEE | | | | | |
| LEG, HIP, ANKLE, BUTTOCK | LB | BOTH LEGS/HIPS/ ANKLES/BUTTOCKS | | TW | TRAUMATIC TUBERCULOSIS | | |
| | LS | SINGLE LEG/HIP ANKLE/BUTTOCK | | TX | TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE | | |
| | | | | T1 | TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE | | |
| HAND | MB | BOTH HANDS | | T2 | TRAUMATIC HEARING LOSS | | |
| | MS | SINGLE HAND | | T3 | TRAUMATIC HEART CONDITION | | |
| FOOT | PB | BOTH FEET | | | | | |
| | PS | SINGLE FOOT | | T4 | TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION | | |
| TRUNK, BONES | R1 | SINGLE COLLAR BONE | | | | | |
| | R2 | BOTH COLLAR BONES | | T8 | TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS) | | |
| | R3 | SHOULDER BLADE | | | | | |
| | R4 | BOTH SHOULDER BLADES | | | | | |
| | RB | RIB | | | | | |
| | RS | STERNUM (BREAST BONE) | | | | | |
| | RV | VERTEBRAE (SPINE; DISC) | | | | | |
| RZ | TRUNK BONES OTHER | | | | | | |
| SHOULDER | SB | BOTH SHOULDERS | | | | | |
| | SS | SINGLE SHOULDER | | | | | |
| THUMB | TB | BOTH THUMBS | | | | | |
| | TS | SINGLE THUMB | | | | | |
| TRUNK, INTERNAL ORGANS | V1 | LUNG, SINGLE | | | | | |
| | V2 | LUNGS, BOTH | | | | | |
| | V3 | KIDNEY, SINGLE | | | | | |
| | V4 | KIDNEYS, BOTH | | | | | |
| | VH | HEART | | | | | |
| | VL | LIVER | | | | | |
| | VR | REPRODUCTIVE ORGANS | | | | | |
| | VS | STOMACH | | | | | |
| | VV | INTESTINES | | | | | |
| | VZ | TRUNK, INTERNAL; OTHER | | | | | |
| <p>** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and <u>repeated exposures to conditions of the work environment over a long period of time.</u> For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.</p> | | | | | | | |
| <p>**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY</p> | | | | | | | |
| | | | RESPIRATORY DISEASE | RA | ASBESTOSIS | | |
| | | | | RB | BRONCHITIS | | |
| | | | | RE | EMPHYSEMA | | |
| | | | | RP | PNEUMOCONIOSIS | | |
| | | | | RS | SILICOSIS | | |
| | | | | R9 | RESPIRATORY DISEASE, OTHER | | |
| <p>f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.</p> | | | | | | | |
| <p>* The injury or condition selected below must be caused by a specific incident or event <u>which occurred during a single work day or shift.</u></p> | | | | | | | |
| GENERAL NATURE CATEGORY | CODE | NATURE OF INJURY NAME | GENERAL NATURE CATEGORY | CODE | NATURE OF INJURY NAME | | |
| *TRAUMATIC INJURY OR DISABILITY | TA | AMPUTATION | DISABILITY, OCCUPATIONAL | DA | ARTHRITIS, BURSITIS | | |
| | TB | BACK STRAIN | | DB | BACK STRAIN, BACK SPRAIN | | |
| | TC | CONTUSION; BRUISE; ABRASION | | DC | CEREBRAL VASCULAR CONDITION; STROKE | | |
| | TD | DISLOCATION | | | | | |
| | TF | FRACTURE | | | | | |
| | TH | HERNIA | | | | | |
| | <p>VIROLOGICAL, INFECTIVE & PARASITIC DISEASES</p> | | | | | | |
| | | | | | VB | BRUCELLOSIS | |
| | | | | | VC | COCCIDIOMYCOSIS | |
| | | | | | VF | FOOD POISONING | |
| | | | | VH | HEPATITIS | | |
| | | | | VM | MALARIA | | |
| | | | | VS | STAPHYLOCOCCUS | | |
| | | | | VT | TUBERCULOSIS | | |
| | | | | V9 | VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER | | |

| GENERAL NATURE CATEGORY | CODE | NATURE OF INJURY NAME | CODE | TYPE OF INJURY NAME |
|--|------|---|----------------------|---|
| | DD | ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S) | 0210 0220 0230 | FELL, SLIPPED, TRIPPED FELL ON SAME LEVEL FELL ON DIFFERENT LEVEL SLIPPED, TRIPPED (NO FALL) |
| | DE | EFFECT OF ENVIRONMENTAL CONDITION | | CAUGHT |
| | DH | HEARING LOSS | 0310 | CAUGHT ON |
| | DK | HEART CONDITION | 0320 | CAUGHT IN |
| | DM | MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS | 0330 | CAUGHT BETWEEN |
| CONDITION | | | 0410 | PUNCTURED, LACERATED |
| | DR | RADIATION | 0420 | PUNCTURED BY |
| | DS | STRAIN, MULTIPLE | 0430 | CUT BY |
| | DU | ULCER | 0440 | STUNG BY |
| | DV | OTHER VASCULAR CONDITIONS | | BITTEN BY |
| | D9 | DISABILITY, OTHER | 0510 | CONTACTED |
| SKIN DISEASE OR CONDITION | SB | BIOLOGICAL | 0520 | CONTACTED WITH (INJURED PERSON MOVING) |
| | SC | CHEMICAL | | CONTACTED BY (OBJECT WAS MOVING) |
| | S9 | DERMATITIS, UNCLASSIFIED | | |
| | | | 0610 | EXERTED |
| | | | 0620 | LIFTED, STRAINED BY (SINGLE ACTION) |
| | | | 0710 | STRESSED BY (REPEATED ACTION) |
| | | | 0720 | EXPOSED |
| | | | 0730 | INHALED |
| | | | 0740 | INGESTED |
| | | | | ABSORBED |
| | | | | EXPOSED TO |
| | | | 0800 | TRAVELING IN |
| NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture). | | | CODE | SOURCE OF INJURY NAME |
| (1) An employee tripped on carpet and struck his head on a desk. TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface). | | | 0100 | BUILDING OR WORKING AREA |
| | | | 0110 | WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.) |
| | | | 0120 | STAIRS, STEPS |
| (2) A Park Ranger contracted dermatitis from contact with poison ivy/oak. TYPE: 510 (contact) SOURCE: 0920 (plant) | | | 0130 | LADDER |
| | | | 0140 | FURNITURE, FURNISHINGS, OFFICE EQUIPMENT |
| (3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade. TYPE: 410 (punctured by) SOURCE: 0830 (metal) | | | 0150 | BOILER, PRESSURE VESSEL |
| | | | 0160 | EQUIPMENT LAYOUT (ERGONOMIC) |
| | | | 0170 | WINDOWS, DOORS |
| (4) An employee was driving a government vehicle when it was struck by another vehicle. TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver) | | | 0180 | ELECTRICITY |
| | | | 0200 | ENVIRONMENTAL CONDITION |
| NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident. | | | 0210 | TEMPERATURE EXTREME (INDOOR) |
| | | | 0220 | WEATHER (ICE, RAIN, HEAT, ETC.) |
| | | | 0230 | FIRE, FLAME, SMOKE (NOT TOBACCO) |
| | | | 0240 | NOISE |
| | | | 0250 | RADIATION |
| | | | 0260 | LIGHT |
| | | | 0270 | VENTILATION |
| | | | 0271 | TOBACCO SMOKE |
| | | | 0280 | STRESS (EMOTIONAL) |
| | | | 0290 | CONFINED SPACE |
| | | | 0300 | MACHINE OR TOOL |
| | | | 0310 | HAND TOOL (POWERED; SAW, GRINDER, ETC.) |
| | | | 0320 | HAND TOOL (NONPOWERED) |
| | | | 0330 | MECHANICAL POWER TRANSMISSION APPARATUS |
| | | | 0340 | GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK) |
| | CODE | TYPE OF INJURY NAME | | |
| | 0110 | STRUCK | | |
| | 0111 | STRUCK BY | | |
| | 0120 | STRUCK BY FALLING OBJECT | | |
| | | STRUCK AGAINST | | |

| CODE | TYPE OF INJURY NAME | CODE | SOURCE OF INJURY NAME |
|------|--|------|--|
| 0350 | VIDEO DISPLAY TERMINAL | 0850 | SCRAP, TRASH |
| 0360 | PUMP, COMPRESSOR, AIR | 0860 | WOOD |
| | PRESSURE TOOL | 0870 | FOOD |
| 0370 | HEATING EQUIPMENT | 0880 | CLOTHING, APPAREL, SHOES |
| 0380 | WELDING EQUIPMENT | | |
| | | 0900 | ANIMATE OBJECT |
| 0400 | VEHICLE | 0911 | DOG |
| 0411 | AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE | 0912 | OTHER ANIMAL |
| | | 0920 | PLANT |
| 0412 | AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE | 0930 | INSECT |
| | | 0940 | HUMAN (VIOLENCE) |
| 0421 | DRIVER OF GOVERNMENT VEHICLE | 0950 | HUMAN (COMMUNICABLE DISEASE) |
| | | 0960 | BACTERIA, VIRUS (NOT HUMAN CONTACT) |
| 0422 | PASSENGER OF GOVERNMENT VEHICLE | | |
| 0430 | COMMON CARRIER (AIRLINE, BUS, ETC.) | 1000 | PERSONAL PROTECTIVE EQUIPMENT |
| | | 1010 | PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES |
| 0440 | AIRCRAFT (NOT COMMERCIAL) | | |
| 0450 | BOAT, SHIP, BARGE | 1020 | RESPIRATOR, MASK |
| | | 1021 | DIVING EQUIPMENT |
| 0500 | MATERIAL HANDLING EQUIPMENT | 1030 | SAFETY BELT, HARNESS |
| | | 1040 | PARACHUTE |
| 0510 | EARTHMOVER (TRACTOR, BACKHOE, ETC.) | | |
| 0520 | CONVEYOR (FOR MATERIAL AND EQUIPMENT) | | |
| 0530 | ELEVATOR, ESCALATOR, PERSONNEL HOIST | | |
| 0540 | HOIST, SLING CHAIN, JACK | | |
| 0550 | CRANE | | |
| 0551 | FORKLIFT | | |
| 0560 | HANDTRUCK, DOLLY | | |
| | | | |
| 0600 | DUST, VAPOR, ETC. | | |
| 0610 | DUST (SILICA, COAL, ETC.) | | |
| 0620 | FIBERS | | |
| 0621 | ASBESTOS | | |
| 0630 | GASES | | |
| 0631 | CARBON MONOXIDE | | |
| 0640 | MIST, STEAM, VAPOR, FUME | | |
| 0641 | WELDING FUMES | | |
| 0650 | PARTICLES (UNIDENTIFIED) | | |
| | | | |
| 0700 | CHEMICAL, PLASTIC, ETC. | | |
| 0711 | DRY CHEMICAL - CORROSIVE | | |
| 0712 | DRY CHEMICAL - TOXIC | | |
| 0713 | DRY CHEMICAL - EXPLOSIVE | | |
| 0714 | DRY CHEMICAL FLAMMABLE | | |
| 0721 | LIQUID CHEMICAL - CORROSIVE | | |
| | | | |
| 0722 | LIQUID CHEMICAL - TOXIC | | |
| 0723 | LIQUID CHEMICAL - EXPLOSIVE | | |
| 0724 | LIQUID CHEMICAL - FLAMMABLE | | |
| | | | |
| 0730 | PLASTIC | | |
| 0740 | WATER | | |
| 0750 | MEDICINE | | |
| | | | |
| 0800 | INAMINATE OBJECT | | |
| 0810 | BOX, BARREL, ETC. | | |
| 0820 | PAPER | | |
| 0830 | METAL ITEM, MINERAL | | |
| 0831 | NEEDLE | | |
| 0840 | GLASS | | |

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

- | | |
|-----------------------------------|--|
| 1. Sailing | 9. Swimming/designated area |
| 2. Boating-powered | 10. Swimming/other area |
| 3. Boating-unpowered | 11. Underwater activities (skin diving, scuba, etc.) |
| 4. Water skiing | 12. Wading |
| 5. Fishing from boat | 13. Attempted rescue |
| 6. Fishing from bank dock or pier | 14. Hunting from boat |
| 7. Fishing while wading | 15. Other |
| 8. Swimming/supervised area | |

NON-WATER RELATED RECREATION

- | | |
|--|---|
| 16. Hiking and walking | 23. Sports/summer (baseball, football, etc.) |
| 17. Climbing (general) | 24. Sports/winter (skiing, sledding, snowmobiling etc.) |
| 18. Camping/picnicking authorized area | 25. Cycling (bicycle, motorcycle, scooter) |
| 19. Camping/picnicking unauthorized area | 26. Gliding |
| 20. Guided tours | 27. Parachuting |
| 21. Hunting | 28. Other non-water related |
| 22. Playground equipment | |

OTHER ACTIVITIES

- | | |
|--|----------------------------------|
| 29. Unlawful acts (fights, riots, vandalism, etc.) | 33. Sleeping |
| 30. Food preparation/serving | 34. Pedestrian struck by vehicle |
| 31. Food consumption | 35. Pedestrian other acts |
| 32. Housekeeping | 36. Suicide |
| | 37. "Other" activities |

b. PERSONAL FLOTATION DEVICE USED - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION - Mark appropriate box.

c. SEAT BELT - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP - Enter ownership for each item listed. (Enter one of the following: USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)

c. \$ AMOUNT OF DAMAGE - Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/ FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT - Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

- | | |
|------------------------|-----------------------------|
| 1. ROW BOAT | 7. DREDGE/DIPPER |
| 2. SAIL BOAT | 8. DREDGE/CLAMSHELL, BUCKET |
| 3. MOTOR BOAT | 9. DREDGE/PIPE LINE |
| 4. BARGE | 10. DREDGE/DUST PAN |
| 5. DREDGE/HOPPER | 11. TUG BOAT |
| 6. DREDGE/SIDE CASTING | 12. OTHER |

b. COLLISION/MISHAP - Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

- | | |
|-----------------------------|-----------------------|
| 1. COLLISION W/OTHER VESSEL | 7. HAULAGE UNIT |
| 2. UPPER GUIDE WALL | 8. BREAKING TOW |
| 3. UPPER LOCK GATES | 9. TOW BREAKING UP |
| 4. LOCK WALL | 10. SWEEP DOWN ON DAM |
| 5. LOWER LOCK GATES | 11. BUOY/DOLPHIN/CELL |
| 6. LOWER GUIDE WALL | 12. WHARF OR DOCK |
| | 13. OTHER |

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES - Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS - Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS - Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, byproducts of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) **OFFICE FACTORS** - Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) **SUPPORT FACTORS** - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) **PERSONAL PROTECTIVE EQUIPMENT** - Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) **DRUGS/ALCOHOL** - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. **WRITTEN JOB/ACTIVITY HAZARD ANALYSIS** - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

INSTRUCTIONS FOR SECTION 12 - TRAINING

a. **WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?** - For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

b. **TYPE OF TRAINING** - Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

c. **DATE OF MOST RECENT TRAINING** - Enter the month, day, and year of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. **DIRECT CAUSES** - The direct cause is that single factor which most directly lead to the accident. See examples below.

b. **INDIRECT CAUSES** - Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee

was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (Note: USACE vehicle was in proper/safe working condition).

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.

Indirect cause: failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date when the corrective action(s) identified in section 14 will be completed.

c. **TITLE AND SIGNATURE** - Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in section 16.

d. **DATE SIGNED** - Enter the month, day, and year that the report was signed by the responsible supervisor.

e. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

**INSTRUCTIONS FOR SECTION 17 - MANAGEMENT
REVIEW (2nd)**

2ND REVIEW - The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

**INSTRUCTIONS FOR SECTION 18 - SAFETY AND
OCCUPATIONAL HEALTH REVIEW**

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

**INSTRUCTION FOR SECTION 19 - COMMAND
APPROVAL**

4TH REVIEW - The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

WORK SHEET FOR GOVT & CONTRACTOR PRELIMINARY ACCIDENT NOTIFICATION

This work sheet is a field tool to assist the collection of information about an accident and facilitate the completion of a Preliminary Accident Notification. For Member of the Public Recreation Visitor accidents use the Initial Notification of Public Recreation Mishap Work Sheet

| General Information: | | | | |
|--|-------------------------------|------------------------------------|---|---------------------|
| 1. Project Name: | 2. HNC Project Office Symbol: | 3. Date Worksheet completed: | | |
| 4. Person Name Completing Worksheet: | | 5. Phone Number: | 6. Contract Number: | |
| 7. Date of Mishap: | | 8. Time of Mishap | | |
| 9. Prime Contractor: | | 10. Subcontractor: | | |
| Location and Mishap Information: | | | | |
| 1. Exact Location of Mishap: | | | | |
| 2. Number of Persons involved: | | 3. Number of Properties involved: | | |
| Personnel Classification: | | | | |
| Government Civilian: | Military: | Government Direct Contractor: | Foreign National: | |
| Volunteer: | Prime Contractor: | Subcontractor: | Public: | Other: |
| Type of Mishap: | | | | |
| Fatality: | Injury / Illness: | Property Damage: | Fire: | Driving: |
| Personal Data: (Note: If more than 2 persons involved provide their personal data on a separate sheet) | | | | |
| 1. Name: Last: | | First: | Middle Initial: | 2. Age: |
| 4. Job Series & Title: | | | 3. Gender: | |
| 6. Duty Status: On Duty: | | Off Duty: | TDY: | 7. Time Work Began: |
| 8. Unit and Station Assignment: | | 9. Office Symbol: | | 10. Date Hired: |
| 11. What was Person doing before the mishap occurred? | | | | |
| Injury Information: | | | | N/A |
| 1. Nature of Injury: | | 2. Primary Body Part Affected: | | 2.a. Secondary: |
| 3. Type of Injury: | | 4. Source of Injury: | | |
| 5. Severity of Injury: Fatality: Permanent Total Disability: Permanent Partial Disability: Other: If Other Describe: | | | | |
| 6. Estimated Days Away: | | | 7. Estimated Days Restricted/Transferred: | |
| 8. Primary Language Spoken: | | 9. English Literate: Yes: No: | | |
| 10. Does this person wish to remain anonymous: Yes: No: | | | | |
| 11. Was injured person hospitalized? Yes: No: | | | | |
| 12. Name of Physician/Health Care Professional: | | | | |
| 13. Medical Treatment Facility Name: | | | 14. Phone #: | |
| 15. Facility Address: | | | | |
| Summary of Mishap | | | | |
| Remarks | | | | |
| Describe Any Information Released to the Public | | | | |

Nature of Injury

Amputation
Abrasion
Back Strain
Burn
Contusion/Bruise
Concussion
Dislocation of joint

Drowning
Fracture
Hearing Loss
Hernia
Laceration/Cut
Puncture
Strain

Stroke
Traumatic Food Poisoning
Traumatic Heart Condition
Traumatic Mental Disorder
Traumatic Respiratory
Traumatic Skin Disease

Tuberculosis
Traumatic
Virological/Infective
Parasitic Disease
Other

Type of Injury

Struck by/against
Fell/slipped/tripped
Caught on/in/between

Punctured/lacerated
Stung/bit by
Contact with/by

Exerted
Exposed
Inhaled

Ingested
Absorbed
Traveling In

Severity of Injury

Injury

Illness

Fatality

Permanent Disability

Source of Injury

Environmental
Condition
Building or other
Area
Walking surface
Electricity
Temperature Extreme
Weather

Fire
Water
Mechanical
Equipment
Guard/Shield
Video Display
Terminal
Heating
Motor Vehicle/Cycle

Boat
Bicycle/Other non-
motorized vehicle
Noise
Radiation
Light
Ventilation
Smoke
Stress

Confined Space
Carbon Monoxide
Inanimate Object
Animal Insect
Human (Violence)
Diving Equipment
Parachute

Body Parts

Arm or Wrist
Breast
Testicle
Abdomen
Chest
Lower Back
Penis
Side
Upper Back
Waist
Trunk Other
Ear
Eye

Brain
Cranial Bones
Teeth
Jaw
Throat/Larynx
Mouth
Nose
Tongue
Head Other External
Elbow
Finger
Thumb
Toe

Face
Scalp
Knee
Leg
Hip
Ankle
Buttock
Hand
Feet
Collar Bone
Shoulder Blade
Rib
Sternum

Vertebrae
Trunk Bones other
Shoulder
Lung
Kidney
Heart
Liver
Reproductive Organs
Stomach
Intestines
Trunk/internal

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 2020



U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

| Total number of deaths | Total number of cases with days away from work | Total number of cases with job transfer or restriction | Total number of other recordable cases |
|------------------------|--|--|--|
| <u>0</u> | <u>2</u> | <u>1</u> | <u>10</u> |
| (G) | (H) | (I) | (J) |

Number of Days

| Total number of days away from work | Total number of days of job transfer or restriction |
|-------------------------------------|---|
| <u>30</u> | <u>181</u> |
| (K) | (L) |

Injury and Illness Types

| Total number of... (M) | | | |
|---------------------------|-----------|-------------------------|----------|
| (1) Injury | <u>13</u> | (4) Poisoning | <u>0</u> |
| (2) Skin Disorder | <u>0</u> | (5) Hearing Loss | <u>0</u> |
| (3) Respiratory Condition | <u>0</u> | (6) All Other Illnesses | <u>0</u> |

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave. NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name APTIM Government
 Street 4171 Essen Lane
 City Baton Rouge State LA Zip 70809

Industry description (e.g., Manufacture of motor truck trailers)
Other Heavy and Civil Engineering Construction

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

OR North American Industrial Classification (NAICS), if known (e.g., 336212)
2 3 7 9 9 0

Employment information

Annual average number of employees 1,811

Total hours worked by all employees last year 3,766,393

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

Alan Weakley
Company executive

President
Title

865-560-7936
Phone

1/28/2021
Date

ATTACHMENT 4

SSHO RESUME AND CERTIFICATIONS



This certificate is awarded to

Brian Rhodes

for the successful completion of the course

40-Hour HAZWOPER Training

Hours: 40 Hours 0 Min Credits:

Completion Date: 11/9/1998



A handwritten signature in black ink that reads 'Virgil L. Barton'.

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



This certificate is awarded to

Brian Rhodes

for the successful completion of the course

OSHA 30 Hour Construction Safety

Hours: 30 Hours 0 Min Credits: 0

Completion Date: 1/28/2010



A handwritten signature in black ink that reads 'Virgil L. Barton'.

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



This certificate is awarded to

Brian Rhodes

for the successful completion of the course

8-Hour HAZWOPER Supervisor Training

Hours: 8 Hours 0 Min Credits: 0

Completion Date: 4/24/2003



A handwritten signature in black ink that reads 'Virgil L. Barton'.

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



This certificate is awarded to

Brian Rhodes

for the successful completion of the course

8-Hour HAZWOPER Refresher

Hours: 8 Hours 0 Min Credits: 0

Completion Date: 11/28/2012



A handwritten signature in black ink that reads 'Virgil L. Barton'. The signature is written in a cursive style with a horizontal line underneath.

Virgil Barton, Sr. Vice President
Quality, EHS, Regulatory Compliance,
Process Improvement



Certificate Number: Online

Certificate of Completion

This is to certify that

Brian Rhodes

has been tested and successfully meets the training requirements for

8-Hour HAZWOPER Annual Refresher

29 CFR 1910(e) & Title 8CCR 5192(e)(3)(A)

Presented this:

Wednesday, November 21, 2018

Compliance Solutions Occupational Trainers, Inc.

Neval Gupta
Vice President

Jeffrey Kline
President/CEO



3980 Quebec St., 2nd Floor, Denver CO 80207-1633 800-711-2706

Student Affiliation:

APTIM

4433

Certificate of Completion

Brian Rhodes

has successfully completed training and passed all testing requirements for
8-Hour HAZWOPER Annual Refresher
as per 29 CFR 1910.120(e)

Presented this
Wednesday, November 27, 2019

Certificate Number: 754982334

Compliance Solutions Occupational Trainers, Inc.



Jeffrey E. Kline
President/CEO



American Red Cross
Training Services

Certificate of Completion

Brian Rhodes

has successfully completed requirements for

Adult and Pediatric First Aid/CPR/AED

Date Completed: 4/1/2020

Validity Period: 2 - Years

Conducted by: American Red Cross



To verify certificate, scan code or visit redcross.org/digitalcertificate and enter ID.

Learn and be inspired at LifesavingAwards.org



008FUE7



DEPARTMENT OF THE ARMY
US ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, UNITED STATES ARMY GARRISON, REDSTONE
4488 MARTIN ROAD
REDSTONE ARSENAL, ALABAMA 35898-5000

MAY 15 2009

REPLY TO
ATTENTION OF

Office of the
Garrison Commander

Mr. Don Burton
Shaw Environmental and Infrastructure Inc
312 Directors Drive
Knoxville, TN 37923

Dear Mr. Burton:

The Army, in working with Shaw Environmental and Infrastructure (Shaw E&I) Inc on the Installation Restoration Program, has seen many Shaw field team members come and go through the years on Redstone Arsenal. Some were assigned here temporarily and some holding permanent positions here on Redstone. Your team's efforts in the field here is commendable. We have come to understand that Shaw instills professionalism at every level within their organization and that every individual working for Shaw understands they represent Shaw's historical high standards on safety, conduct, integrity, professionalism, and customer satisfaction.

So with this in mind, as we near the end of the Total Environmental Restoration Contract (TERC), we recognize there is one individual, Mr. Brian Rhodes, as one who stands above all standards Shaw embeds in their team members. Among other noted persona traits pride can also be included in the list of high standards noted above. Working within any military base is a complicated task as security, safety, regulatory compliance, politics, tenant coordination, ranges, and a host of many other requirements must be met to comply with Federal guidelines or as some say, "The Army Way".

Mr. Rhodes has met this challenge and has exceeded in performing his duties with all the pride and high standards any Federal or Shaw manager would expect from any team member. His efficient and effective efforts to coordinate the many task associated with environmental cleanup and Site Access Control has made our lives on this base more tranquil. This Letter of Appreciation to Mr. Rhodes can only be a token as our admiration for his work deserves more than just a letter of acknowledgement.

It is with great pleasure that we commend your team, and especially Mr. Rhodes. We are furnishing a copy of this Letter of Appreciation to Ms. Juana Torres-Perez, Contractor Officers Representative, US Army Corps of Engineers, Savannah District (CESAS-PM-H), so that Acquisitions may know Shaw E&I Inc. has a learned colleague team member here at Redstone working on the TERC contract.

My point of contact is Ms. Terry De la Paz, Environmental Management Division (IMSE-RED-PWE), 256-955-6968 or email terry.delapaz@us.army.mil.

Sincerely,



Robert M. Pastorelli
Colonel, US Army
Garrison Commander

Brian Rhodes

(256) 714-4200 | 205 Yonex Drive Madison, AL 35756 | brianrhodes24@yahoo.com

Senior Environmental Scientist

Accomplished geologist with 20 years of environmental site investigation experience and 15+ years management experience. Experienced project geologist, waste specialist, and site manager. Expert in the collection and interpretation/evaluation of soil/groundwater samples. Adept at project management and problem-solving in hydrogeologic studies, water resources, environmental site assessments, remedial actions, soil & groundwater contamination studies, stormwater management, geotechnical investigations, land use planning, heavy metal remediation, and more.

EDUCATION

Bachelor of Science Degree in Geology (1997)

University of Alabama | Tuscaloosa, AL

Associate of Science (1991)

Calhoun Community College | Decatur, AL

CERTIFICATIONS

40-Hour HAZWOPER as per 29 CFR 1910.120(e)

Hazmat Transportation Security Awareness as per 49 CFR 172.704

H&S Program Management for Project Managers and Supervisors

Construction Quality Management for Contractors (Army Corps of Engineers)

OSHA 10-Hour Construction Safety

IATA Dangerous Goods Transportation as per DOT CFR 172.704(a), (1), (2) and (4)

DOT Hazardous Materials Transportation as per 49 CFR 172.704(a), (1) and (3)

OSHA 30-Hour Construction Safety

50-Hour Site Safety Officer

Level I Antiterrorism Awareness Training

OPSEC Awareness for Military Members, DOD employees and Contractors

Military Munitions Response Program (MMRP) 101 Workshop (Army Corps of Engineers)

Munitions Response Site Prioritization Protocol (Army Corps of Engineers)

PROFESSIONAL EXPERIENCE

APTIM (Sep 2013–Present)

Shaw Group (Sep 2010–Sep 2013)

Manage environmental site investigations in the following capacities under the Army's Program Management Contract:

Quality Control Site Manager (QCSM), Environmental Site Investigations

- ★ Oversee and maintain quality control for several sites, ensuring contracts are followed and subcontractors followed due diligence, resulting in 100% completion and approval by state and national regulators
 - Manage on-site and off-site QC program, including field sampling and characterization, construction, and consulting engineering activities
 - Ensure overall project quality and that deliverables meet corporate quality standards; evaluate quality-related status, procedures, and non-conformances in coordination with the project QA
 - Monitor all subcontractors; prepare daily QC reports; work closely with the QA/QC Manager on any adverse conditions that couldn't be resolved at the project level
 - Assist with training and orientation of field staff; conduct random performance and systems inspections to verify all personnel are following implemented work plan procedures; identify and report any nonconforming items or activities

Project Geologist, Environmental Site Investigations

- ★ Achieved 125+ milestones the PMC contract team, including 85 sites with approved RCRA Facility Investigations (RFIs), 53 sites with No Further Actions (NFAs), and 22 sites with approved Corrective Measures Implementation Work Plans (CMIPs)
- ★ Managed 12 remediation projects of off-site shipment of contaminated soils, working directly with subcontractors during soil excavations, which resulted in meeting cleanup goals
- ★ Managed the construction of 2 on-site landfills, which required consolidating waste and soil and capping them with a geosynthetic clay liner, while taking precautions for contaminants including DDT, DDE, and PAHs
 - Oversee all on-site geological activities, supervise subcontracted drilling, subsurface investigations, remediation, and groundwater sampling crews; conduct all geological field documentation forms and boring/drilling logs
 - Manage subcontractor investigations and provide technical guidance; generate daily QC reports

- Develop technical approaches, work plans, and statements of work; evaluate, select, and oversee subcontractors; ensure contracts are properly implemented, establish safety procedures, maintain schedule and budget

Aptim Federal Services (formerly CB & I Federal Services) (Jul 2017–**Present**)
 CB&I Federal Services (formerly Shaw Group) (Sep 2013–Jul 2017)

Site Safety and Health Officer

- ★ Evaluated the Health and Safety aspects of the on-site tasks to ensure that activities are performed in a safe manner
- ★ Coordinated with Task Managers to complete Health and Safety Work Plan agenda and worked with on-site personnel to achieve compliance with applicable Health and Safety Plans
- ★ Conducted site orientation training with all new onsite personnel to insure all general site hazards, project safety rules, chain of command and emergency procedures are provided
- ★ Worked closely with Senior Health and Safety officers and Task Managers to develop and implement Activity Hazard Analysis for any anticipated hazards for all associated tasks to include the following
 - Activity Hazard Analysis includes all chemical and physical hazards that may be encountered for each task. These control measures include work practice controls, engineering controls, health and safety policy reference and use of appropriate personal protective equipment (PPE).
 - Implementation of Job Safety Analysis (JSA) which is a checklist of daily hazards along with any change conditions encountered during a work period
 - Daily safety hazards to be analyzed may include the following
 - Mobilization/Demobilization of heavy equipment
 - Slips, Trips and Falls
 - Heavy Lifting, Strains and Sprains
 - Use of Heavy Equipment
 - Heat Stress and Cold Stress
 - Noise Prevention
 - Spill Prevention
 - Personal Protective Equipment (PPE)
 - Air Monitoring

Waste Specialist

- ★ Successfully made off-site shipments of 5200+ drums of waste, 300,000+ gallons of liquid, and 200,000+ cubic yards of contaminated soil through the successful management of non-hazardous and hazardous waste
- ★ Developed a drum tracking system to address issues with drum labeling and tracking, which resulted in the proper disposal of 100% of drums generated
 - Manage waste stream from approx. 300 environmental sites on RSA, ensuring all containers undergo a receipt inspection to verify proper requirements have been met
 - Established and maintain a waste tracking system which tracks waste containers from “cradle to grave”
 - Conduct weekly inspections on one year and 90 day hazardous waste storage areas to ensure hazardous waste are properly stored, labeled, packaged, characterized and documented in accordance with the Waste Management Plan (WMP)
 - Ensure all storage areas are in compliance with RCRA standards which include proper labeling, spill containment kits and proper PPE
 - Work directly with government and regulatory personnel on waste disposal, ensuring documentation is properly prepared, executed, and retained for official records; ensure all waste shipments meet the U.S. Department of Transportation (DOT) requirements
 - Coordinate with Army and regulatory personnel for the off-site shipment of non-hazardous and hazardous waste streams
 - Ensure all hazardous/non-hazardous waste is properly containerized in accordance with Department of Transportation, 49 CFR

Sample Coordinator

- ★ Managed numerous soil and groundwater sampling events and ensured that they were successful
- ★ Resolved chemical agent contamination of multiple sites by successfully managing field sampling efforts during intrusive investigation activities, including:
 - Coordinating and tracking sample status for chemical analysis (CA) screening and analyses
 - Working with several investigation teams including, Chemical, Biological, Radiological, Nuclear, and High Yield Explosives and Remediation Activity (CARA), Edgewood, Chemical and Biological Center (ECBC) and multiple laboratories to ensure that CA screening and analyses did not negatively impact analytical holding times
 - Implementing recovery plans to ensure that HTRW laboratories received CA clearance in time so that analytical holding times were met
 - Manage laboratory and facilitation of sample and documentation transfers, forwarding discrepancies to the Field Sampling Lead, the Project Chemist, and the Laboratory PM for resolution
 - Ensure all analytical samples are collected, documented, packaged, and shipped using project-specific plans and IW QAPP; assist in identifying and resolving any technical or quality issues regarding sample collection and analysis; resolve any non-conformances or quality issues

Shaw Group (Aug 2003–Sep 2010)

Site Manager

- Managed the coordination of work activities, quality, schedule, budget, and subcontractors; ensured compliance of the scope of work and environmental activities
- Ensured field activities are completed and meet project objectives in accordance with Redstone Arsenal and the Army Corps of Engineers; ensure all site personnel are trained in procedures, that the procedures are adhered to, and that all activities are documented
- Tracked and maintained inventory of all Government Furnished Equipment (GFE) per FAR Part 45 as by instructed by United States government.

International Technology (Nov 1998–Jan 2002)

Project Geologist

- Implemented and maintained a site-wide surface water monitoring system that synthesized available and newly acquired data to develop a site-wide understanding of surface water flow and discharge
- Provided field oversight to HTW drilling sites, including hollow stem auger and sonic drilling methods for the installation of monitoring wells for site investigations
- Analyzed and reported geological materials, completed field document boring and drilling logs, collected soil and groundwater samples

APPENDIX F

**INVESTIGATION-DERIVED WASTE STANDARD OPERATING
PROCEDURE 4.0**

Subject: INVESTIGATION-DERIVED WASTE

1.0 PURPOSE AND SUMMARY

This Standard Operating Procedure (SOP) establishes specific management practices for the in-process handling and subsequent disposition of environmental media generated as a result of investigation and removal actions at Redstone Arsenal (RSA), Madison County, Alabama. Investigation-derived waste (IDW) will be handled in accordance with the most recent versions of Alabama Environmental Investigation and Remediation Guidance and Alabama Administrative Code (AAC) 335-14. This SOP serves as an update to IDW plans previously submitted to comply with Alabama Department of Environmental Management (ADEM) Consent Order No. 97-203-CHW for the management of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) IDW.

In support of RSA's Installation Restoration Program under the Federal Facilities Compliance Act of 1992 and CERCLA and to meet the requirements of RSA's Resource Conservation and Recovery Act (RCRA) permit, RSA is conducting investigation and removal activities which generate environmental media. The media typically consist of drill cuttings and fluids, monitoring well purge and development water, spent personal protective equipment (PPE), and other inert materials (i.e., plastic, rope, tape, paper, etc.) generated during operations, well installation and sampling activities, remedial actions, and associated site activities. When accumulated, the media must be managed appropriately to minimize the exposure to human health and the environment while adhering to applicable regulatory requirements.

2.0 TABLE OF CONTENTS

- 1.0 Purpose and Summary
- 2.0 Table of Contents
- 3.0 Responsibilities
 - 3.1 Quality Control Site Manager
 - 3.2 Field Team
 - 3.3 Quality Assurance/Quality Control Manager
- 4.0 Definitions
- 5.0 Text
 - 5.1 Required Records and Forms
 - 5.2 Required Materials, Equipment, or Supplies
 - 5.3 Procedures
 - 5.3.1 Preparation
 - 5.3.2 Specific Preparation
 - 5.3.2.1 Initial Handling Requirements
 - 5.3.2.2 Labeling
 - 5.3.2.3 Storage
 - 5.4 Characterization of Media

- 5.5 Management and Disposition
- 5.6 Wastewater
 - 5.6.1 Nonhazardous Wastewater
 - 5.6.2 Hazardous Wastewater
- 5.7 Solids
 - 5.7.1 Nonhazardous Solids
 - 5.7.2 Hazardous Solids
- 6.0 Exception Provision
- 7.0 Cross References and Other Sources of Information
- 8.0 Attachments

3.0 RESPONSIBILITIES

3.1 Quality Control Site Manager

The Quality Control Site Manager (QCSM) is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to their respective procedures. The QCSM is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members also perform work in accordance with this SOP.

3.3 Quality Assurance/Quality Control Manager

The Quality Assurance/Quality Control Manager is responsible for ensuring that this SOP is correctly implemented and that the quantity and quality of field- measurable physical characteristic samples collected meet the requirements of the Site-Specific Field Sampling Plans (SFSP).

4.0 DEFINITIONS

None.

5.0 TEXT

5.1 Required Records and Forms

For a description of required forms, refer to SOP No. 1.0, *Field Documentation*.

- Sample Collection Log (SCL)
 - Field Activity Daily Log
-

- Sample tags/labels and the appropriate forms/documentation for sample shipment
- Material Safety Data Sheets (MSDS)
- SFSP.

5.2 Required Materials, Equipment, or Supplies

- Indelible black ink pens and markers
- Appropriate sample containers
- Insulated cooler and waterproof sealing tape
- Nitrile or latex gloves
- Decontamination equipment and supplies, including rinse bottles and deionized water
- Personal protective equipment (PPE)
- Socket wrench or bung wrench to access drums
- Appropriate equipment and meters for obtaining field measurements as specified in the SFSP (i.e., photoionization detector/flame ionization detector).

5.3 Procedures

5.3.1 Preparation

The following steps must be followed when preparing for management activities of IDW:

- Verify that all personnel have read and understand the approved Site-Specific Health and Safety Plan and have the proper training and certifications required under the Occupational Safety and Health Administration.
- Don the appropriate PPE as dictated by the Site-Specific Health and Safety Plan.
- Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from standard operating procedures on the Field Activity Daily Log and include rationale for changes.

5.3.2 Specific Preparation

The following paragraphs detail the planned methodologies for dealing with environmental media generated during site activities. For the purpose of this document, a site, an area of contamination (AOC), and a solid waste management unit (SWMU) are all synonymous.

5.3.2.1 Initial Handling Requirements

All environmental media will be managed in an effort to minimize exposure to human health and the environment. Typically, the media will be generated as a result of these

major activities: drilling soil borings; installation and development of monitoring wells; and groundwater sampling activities.

In instances where soil borings are advanced, either to retrieve soil samples or to allow for the retrieval of a groundwater sample via a hydropunch or similar sampling device (including obtaining a sample from an open borehole), the following handling protocols for IDW soil will be used:

- All soil cuttings will be placed adjacent to the borehole on plastic or other suitable material capable of preventing contact with the ground surface.
- All cuttings will be covered daily or during rainfall events to prevent contact with moisture.
- Upon completion of the downhole activity (i.e., drilling, groundwater sampling, etc.), the soil cuttings will be placed in open topped 55-gallon drums, labeled, sampled, and properly stored.

In cases where a soil test boring is advanced for the purposes of installing a monitoring well, all environmental media accumulated will be containerized to allow for characterization upon generation and situated at or near the point of generation. As solids are generated, they will first be placed into open-topped 55-gallon drums or other approved containers pending further characterization. Solids may be bulked into larger approved containers situated within the AOC. Liquids may be bulked upon generation unless directed otherwise. All solids and liquids will be separated prior to disposal.

Liquids may be held on site at the AOC or SWMU and are not required to be moved to a separate 90-day storage area. However, either the satellite accumulation restrictions regulating storage of less than 55 gallons or 90-day storage rules would apply to hazardous liquids that remain on the SWMU/AOC. Section 5.3.2.3 further discusses storage requirements. If hazardous liquids are stored on site, the satellite accumulation area or the temporary less-than-90-day storage area must meet ADEM requirements for secondary containment standards as noted in Section 5.3.2.3.

5.3.2.2 Labeling

After each container (i.e., drum, roll-off box, etc.) has been filled, the container and lid, if appropriate, will be labeled with a description of the media (i.e., soil, purge water, decon water, PPE), origin of media (i.e., Soil Boring A- 1, Monitor Well RS-0 1 2, etc.), date the media were placed in the container, site identification (i.e., SWMU or AOC number), date container was sealed and sampled, and a short statement stating that the contents are on hold waiting analytical test results. If the analytical results determine that the container contents are hazardous, a standard hazardous waste label will be placed on each container. The accumulation start date will be the same as the date recorded on the initial drum. A copy of correspondence (email) from ADEM clarifying their position on handling of potentially hazardous wastewater at RSA is provided as an attachment to this SOP. Nonhazardous waste containers may be labeled using a paint pen or other indelible

marker that will not fade when exposed to weather. Hazardous waste containers will be marked with labels and information pursuant 40 Code of Federal Regulations (CFR) 262.34. A record of the number of containers, their contents, and the regulatory status of the waste will be completed at each generation site and will be included in the Field Activity Daily Log before leaving each site.

5.3.2.3 Storage

At the end of each day and/or field activity, all containers will be sealed or covered in such a way to prevent the introduction of rain water or surface runoff. Nonhazardous IDW will either be moved to a central IDW storage area, or, if feasible and in the best interest of operations, nonhazardous IDW will remain in the SWMU/AOC from where it was generated until final disposition is selected.

Within 72 hours of being generated, hazardous solid IDW will be moved to an RSA-approved Satellite Accumulation Area, a temporary 90-day storage area, or a fully permitted waste storage area. Wastewater IDW may be held at the AOC or SWMU in a temporary less-than-90-day storage area or it may be moved to a central 90-day storage area. Any temporary 90-day storage area established on an AOC or SWMU will meet ADEM's secondary containment standards. Wastewater or solid hazardous IDW will be labeled during storage as discussed in Section 5.3.2.2.

Waste may be transported between storage areas when required or in preparation of disposal activities without specific regulatory concurrence (i.e., RSA is not required to obtain specific regulatory approval to transport wastes within the confines of RSA). Drums of hazardous wastewater will be removed from the AOC or SWMU in less than 90 days. All hazardous IDW will be shipped off site or properly treated and managed on site within 90 days of its accumulation start date.

5.4 Characterization of Media

The characterization of the media will be determined by a combination of generator knowledge and use of analytical data obtained during the activity from which the materials were generated. As stated, it is anticipated that specific generation activities will include soil borings, monitoring well installations, and monitoring well purge and development actions. Water obtained from specific monitoring well sampling points (i.e., purge and development water) will be characterized using groundwater sampling data taken from the specific well site from which the water was obtained. Analytical data obtained from a particular borehole reflecting soil contaminant levels will be used to characterize solids generated from that borehole. Other solids (such as rock) will be characterized for disposal based on the analytical results of the soil and water sampled at the specific location where the solids were generated. When appropriate, analytical data will be extrapolated to reflect toxicity characteristic leaching procedure (TCLP) values (i.e., 20x divisor rule for soils). Generator knowledge may be used to evaluate the media potential for toxicity, corrosivity, ignitability, reactivity, and listed waste scenarios.

In the event generator knowledge and data associated with previous site investigations are inadequate to accurately and thoroughly characterize the IDW, waste will be managed as hazardous waste. A representative sample will be retrieved from each waste stream warranting further characterization. In addition, representative samples will be collected from all IDW determined to be nonhazardous based on generator knowledge. These samples will be taken directly from containers after the waste has been generated. The suite of analyses to be run will be determined based on suspected contaminants and any information gleaned from previously available data. Hazardous versus nonhazardous determinations will be made utilizing those parameters outlined in AAC R. 335-14-2-.02, *Criteria for Identifying the Characteristics of Hazardous Wastes and for Listing Hazardous Waste*. More specifically, hazardous characteristics will be determined utilizing the requirements of AAC R. 335-14-2-.02 (1) and 335-14-2-.03. Where listed wastes are expected or where the potential exists, specific analytes (i.e., totals as opposed to TCLP) for the listed compounds will be tested in addition to determining any hazardous characteristics. All sampling and analytical testing protocols will be consistent with ADEM/U.S. Environmental Protection Agency (EPA) requirements and methodologies.

5.5 Management and Disposition

Once adequately characterized, the containers will be labeled as described. U.S. Department of Transportation-approved labels will be used if transportation outside of RSA boundaries is required or anticipated. The media may also be bulked on site (within the staging area) with like waste streams possessing compatible nonreacting characteristics.

5.6 Wastewater

In general, all wastewater generated during the described site activities will most likely be disposed either at an RSA-approved treatment facility or at the wastewater treatment facility currently operated at RSA.

5.6.1 Nonhazardous Wastewater

Upon proper characterization and approval from RSA representatives, wastewater determined to be nonhazardous (Section 40 CFR Part 261) but possessing some level of contaminants can be disposed directly into RSA's sanitary sewer system, where it will ultimately be treated at the RSA wastewater treatment plant (WWTP). The RSA representative will request waste characterization data, approximate volume, and the location of disposal in making the determination to accept sewer discharge. The nonhazardous water will typically be discharged at a manhole(s) located near the generation site.

All discharges will be in accordance with provisions outlined in Division 6, *Water Quality Program*, of the AAC. More specifically, the discharge will not be greater than 5 percent of the average dry weather capacity of the WWTP, greater than 5 percent of the

design capacity of the WWTP, or subject to Section 403.6 of the Federal Water Pollution Control Act. No disposal permit is required as long as the wastewater is discharged in quantities of less than 25,000 gallons per day and the water is nonhazardous (40 CFR 261).

Wastewater generated during site activities and for which analytical tests showed no level of contamination present above approved detection limits will be considered nonregulated. The disposal means and methods of nonregulated waste water are at the discretion of RSA representatives (e.g., storm water system, open ditch, etc.) and do not require regulatory consultation or concurrence.

On a quarterly basis, RSA will submit documentation of all discharges (regulated and nonregulated) to ADEM. The documentation will contain pertinent information regarding the discharge, including, date, time, volumes, analytical data (if available), site, action, etc. All discharges to the sanitary sewer system will be coordinated in advance.

5.6.2 Hazardous Wastewater

Hazardous wastewater will be transported, when required, and treated at an off-site wastewater treatment facility when the following conditions are met:

1. The treatment facility meets the definition of a wastewater treatment unit as defined in AAC R. 335-14-1-.02.
2. The treatment facility is capable of (a) rendering characteristically hazardous wastes (AAC R. 335-14-2-.03) nonhazardous or (b) removing listed wastes (AAC R. 335-14-2-.04) from the contaminated media so that the media no longer contain the listed waste for which the media were originally considered hazardous. If after treatment, analytical tests show the listed waste is not present above laboratory detection limits, then the contaminated media will be considered to no longer contain the listed waste and will no longer be considered hazardous.
3. The wastewater treatment facility has been constructed at RSA in conjunction with a removal, interim remedial action, or remedial action at an AOC.

At no time will liquids that possess hazardous characteristics or meet the definition of a listed waste be disposed into the sanitary sewer system, unless the waste is specifically exempt under RCRA, CERCLA, or its applicable or relevant and appropriate requirement without applicable ADEM authorization.

Wastewater determined to be hazardous may be transported between AOCs and within RSA boundaries for treatment/disposition in accordance with the previously outlined provisions without specific regulatory concurrence.

On a quarterly basis, RSA will submit documentation of discharges to ADEM. The documentation will contain pertinent information regarding the discharge including date, time, volumes, analytical (if available), site, action, etc.

All discharges to the sanitary sewer system will be coordinated prior to any discharge.

In the event that RSA does not have a facility on line capable of treating the hazardous wastewater at or around the time of generation, and the water is expected to remain on site for a prolonged period of time (but not to exceed 90 days), the water will be stored in an area with an adequate secondary containment system until an approved treatment system is on line.

Unless specifically mandated by ADEM and EPA, the treatment and disposal of hazardous and nonhazardous wastewater will be performed as previously described. The wastes will be treated and disposed in a timely manner so as to expedite site activities and to ensure the protection of human health and the environment. Except where noted, specific written concurrence from ADEM and EPA prior to those actions previously described is not required.

5.7 Solids

Solids may include soil cuttings, rock, grout, spent PPE, plastic sheeting, rope, unused monitoring well construction materials, and other environmental media generated during field activities. All solids will be containerized at or near the point of generation and staged as described in Section 5.3.2.1. Other specific management practices are described in Sections 5.7.1 and 5.7.2.

5.7.1 Nonhazardous Solids

Soil cuttings and rock determined to be nonhazardous will be staged within the confines of the AOC from which they were generated or stored properly in an RSA-approved storage area. After characterizations (hazardous versus nonhazardous) are finalized and depending upon site conditions, nonhazardous cuttings will be removed from containers and replaced “at or near” the location from which they were derived. “At or near” infers media will be placed as near to their point of origin as is practical. Examples would be placing monitoring well cuttings around the monitoring well from which they originated as opposed to within it. However, when not practical, the media may be centrally located within the confines of the originating AOC in an area of minimal traffic and where the media could be managed in a manner protective of human health and the environment. At no time will contaminated media originating from one AOC be transported to another AOC for placement without prior written concurrence from ADEM and EPA.

In the event that site conditions are not conducive to the replacement of the materials (i.e., restricted space, confined area, etc.), soils and rock determined to be nonhazardous may be disposed into RSA's Solid Waste Disposal Facility-Construction/Demolition Landfill (ADEM Permit No. 45-03) or an approved off-site non-hazardous solid waste disposal facility as long as the following conditions are met:

1. Soils exhibiting contaminant levels below analytical detection limits are considered nonregulated and will be disposed at the discretion of RSA representatives.
-

2. The soil analytes do not exceed 50 percent of the TCLP analysis for any given compound. A disposal report is submitted within 45 days of disposal that includes a signed copy of ADEM's Solid/Hazardous Waste Determination form and any applicable analytical results.

Other nonhazardous solids such as spent PPE, plastic sheeting, rope, unused monitoring well construction materials, and other environmental media generated during field activities that have been determined to be nonhazardous will be emptied into dumpsters or roll-offs for disposal off site at a permitted solid waste disposal facility.

5.7.2 Hazardous Solids

Hazardous IDW solids can be segregated into two categories for purposes of waste management. The first is strictly IDW soils. Hazardous IDW soils will be immediately handled and stored as hazardous waste while on RSA. The waste soils will be analyzed, profiled, and managed off site at a permitted transportation, storage, and disposal facility for its characteristic and/or listed waste status. The second hazardous IDW solid category is essentially all non-soil-like media, generally anticipated to be in the form of debris and PPE. The soil versus nonsoil differentiation is necessary in order to select the correct treatment and disposal technology. Hazardous nonsoil and debris media can present different analytical and treatment strategies than contaminated soils.

6.0 EXCEPTION PROVISION

None.

7.0 CROSS REFERENCES AND OTHER SOURCES OF INFORMATION

This SOP will be used in conjunction with the following cross references where applicable.

SOP No. 1.0 – Field Documentation

SOP No. 11.0 – Field Generated Records Management

Alabama Department of Environmental Management (ADEM), 2009, Division 14 - Hazardous Waste Program, Revised Effective March.

Alabama Department of Environmental Management (ADEM), 2005, **Alabama Environmental Investigation and Remediation Guidance**, September.

McCoy and Associates, 1995, **RCRA Regulations and Keyword Index**, Elsevier, 1995.

U. S. Environmental Protection Agency (EPA), 1992a, **Guide to Management of Investigative-Derived Wastes**, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, April 1992.

U. S. Environmental Protection Agency (EPA), 1992b, **Management of Contaminated Media**, Region IV EPA, Guidance Number TSC-92-02, December 28, 1992.

U. S. Environmental Protection Agency (EPA), 1991, **Management of Investigative-Derived Wastes During Site Inspections**, Office of Research and Development, Publication, EPA/540/G-91/009, May 1991.

8.0 ATTACHMENTS

- Attachment 1, ADEM Email Addressing IDW.
-

ATTACHMENT 1
ADEM EMAIL ADDRESSING IDW

This page was intentionally left blank.

Attachment I
ADEM Email Addressing IDW
RSA IWSAP SOPP 4.0

Kurth, Randy

Subject: FW: Response to ADEM original comments on the IDW discussion {Update}
Importance: High

From: Morrissette, Krishna M [mailto:KMorrissette@adem.state.al.us]
Sent: Wednesday, November 17, 2010 2:54 PM
To: Kurth, Randy
Cc: Davis, Emily; Burton, Don; Hodges, Barry A Mr CIV USA USACE; Shell, Ronald T; Wilson, J Jason; Reese, Dennis
Subject: RE: Response to ADEM original comments on the IDW discussion {Update}
Importance: High

Randy,

Sorry for the confusion on the 90-day storage issue. Here are some comments to further clarify ADEM position on the handling/ staging of potentially hazardous wastewater at RSA:

1. Wastewater can be held at the AOC or SWMU site and does not have to be immediately moved to another < 90 day storage area. The holding area must meet secondary containment standards.
2. It is OK to initially label the wastewater filled drums with the following information.
 - Description of the drum contents (e.g. wastewater from RSA-XXX)
 - Accumulation start date (the date the drum was filled)
 - A short statement that states that the contents are on hold awaiting analytical test results
3. If the analytical results come back noting the drum contents are hazardous, a standard hazardous waste label must be put on the drum noting all required information. The accumulation start date for the standard HW label should be the same date as recorded on the initial drum label.
4. Drums of hazardous wastewater must be removed from the AOC or SWMU in less than 90 days.

Remember that the generator must meet the < 90 day storage rules and regulations (e.g. weekly inspections, training, secondary containment, etc.) while holding the hazardous wastewater drums at the AOC or SWMU site.

As for your response to the example IDW information needed to support generator knowledge determination, it is adequate for our on-site visits. Since it is late in the afternoon for you (EST), I will try to call you to confirm the information presented in this email. Thanks again for your help in this matter, Randy!

Sincerely Yours,

Krishna "Kel" Morrissette

ADEM - Land Division: Facilities Engineering Section
Work: (334) 394-4335
Fax: (334) 279-3050
email: kmorrissette@adem.state.al.us

This page was intentionally left blank.

APPENDIX F

**INVESTIGATION-DERIVED WASTE STANDARD OPERATING
PROCEDURE 4.0**

Subject: INVESTIGATION-DERIVED WASTE

1.0 PURPOSE AND SUMMARY

This Standard Operating Procedure (SOP) establishes specific management practices for the in-process handling and subsequent disposition of environmental media generated as a result of investigation and removal actions at Redstone Arsenal (RSA), Madison County, Alabama. Investigation-derived waste (IDW) will be handled in accordance with the most recent versions of Alabama Environmental Investigation and Remediation Guidance and Alabama Administrative Code (AAC) 335-14. This SOP serves as an update to IDW plans previously submitted to comply with Alabama Department of Environmental Management (ADEM) Consent Order No. 97-203-CHW for the management of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) IDW.

In support of RSA's Installation Restoration Program under the Federal Facilities Compliance Act of 1992 and CERCLA and to meet the requirements of RSA's Resource Conservation and Recovery Act (RCRA) permit, RSA is conducting investigation and removal activities which generate environmental media. The media typically consist of drill cuttings and fluids, monitoring well purge and development water, spent personal protective equipment (PPE), and other inert materials (i.e., plastic, rope, tape, paper, etc.) generated during operations, well installation and sampling activities, remedial actions, and associated site activities. When accumulated, the media must be managed appropriately to minimize the exposure to human health and the environment while adhering to applicable regulatory requirements.

2.0 TABLE OF CONTENTS

- 1.0 Purpose and Summary
- 2.0 Table of Contents
- 3.0 Responsibilities
 - 3.1 Quality Control Site Manager
 - 3.2 Field Team
 - 3.3 Quality Assurance/Quality Control Manager
- 4.0 Definitions
- 5.0 Text
 - 5.1 Required Records and Forms
 - 5.2 Required Materials, Equipment, or Supplies
 - 5.3 Procedures
 - 5.3.1 Preparation
 - 5.3.2 Specific Preparation
 - 5.3.2.1 Initial Handling Requirements
 - 5.3.2.2 Labeling
 - 5.3.2.3 Storage
 - 5.4 Characterization of Media

- 5.5 Management and Disposition
- 5.6 Wastewater
 - 5.6.1 Nonhazardous Wastewater
 - 5.6.2 Hazardous Wastewater
- 5.7 Solids
 - 5.7.1 Nonhazardous Solids
 - 5.7.2 Hazardous Solids
- 6.0 Exception Provision
- 7.0 Cross References and Other Sources of Information
- 8.0 Attachments

3.0 RESPONSIBILITIES

3.1 Quality Control Site Manager

The Quality Control Site Manager (QCSM) is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to their respective procedures. The QCSM is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members also perform work in accordance with this SOP.

3.3 Quality Assurance/Quality Control Manager

The Quality Assurance/Quality Control Manager is responsible for ensuring that this SOP is correctly implemented and that the quantity and quality of field- measurable physical characteristic samples collected meet the requirements of the Site-Specific Field Sampling Plans (SFSP).

4.0 DEFINITIONS

None.

5.0 TEXT

5.1 Required Records and Forms

For a description of required forms, refer to SOP No. 1.0, *Field Documentation*.

- Sample Collection Log (SCL)
 - Field Activity Daily Log
-

- Sample tags/labels and the appropriate forms/documentation for sample shipment
- Material Safety Data Sheets (MSDS)
- SFSP.

5.2 Required Materials, Equipment, or Supplies

- Indelible black ink pens and markers
- Appropriate sample containers
- Insulated cooler and waterproof sealing tape
- Nitrile or latex gloves
- Decontamination equipment and supplies, including rinse bottles and deionized water
- Personal protective equipment (PPE)
- Socket wrench or bung wrench to access drums
- Appropriate equipment and meters for obtaining field measurements as specified in the SFSP (i.e., photoionization detector/flame ionization detector).

5.3 Procedures

5.3.1 Preparation

The following steps must be followed when preparing for management activities of IDW:

- Verify that all personnel have read and understand the approved Site-Specific Health and Safety Plan and have the proper training and certifications required under the Occupational Safety and Health Administration.
- Don the appropriate PPE as dictated by the Site-Specific Health and Safety Plan.
- Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from standard operating procedures on the Field Activity Daily Log and include rationale for changes.

5.3.2 Specific Preparation

The following paragraphs detail the planned methodologies for dealing with environmental media generated during site activities. For the purpose of this document, a site, an area of contamination (AOC), and a solid waste management unit (SWMU) are all synonymous.

5.3.2.1 Initial Handling Requirements

All environmental media will be managed in an effort to minimize exposure to human health and the environment. Typically, the media will be generated as a result of these

major activities: drilling soil borings; installation and development of monitoring wells; and groundwater sampling activities.

In instances where soil borings are advanced, either to retrieve soil samples or to allow for the retrieval of a groundwater sample via a hydropunch or similar sampling device (including obtaining a sample from an open borehole), the following handling protocols for IDW soil will be used:

- All soil cuttings will be placed adjacent to the borehole on plastic or other suitable material capable of preventing contact with the ground surface.
- All cuttings will be covered daily or during rainfall events to prevent contact with moisture.
- Upon completion of the downhole activity (i.e., drilling, groundwater sampling, etc.), the soil cuttings will be placed in open topped 55-gallon drums, labeled, sampled, and properly stored.

In cases where a soil test boring is advanced for the purposes of installing a monitoring well, all environmental media accumulated will be containerized to allow for characterization upon generation and situated at or near the point of generation. As solids are generated, they will first be placed into open-topped 55-gallon drums or other approved containers pending further characterization. Solids may be bulked into larger approved containers situated within the AOC. Liquids may be bulked upon generation unless directed otherwise. All solids and liquids will be separated prior to disposal.

Liquids may be held on site at the AOC or SWMU and are not required to be moved to a separate 90-day storage area. However, either the satellite accumulation restrictions regulating storage of less than 55 gallons or 90-day storage rules would apply to hazardous liquids that remain on the SWMU/AOC. Section 5.3.2.3 further discusses storage requirements. If hazardous liquids are stored on site, the satellite accumulation area or the temporary less-than-90-day storage area must meet ADEM requirements for secondary containment standards as noted in Section 5.3.2.3.

5.3.2.2 Labeling

After each container (i.e., drum, roll-off box, etc.) has been filled, the container and lid, if appropriate, will be labeled with a description of the media (i.e., soil, purge water, decon water, PPE), origin of media (i.e., Soil Boring A- 1, Monitor Well RS-0 1 2, etc.), date the media were placed in the container, site identification (i.e., SWMU or AOC number), date container was sealed and sampled, and a short statement stating that the contents are on hold waiting analytical test results. If the analytical results determine that the container contents are hazardous, a standard hazardous waste label will be placed on each container. The accumulation start date will be the same as the date recorded on the initial drum. A copy of correspondence (email) from ADEM clarifying their position on handling of potentially hazardous wastewater at RSA is provided as an attachment to this SOP. Nonhazardous waste containers may be labeled using a paint pen or other indelible

marker that will not fade when exposed to weather. Hazardous waste containers will be marked with labels and information pursuant 40 Code of Federal Regulations (CFR) 262.34. A record of the number of containers, their contents, and the regulatory status of the waste will be completed at each generation site and will be included in the Field Activity Daily Log before leaving each site.

5.3.2.3 Storage

At the end of each day and/or field activity, all containers will be sealed or covered in such a way to prevent the introduction of rain water or surface runoff. Nonhazardous IDW will either be moved to a central IDW storage area, or, if feasible and in the best interest of operations, nonhazardous IDW will remain in the SWMU/AOC from where it was generated until final disposition is selected.

Within 72 hours of being generated, hazardous solid IDW will be moved to an RSA-approved Satellite Accumulation Area, a temporary 90-day storage area, or a fully permitted waste storage area. Wastewater IDW may be held at the AOC or SWMU in a temporary less-than-90-day storage area or it may be moved to a central 90-day storage area. Any temporary 90-day storage area established on an AOC or SWMU will meet ADEM's secondary containment standards. Wastewater or solid hazardous IDW will be labeled during storage as discussed in Section 5.3.2.2.

Waste may be transported between storage areas when required or in preparation of disposal activities without specific regulatory concurrence (i.e., RSA is not required to obtain specific regulatory approval to transport wastes within the confines of RSA). Drums of hazardous wastewater will be removed from the AOC or SWMU in less than 90 days. All hazardous IDW will be shipped off site or properly treated and managed on site within 90 days of its accumulation start date.

5.4 Characterization of Media

The characterization of the media will be determined by a combination of generator knowledge and use of analytical data obtained during the activity from which the materials were generated. As stated, it is anticipated that specific generation activities will include soil borings, monitoring well installations, and monitoring well purge and development actions. Water obtained from specific monitoring well sampling points (i.e., purge and development water) will be characterized using groundwater sampling data taken from the specific well site from which the water was obtained. Analytical data obtained from a particular borehole reflecting soil contaminant levels will be used to characterize solids generated from that borehole. Other solids (such as rock) will be characterized for disposal based on the analytical results of the soil and water sampled at the specific location where the solids were generated. When appropriate, analytical data will be extrapolated to reflect toxicity characteristic leaching procedure (TCLP) values (i.e., 20x divisor rule for soils). Generator knowledge may be used to evaluate the media potential for toxicity, corrosivity, ignitability, reactivity, and listed waste scenarios.

In the event generator knowledge and data associated with previous site investigations are inadequate to accurately and thoroughly characterize the IDW, waste will be managed as hazardous waste. A representative sample will be retrieved from each waste stream warranting further characterization. In addition, representative samples will be collected from all IDW determined to be nonhazardous based on generator knowledge. These samples will be taken directly from containers after the waste has been generated. The suite of analyses to be run will be determined based on suspected contaminants and any information gleaned from previously available data. Hazardous versus nonhazardous determinations will be made utilizing those parameters outlined in AAC R. 335-14-2-.02, *Criteria for Identifying the Characteristics of Hazardous Wastes and for Listing Hazardous Waste*. More specifically, hazardous characteristics will be determined utilizing the requirements of AAC R. 335-14-2-.02 (1) and 335-14-2-.03. Where listed wastes are expected or where the potential exists, specific analytes (i.e., totals as opposed to TCLP) for the listed compounds will be tested in addition to determining any hazardous characteristics. All sampling and analytical testing protocols will be consistent with ADEM/U.S. Environmental Protection Agency (EPA) requirements and methodologies.

5.5 Management and Disposition

Once adequately characterized, the containers will be labeled as described. U.S. Department of Transportation-approved labels will be used if transportation outside of RSA boundaries is required or anticipated. The media may also be bulked on site (within the staging area) with like waste streams possessing compatible nonreacting characteristics.

5.6 Wastewater

In general, all wastewater generated during the described site activities will most likely be disposed either at an RSA-approved treatment facility or at the wastewater treatment facility currently operated at RSA.

5.6.1 Nonhazardous Wastewater

Upon proper characterization and approval from RSA representatives, wastewater determined to be nonhazardous (Section 40 CFR Part 261) but possessing some level of contaminants can be disposed directly into RSA's sanitary sewer system, where it will ultimately be treated at the RSA wastewater treatment plant (WWTP). The RSA representative will request waste characterization data, approximate volume, and the location of disposal in making the determination to accept sewer discharge. The nonhazardous water will typically be discharged at a manhole(s) located near the generation site.

All discharges will be in accordance with provisions outlined in Division 6, *Water Quality Program*, of the AAC. More specifically, the discharge will not be greater than 5 percent of the average dry weather capacity of the WWTP, greater than 5 percent of the

design capacity of the WWTP, or subject to Section 403.6 of the Federal Water Pollution Control Act. No disposal permit is required as long as the wastewater is discharged in quantities of less than 25,000 gallons per day and the water is nonhazardous (40 CFR 261).

Wastewater generated during site activities and for which analytical tests showed no level of contamination present above approved detection limits will be considered nonregulated. The disposal means and methods of nonregulated waste water are at the discretion of RSA representatives (e.g., storm water system, open ditch, etc.) and do not require regulatory consultation or concurrence.

On a quarterly basis, RSA will submit documentation of all discharges (regulated and nonregulated) to ADEM. The documentation will contain pertinent information regarding the discharge, including, date, time, volumes, analytical data (if available), site, action, etc. All discharges to the sanitary sewer system will be coordinated in advance.

5.6.2 Hazardous Wastewater

Hazardous wastewater will be transported, when required, and treated at an off-site wastewater treatment facility when the following conditions are met:

1. The treatment facility meets the definition of a wastewater treatment unit as defined in AAC R. 335-14-1-.02.
2. The treatment facility is capable of (a) rendering characteristically hazardous wastes (AAC R. 335-14-2-.03) nonhazardous or (b) removing listed wastes (AAC R. 335-14-2-.04) from the contaminated media so that the media no longer contain the listed waste for which the media were originally considered hazardous. If after treatment, analytical tests show the listed waste is not present above laboratory detection limits, then the contaminated media will be considered to no longer contain the listed waste and will no longer be considered hazardous.
3. The wastewater treatment facility has been constructed at RSA in conjunction with a removal, interim remedial action, or remedial action at an AOC.

At no time will liquids that possess hazardous characteristics or meet the definition of a listed waste be disposed into the sanitary sewer system, unless the waste is specifically exempt under RCRA, CERCLA, or its applicable or relevant and appropriate requirement without applicable ADEM authorization.

Wastewater determined to be hazardous may be transported between AOCs and within RSA boundaries for treatment/disposition in accordance with the previously outlined provisions without specific regulatory concurrence.

On a quarterly basis, RSA will submit documentation of discharges to ADEM. The documentation will contain pertinent information regarding the discharge including date, time, volumes, analytical (if available), site, action, etc.

All discharges to the sanitary sewer system will be coordinated prior to any discharge.

In the event that RSA does not have a facility on line capable of treating the hazardous wastewater at or around the time of generation, and the water is expected to remain on site for a prolonged period of time (but not to exceed 90 days), the water will be stored in an area with an adequate secondary containment system until an approved treatment system is on line.

Unless specifically mandated by ADEM and EPA, the treatment and disposal of hazardous and nonhazardous wastewater will be performed as previously described. The wastes will be treated and disposed in a timely manner so as to expedite site activities and to ensure the protection of human health and the environment. Except where noted, specific written concurrence from ADEM and EPA prior to those actions previously described is not required.

5.7 Solids

Solids may include soil cuttings, rock, grout, spent PPE, plastic sheeting, rope, unused monitoring well construction materials, and other environmental media generated during field activities. All solids will be containerized at or near the point of generation and staged as described in Section 5.3.2.1. Other specific management practices are described in Sections 5.7.1 and 5.7.2.

5.7.1 Nonhazardous Solids

Soil cuttings and rock determined to be nonhazardous will be staged within the confines of the AOC from which they were generated or stored properly in an RSA-approved storage area. After characterizations (hazardous versus nonhazardous) are finalized and depending upon site conditions, nonhazardous cuttings will be removed from containers and replaced “at or near” the location from which they were derived. “At or near” infers media will be placed as near to their point of origin as is practical. Examples would be placing monitoring well cuttings around the monitoring well from which they originated as opposed to within it. However, when not practical, the media may be centrally located within the confines of the originating AOC in an area of minimal traffic and where the media could be managed in a manner protective of human health and the environment. At no time will contaminated media originating from one AOC be transported to another AOC for placement without prior written concurrence from ADEM and EPA.

In the event that site conditions are not conducive to the replacement of the materials (i.e., restricted space, confined area, etc.), soils and rock determined to be nonhazardous may be disposed into RSA's Solid Waste Disposal Facility-Construction/Demolition Landfill (ADEM Permit No. 45-03) or an approved off-site non-hazardous solid waste disposal facility as long as the following conditions are met:

1. Soils exhibiting contaminant levels below analytical detection limits are considered nonregulated and will be disposed at the discretion of RSA representatives.
-

2. The soil analytes do not exceed 50 percent of the TCLP analysis for any given compound. A disposal report is submitted within 45 days of disposal that includes a signed copy of ADEM's Solid/Hazardous Waste Determination form and any applicable analytical results.

Other nonhazardous solids such as spent PPE, plastic sheeting, rope, unused monitoring well construction materials, and other environmental media generated during field activities that have been determined to be nonhazardous will be emptied into dumpsters or roll-offs for disposal off site at a permitted solid waste disposal facility.

5.7.2 Hazardous Solids

Hazardous IDW solids can be segregated into two categories for purposes of waste management. The first is strictly IDW soils. Hazardous IDW soils will be immediately handled and stored as hazardous waste while on RSA. The waste soils will be analyzed, profiled, and managed off site at a permitted transportation, storage, and disposal facility for its characteristic and/or listed waste status. The second hazardous IDW solid category is essentially all non-soil-like media, generally anticipated to be in the form of debris and PPE. The soil versus nonsoil differentiation is necessary in order to select the correct treatment and disposal technology. Hazardous nonsoil and debris media can present different analytical and treatment strategies than contaminated soils.

6.0 EXCEPTION PROVISION

None.

7.0 CROSS REFERENCES AND OTHER SOURCES OF INFORMATION

This SOP will be used in conjunction with the following cross references where applicable.

SOP No. 1.0 – Field Documentation

SOP No. 11.0 – Field Generated Records Management

Alabama Department of Environmental Management (ADEM), 2009, Division 14 - Hazardous Waste Program, Revised Effective March.

Alabama Department of Environmental Management (ADEM), 2005, **Alabama Environmental Investigation and Remediation Guidance**, September.

McCoy and Associates, 1995, **RCRA Regulations and Keyword Index**, Elsevier, 1995.

U. S. Environmental Protection Agency (EPA), 1992a, **Guide to Management of Investigative-Derived Wastes**, Office of Solid Waste and Emergency Response, Publication 9345.3-03FS, April 1992.

U. S. Environmental Protection Agency (EPA), 1992b, **Management of Contaminated Media**, Region IV EPA, Guidance Number TSC-92-02, December 28, 1992.

U. S. Environmental Protection Agency (EPA), 1991, **Management of Investigative-Derived Wastes During Site Inspections**, Office of Research and Development, Publication, EPA/540/G-91/009, May 1991.

8.0 ATTACHMENTS

- Attachment 1, ADEM Email Addressing IDW.
-

ATTACHMENT 1
ADEM EMAIL ADDRESSING IDW

This page was intentionally left blank.

Attachment I
ADEM Email Addressing IDW
RSA IWSAP SOPP 4.0

Kurth, Randy

Subject: FW: Response to ADEM original comments on the IDW discussion {Update}
Importance: High

From: Morrissette, Krishna M [mailto:KMorrissette@adem.state.al.us]
Sent: Wednesday, November 17, 2010 2:54 PM
To: Kurth, Randy
Cc: Davis, Emily; Burton, Don; Hodges, Barry A Mr CIV USA USACE; Shell, Ronald T; Wilson, J Jason; Reese, Dennis
Subject: RE: Response to ADEM original comments on the IDW discussion {Update}
Importance: High

Randy,

Sorry for the confusion on the 90-day storage issue. Here are some comments to further clarify ADEM position on the handling/ staging of potentially hazardous wastewater at RSA:

1. Wastewater can be held at the AOC or SWMU site and does not have to be immediately moved to another < 90 day storage area. The holding area must meet secondary containment standards.
2. It is OK to initially label the wastewater filled drums with the following information.
 - Description of the drum contents (e.g. wastewater from RSA-XXX)
 - Accumulation start date (the date the drum was filled)
 - A short statement that states that the contents are on hold awaiting analytical test results
3. If the analytical results come back noting the drum contents are hazardous, a standard hazardous waste label must be put on the drum noting all required information. The accumulation start date for the standard HW label should be the same date as recorded on the initial drum label.
4. Drums of hazardous wastewater must be removed from the AOC or SWMU in less than 90 days.

Remember that the generator must meet the < 90 day storage rules and regulations (e.g. weekly inspections, training, secondary containment, etc.) while holding the hazardous wastewater drums at the AOC or SWMU site.

As for your response to the example IDW information needed to support generator knowledge determination, it is adequate for our on-site visits. Since it is late in the afternoon for you (EST), I will try to call you to confirm the information presented in this email. Thanks again for your help in this matter, Randy!

Sincerely Yours,

Krishna "Kel" Morrissette

ADEM - Land Division: Facilities Engineering Section
Work: (334) 394-4335
Fax: (334) 279-3050
email: kmorrissette@adem.state.al.us

This page was intentionally left blank.

APPENDIX G

ALABAMA BEST MANAGEMENT PRACTICES

Appendix G

**Alabama Best Management Practices
RSA-014S, Unlined Inactive Burn Trenches, Unit #2
Operable Unit 14
U.S. Army Garrison-Redstone
Madison County, Alabama
EPA ID No. AL7 210 020 742**

Prepared for:

**U.S. Army Engineering and Support Center
Huntsville Engineering and Support Center
ATTN: CEHNC-OEC
5021 Bradford Drive East
Huntsville, AL 35805**

Prepared by:

**Aptim Federal Services, LLC
11400 Parkside Drive, Suite 400
Knoxville, Tennessee 37934**

**Contract No. W912DY-17-D-0003
Delivery Order No. W912DY19F1116**

March 2022

Reference:

Alabama Handbook for Erosion Control, Sediment Control and Stormwater Management on Construction Sites and Urban Areas. Auburn, AL, July 2018.

Site Preparation

- A. Construction Exit Pad (CEP)
- B. Land Grading (LG)

Surface Stabilization

- C. Permanent Seeding (PS)
- D. Temporary Seeding (TS)
- E. Preservation of Vegetation (PV)

Runoff Conveyance

- F. Check Dam (CD)
- G. Diversion (DV)

Sediment Control

- H. Sediment Barrier (SB)

Other

- I. Corrective Action Log
- J. CBMPP Amendment Log
- K. Grading and Stabilization Log
- L. Rainfall Documentation Log

A. Construction Exit Pad (CEP)

Construction Exit Pad (CEP)



Practice Description

A construction pad is a stone base pad or manufactured product designed to provide a buffer area where mud and caked soil can be removed from the tires of construction vehicles to avoid transporting it onto public roads. This practice applies anywhere traffic will be leaving a construction site and moving directly onto a public road or street.

Planning Considerations

Roads and streets adjacent to construction sites should be kept clean for the general safety and welfare of the public. A construction exit pad (Figure CEP-1) should be provided where mud can be removed from construction vehicle tires before they enter a public road.

Where possible the construction exit pad should be located and constructed at a site where surface runoff from the pad will not transport sediment from the pad off the site. If the pad slope toward the road exceeds 2%, a diversion ridge 6" to 8" high with 3:1 side slopes should be constructed across the foundation approximately 15 feet from the entrance. This diversion ridge should divert surface runoff from the pad away from the road and into a sediment trap or basin.

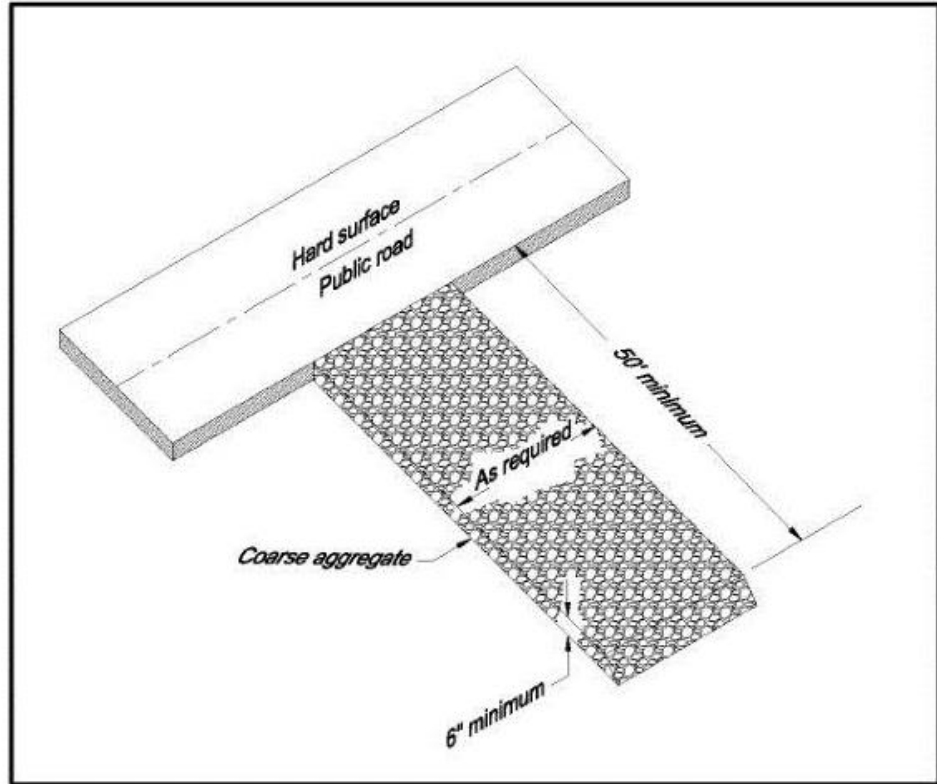


Figure CEP-1 Gravel Construction Exit

If the action of the vehicle traveling over the gravel pad does not sufficiently remove the mud or if the site is in a particularly sensitive area, a washing facility should be included with the pad (Figure CEP-2). When a washing facility is required all wash water shall be diverted to a sediment trap or basin.

If the construction exit pad is located in an area with soils that will not support traffic when wet, an underliner of geotextile will be required to provide stability to the pad.

Construction of stabilized roads throughout the development site should be considered to lessen the amount of mud transported by vehicular traffic. The construction exit pad should be located to provide for maximum use by construction vehicles.

Consideration should be given to limiting construction vehicles to only one ingress and egress point. Measures may be necessary to make existing traffic use the construction exit pad.

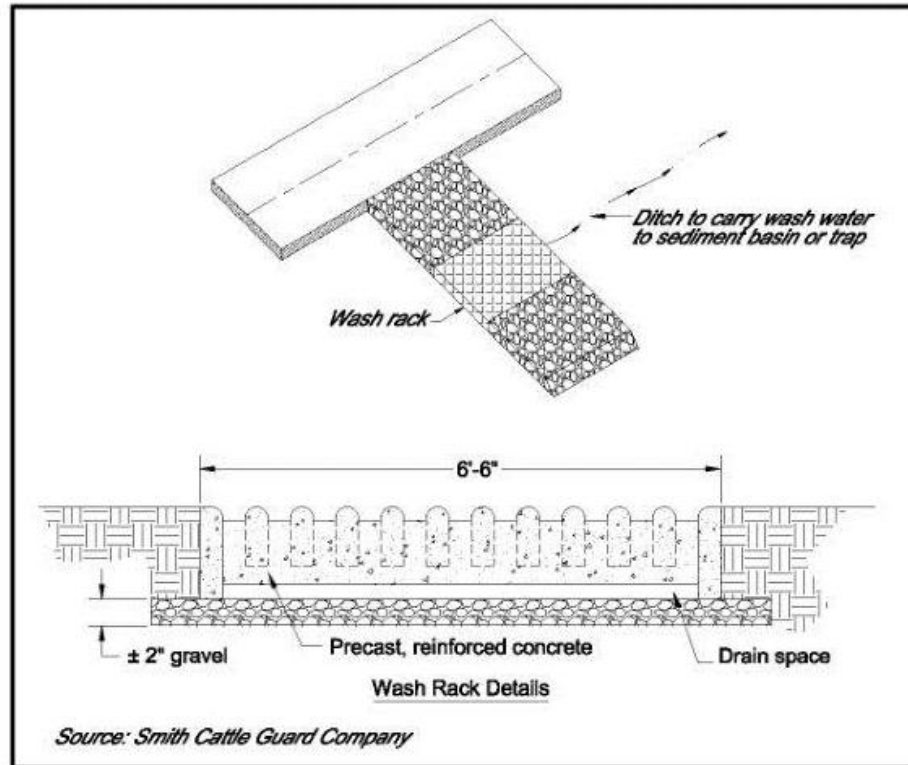


Figure CEP-2 Construction Exit with Wash Rack

Design Criteria

Aggregate size

Aggregate should be Alabama Highway Department coarse aggregate gradation No.1.

Pad Thickness

The exit pad shall have a minimum aggregate thickness of 6”.

Geotextiles

A non-woven geotextile shall be placed underneath the aggregate. The geotextile shall be of the strength and durability required for the project to ensure the aggregate and soil base are stable. Generally, the non-woven geotextile should meet the requirements for a Class 2 geotextile used for separation that is found in the current version of AASHTO M288.

Pad Length

The exit pad should provide for entering and parking the longest anticipated construction vehicles. A pad is typically 50 feet long but the required length may be longer or shorter.

Pad Width

The exit pad width is typically 20 feet but may be narrower or wider to equal the full width of the vehicular egress.

Washing

A washing facility shall be provided if necessary to prevent mud and caked soil from being transported to public streets and highways. It shall be constructed of concrete, stone, and/or other durable materials. Provisions shall be provided for the mud and other material to be carried away from the washing facility to a sediment trap or basin to allow for settlement of the sediment from the runoff before it is released from the site.

B. Land Grading (LG)

Land Grading (LG)



Practice Description

Land grading is reshaping of the ground surface to provide suitable topography for buildings, facilities and other land uses, to control surface runoff, and to minimize soil erosion and sedimentation both during and after construction. This practice applies to sites where the existing topography must be modified to prepare for another land use, or where adapting proposed development to the existing landscape can reduce the erosion potential of the site and the cost of installing erosion and sediment control measures. In some instances, other practices such as diversions or benches can be used to reduce the length of continuous slopes and reduce erosion potential.

Planning Considerations

A detailed plan should be developed by a qualified design professional for all land grading activities at the project site. The plan should show all areas to be disturbed, the areas of cut, areas of fill, and the finished elevation for all graded areas. Areas that will be mowed after the site is developed should have slopes planned that are not too steep for the type of mowing equipment that will be used for regular maintenance.

The grading plan should be designed to protect existing vegetation where possible, especially around natural drainageways. Grading activities should be scheduled to minimize the area disturbed at any one time during the construction process. The plan should include provisions for stabilizing disturbed areas immediately after final grading is completed. Provisions should also be made to protect existing

underground utilities. Finally, topsoil should be removed and stockpiled for use in revegetating the site.

The grading plan should also include necessary practices for controlling sediment and erosion at the site. These practices could include stable outlets and slope breaks such as diversions or benches.

Design Criteria

Site Preparation

A detailed survey of the construction site should be performed by a qualified surveyor prior to grading plan development. This survey should include existing topographic information at the site including existing elevations, existing drainage patterns, locations of existing overhead and underground utilities, and construction limit boundaries.

The grading plan should require that the existing topsoil at sites to be graded be removed as the first step in the grading process. The plan should include a location on the construction site where topsoil will be stockpiled. Stockpiled topsoil should be protected by temporary vegetation (see Temporary Vegetation practice) or other appropriate temporary cover, such as plastic, until it is used to cover disturbed areas in advance of permanent vegetation of the site.

The grading plan should include a schedule of disturbance activities that minimizes the area disturbed at any point in time using sequencing and staging concepts. In areas where clearing of existing vegetation is planned, the area should be cleared and grubbed by removing trees, vegetation, roots and other debris such as trash. In areas to be filled all loose or weak soil and oversized rocks should be removed from the area. The foundation of the area to be filled should consist of soil or rock material of adequate strength to support the proposed fill material and the structures to be built at the site. The exact depth of material to be removed should be determined by a qualified geotechnical professional according to accepted engineering standards.

Grading

A plan for placement of fill should be developed by a qualified geotechnical professional. The plan should specify the source of fill materials, which should be obtained on site if possible. Materials used for fill, when placed according to the plans and specifications, should provide sufficient strength to support structures planned for construction at the location.

Loose fill material should be placed in layers not exceeding 9” in thickness. The materials should be compacted to a moisture content and to a dry density that will produce the design bearing strength required for structures planned at the site. A qualified geotechnical engineer should provide fill placement specifications using standard accepted engineering practices.

Long and/or steep slope lengths can result in rill and gully erosion on slopes. Erosion on these type slopes can be minimized by breaking the slope with

diversions or benches (see Diversion practice). Diversion widths should be compatible with the expected maintenance equipment. Care is needed in locating outlets that will be stable and not cause gully erosion. The following table gives general guidance on the horizontal spacing of slope breaks:

Table LG-1 Guidelines for Spacing Slope Breaks ¹

| Slope (H:V) | Horizontal Spacing (Ft) |
|-----------------|-------------------------|
| 1:1 | 20 |
| 2:1 | 40 |
| 3:1 | 60 |
| 4:1 and 5:1 | 80 |
| 6:1 to 9:1 | 120 |
| 10:1 or flatter | 200 |

¹ Adjustments in spacing may be made to account for soil and site conditions and professional experience of the site designer.

In areas where seepage and ground water are present subsurface drains should be installed to improve slope stability or soil bearing capacity (see Subsurface Drain practice).

Steep slopes should be avoided if possible. Slopes that are to be vegetated should be 2 horizontal to 1 vertical or flatter. If the slope is to be maintained by tractor or other equipment the slope should be 3 horizontal to 1 vertical or flatter. Slopes should be designed to blend with surrounding topography as much as possible.

Erosion Control

The grading plan should include provisions for stabilization of graded areas immediately after final grading is completed. On areas that will have no additional disturbance, permanent vegetation should be applied immediately to the site (see Permanent Seeding practice) if grading is finished during the planting season. If grading is finished outside of the recommended planting dates a temporary cover should be installed using a Temporary Seeding or other appropriate cover and the Permanent Seeding planned for the next planting period. On areas where work is to be interrupted or delayed for 14 calendar days or longer, such as topsoil stockpiles, the area should be stabilized using mulch or temporary seeding (see Mulching or Temporary Seeding practice). Other stabilization measures such as hydraulic mulch or erosion control blankets should be used in extreme conditions, such as steep slopes and channels.

Where practical, runoff from undisturbed off-site areas should be diverted around the construction site to prevent erosion on the disturbed areas (see Diversion practice).

Sediment Control

Required sediment control practices should be installed before the land disturbance activities in the drainage area of the sediment control practices. Until disturbed

areas can be stabilized, appropriate sediment control measures will be maintained to minimize sediment delivery off-site. Measures should include as a minimum:

- Sediment Barriers – Placed along toes of slopes (see Sediment Barrier practice).
- Sediment Basins – Divert sediment laden runoff to basins as needed to minimize off-site sedimentation (see Sediment Basin practice).
- Inlet Protection – Where sediment-laden runoff is diverted to on-site stormwater drain inlets, the inlets should be protected with an appropriate sediment control practice.
- Stabilized Outlets – All runoff from the site should be conveyed in stabilized channels (see Grassed Swale, Lined Swale, Rip-rap Lined Swale, or other appropriate channel stabilization).

C. Permanent Seeding (PS)

Permanent Seeding (PS)



Practice Description

Permanent seeding is the establishment of perennial vegetation on disturbed areas from seed. Permanent vegetation provides economical long-term erosion control and helps prevent sediment from leaving the site. This practice is used when vegetation is desired and appropriate to permanently stabilize the soil.

Planning Considerations

The advantages of seeding over other means of establishing plants include the smaller initial cost, lower labor input, and greater flexibility of method.

Disadvantages of seeding include potential for erosion during the establishment stage, seasonal limitations on suitable seeding dates, and weather-related problems such as droughts.

The probability of successful plant establishment can be maximized through good planning. The selection of plants for permanent vegetation must be site specific. Factors that should be considered are type of soils, climate, establishment rate, and management requirements of the vegetation. Other factors that may be important are wear, mowing tolerance, and salt tolerance of vegetation.

Plant selection for permanent vegetation should be based on plant characteristics, site and soil conditions, time of year of planting, method of planting, and the intended use of the vegetated area. Climate factors can vary widely in Alabama. Important plant attributes are discussed in *Vegetation Establishment for Erosion and Sediment Control* in Chapter 2.

Plant selection may include companion plants to provide quick cover on difficult sites, late seedings, or where the desired permanent cover may be slow to establish. Annuals are usually used for companion plants and should be selected carefully to prevent using a species that provide so much competition that it prevents the establishment of the desired species.

Seeding properly carried out within the optimum dates has a higher probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as plantings are deviated from the optimum dates, the probability of failure increases rapidly. Seeding dates should be taken into account in scheduling land-disturbing activities.

Site quality impacts both short-term and long-term plant success. Sites that have compacted soils, soils that are shallow to rock or have textures that are too clayey or too sandy should be modified whenever practical to improve the potential for plant growth and long-term cover success.

The operation of equipment is restricted on slopes steeper than 3:1, severely limiting the quality of the seedbed that can be prepared. Provisions for establishment of vegetation on steep slopes can be made during final grading. In construction of fill slopes, for example, the last 4-6" might not be compacted. A loose, rough seedbed with irregularities that hold seeds and lime and fertilizer is essential for hydroseeding. Cut slopes should be roughened (see Land Grading practice).

Proper mulching is critical to protect against erosion on steep slopes. When using straw, anchor with netting or asphalt. On slopes steeper than 2:1, jute, excelsior, or synthetic matting may be required.

The use of irrigation (temporary or permanent) will greatly improve the success of vegetation establishment.

Design Criteria

Plant Selection

Select plants that can be expected to meet planting objectives. To simplify plant selection, use Figure PS-1 Geographical Areas for Species Adaptation and Seeding Dates and Table PS-1, Commonly Used Plants for Permanent Cover. Mixtures commonly specified by the Alabama Department of Transportation are an appropriate alternative for plantings on rights-of-ways. Additional information related to plants commonly used in Alabama is found in Chapter 2 under the section Vegetation for Erosion and Sediment Control.

The plants used for temporary vegetation may be used for companion plants provided the seeding rate of the annual species is reduced by one half. See the Temporary Seeding practice for additional information on establishing temporary vegetation. **Ryegrass or other highly competitive plants should not be used as a companion plant with a permanent seeding.**



Figure PS-1 Geographical Areas for Species Adaptation and Seeding Dates

Note: Site conditions related to soils and aspect in counties adjacent to or close to county boundaries may justify adjustments in planting dates by qualified design professionals.

Table PS-1 Commonly Used Plants for Permanent Cover with Seeding Rates and Dates

| Species | Seeding Rates/Ac PLS | North | Central | | South |
|---|-------------------------|----------------|----------------|----------------|-------|
| | | | Seeding Dates | | |
| Bahiagrass, Pensacola | 40 lbs | -- | Mar 1-July 1 | Feb 1-Nov 1 | |
| Bermudagrass, Common | 10 lbs | Apr 1-July 1 | Mar 15-July 15 | Mar 1-July 15 | |
| Bahiagrass, Pensacola Bermudagrass, Common | 30 lbs 5 lbs | -- | Mar 1-July 1 | Mar 1-July 15 | |
| Bermudagrass, Hybrid (Lawn Types) | Solid Sod | Anytime | Anytime | Anytime | |
| Bermudagrass, Hybrid (Lawn Types) | Sprigs 1/sq ft | Mar 1-Aug 1 | Mar 1-Aug 1 | Feb 15-Sep 1 | |
| Fescue, Tall | 40-50 lbs | Sep 1-Nov 1 | Sep 1-Nov 1 | -- | |
| Sericea | 40-60 lbs | Mar 15-July 15 | Mar 1-July 15 | Feb 15-July 15 | |
| Sericea & Common Bermudagrass | 40lbs 10 lbs | Mar 15-July 15 | Mar 1-July 15 | Feb 15-July 15 | |
| Switchgrass, Alamo | 4 Lbs | Apr 1-Jun 15 | Mar 15-Jun 15 | Mar 15-Jun15 | |

PLS means pure live seed and is used to adjust seeding rates. For example, to plant 10 lbs PLS of a species with germination of 80% and purity of 90%, $PLS = 0.8 \times 0.9 = 72\%$. $10 \text{ lbs PLS} = 10 / 0.72 = 13.9 \text{ lbs}$ of the species to be planted.

Seedbed Requirements

Establishment of vegetation should not be attempted on sites that are unsuitable due to compaction or inappropriate soil texture, poor drainage, concentrated overland flow, or steepness of slope until measures have been completed to correct these problems. To maintain a good stand of vegetation, the soil must meet certain minimum requirements as a growth medium. A good growth medium should have these attributes:

- Sufficient pore space to permit root penetration.
- Enough fine-grained soil material (silt and clay) to maintain adequate moisture and nutrient supply.
- Sufficient depth of soil to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 12" or more, except on slopes steeper than 2:1 where topsoiling is not feasible.
- A favorable pH range for plant growth, usually 6.0-6.5.

- Sufficient nutrients (nitrogen, phosphorus and potassium) for initial plant establishment.
- Freedom from large roots, branches, stones, or large clods. Clods and stones may be left on slopes steeper than 3:1 if they are to be hydroseeded.

If any of the above attributes are not met: i.e., if the existing soil is too dense, coarse, shallow or acidic to foster vegetation – chiseling, topsoil, or special amendments should be used to improve soil conditions. The soil conditioners described below may be beneficial or topsoil may be applied (for guidance on topsoiling see Topsoiling practice). These amendments should only be necessary where soils have limitations that make them poor for plant growth or for turf establishment.

- Peat-appropriate types are sphagnum moss peat, reed-sedge peat, or peat humus, all from fresh-water sources. Peat should be shredded and conditioned in storage piles for at least 6 months after excavation.
- Sand-should be clean and free of toxic materials.
- Vermiculite-use horticultural grade.
- Rotted manure-use stable or cattle manure not containing undue amounts of straw or other bedding materials.
- Thoroughly rotted sawdust-should be free of stones and debris. Add 6 lbs of nitrogen to each cubic yard.

Soil Amendments

Liming Materials

Lime (Agricultural limestone) should have a neutralizing value of not less than 90 percent calcium carbonate equivalent and 90 percent will pass through a 10-mesh sieve and 50 percent will pass through a 60-mesh sieve.

Selma chalk should have a neutralizing value of not less than 80 percent calcium carbonate equivalent and 90 percent will pass through a 10-mesh sieve.

Other liming materials that may be selected should be provided in amounts that provide equal value to the criteria listed for agricultural lime or be used in combination with agricultural limestone or Selma chalk to provide equivalent values to agricultural limestone.

Plant Nutrients

Commercial grade fertilizers that comply with current Alabama Fertilizer Laws should be used to supply nutrients required to establish vegetation.

Lime and fertilizer needs should be determined by soil tests. Soil testing is performed by the Auburn University Soil Testing Laboratory and provides recommendations based on field tests on Alabama soils. The local county Cooperative Extension Service can provide information on obtaining soil tests. Commercial laboratories that make recommendations based on soil analysis may be used.

When soil tests are not available, use the following rates for application of soil amendments.

Sandy soils: Use 1 ton/acre (exception on sandy soils – if the cover will be tall fescue and clover) use 2 tons/acre.

Clayey soils: 2 tons/acre.

(Do not apply lime to alkaline soils).

Grasses alone: Use 400 lbs/acre of 8-24-24 or the equivalent. Apply 30 lbs of additional nitrogen when grass has emerged and begun growth (approximately 0.8lbs/1000 ft²).

Grass-legume mixtures: Use 800 to 1200 lbs/acre of 5-10-10 or the equivalent.

Legumes Alone: Use 400 to 600 lbs/acre of 0-20-20 or the equivalent.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Application of Soil Amendments

Apply lime and fertilizer evenly and incorporate into the top 6” of soil by disking, chiseling or other suitable means during seedbed preparation. Operate machinery on the contour. On sites too steep for seedbed preparation, fertilizer and lime can be applied with a hydroseeder.

Seedbed Preparation

If needed, grade and shape to provide a surface on which equipment can safely and efficiently be used for seedbed preparation and seeding.

Install necessary sediment control practices before seedbed preparation and complete grading according to the approved plan.

Prepare a friable seedbed with tillage to a depth of at least 6”. Break up large clods, alleviate compaction, and smooth and firm the soil into a uniform surface. Fill in or level depressions that can collect water.

Planting Methods

Seeding

Use certified seed for permanent seeding whenever possible. Certified seed is inspected by the Alabama Crop Improvement Association to meet high quality standards and will be tagged with a “Certified Seed” tag. (Note: all seed sold in

Alabama is required by law to be tagged to identify seed purity, germination, and presence of weed seeds. Seed must meet state standards for content of noxious weeds.)

Seeding dates are determined using Figure PS-1 and Table PS-1.

Inoculate legume seed with the Rhizobium bacteria appropriate to the species of legume. Details of legume inoculation are located in Chapter 2 in the part on Vegetation for Erosion and Sediment Control under Inoculation of Legumes.

Plant seed uniformly with a cyclone seeder, a drill seeder, a cultipacker seeder, or by hand on a fresh, firm, friable seedbed. If the seedbed has been sealed by rainfall, it should be disked so the seed will be sown into a freshly prepared seedbed.

When using broadcast-seeding methods, subdivide the area into workable sections and determine the amount of seed needed for each section. Apply one-half the seed while moving back and forth across the area, making a uniform pattern; then apply the second half in the same way, but moving at right angles to the first pass.

Cover broadcast seed by raking or chain dragging; then firm the surface with a roller or cultipacker to provide good seed contact. Small grains should be planted no more than 1" deep and grasses and legume seed no more than ½" deep.

Hydroseeding

Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydroseeding operations; large clods, stones, and irregularities provide cavities in which seeds can lodge.

Mix seed, inoculant if required, and a seed carrier with water and apply as a slurry uniformly over the area to be treated. The seed carrier should be a cellulose fiber, natural wood fiber or other approved fiber mulch material which is dyed an appropriate color to facilitate uniform application of seed. Use the correct legume inoculant at 4 times the recommended rate when adding inoculant to a hydroseeder slurry. The mixture should be applied within one hour after mixing to reduce damage to seed.

Fertilizer should not be mixed with the seed-inoculant mixture because fertilizer salts may damage seed and reduce germination and seedling vigor.

Fertilizer may be applied with a hydroseeder as a separate operation after seedlings are established.

Lime is not normally applied with a hydraulic seeder because it is abrasive but if necessary it can be added to the seed slurry and applied at seeding or it may be applied with the fertilizer mixture. Also, lime can be blown onto steeper slopes in dry form.

Sprigging

Hybrid bermudagrass cannot be grown from seed and must be planted vegetatively. Vegetative methods of establishing common and hybrid bermudagrass, centipedegrass and zoysia include sodding, plugging and sprigging (see Sodding practice).

When sprigs are planted with a sprigging machine, furrows should be 4-6" deep and 2 feet apart. Place sprigs no farther than 2 feet apart in the row and so that at least one rooting node is in the furrow.

When broadcasting is used for sprig planting, broadcast sprigs at the specified rate (Table PS-1). Press into the top ½" to 2" of soil with a cultipacker or with a disk set nearly straight so that the sprigs are not brought back to the surface. A mulch tacking machine may be used to press sprigs into the soil.

Mulching

The use of mulch provides instant cover and helps ensure establishment of vegetation under normal conditions and is essential to seeding success under harsh site conditions (see Mulching practice). Harsh site conditions include: slopes steeper than 3:1 and adverse soils (shallow, rocky, or high in clay or sand). Areas with concentrated flow should be treated differently and require sod, a hydromulch formulated for channels or an appropriate erosion control blanket.

Irrigation

Moisture is essential for seed germination and vegetation establishment. Supplemental irrigation can be very helpful in assuring adequate stands in dry seasons or to speed development of full cover. It is a requirement for establishment of vegetation from sod and sprigs and should be used elsewhere when feasible. However, irrigation is rarely critical for low-maintenance vegetation planted at the appropriate time of the year.

Water application rates must be carefully controlled to prevent runoff. Inadequate or excessive amounts of water can be more harmful than no supplemental water.

Maintenance

Generally, a stand of vegetation cannot be determined to be fully established until soil cover has been maintained for 1 full year from planting. Inspect vegetated areas for failure and make necessary repairs and vegetate as soon as possible.

If a stand has inadequate cover, reevaluate choice of plant materials and quantities of lime and fertilizer. Re-establish the stand after seedbed preparation or over-seed the stand. Consider a temporary seeding if the time of year is not appropriate for establishment of permanent vegetation (see Temporary Seeding practice).

If vegetation fails to grow, a soil test should be made to determine if soil acidity or nutrient imbalance is responsible.

To attain complete establishment, fertilization is usually required in the second growing season. Turf grasses require annual maintenance fertilization. Use soil tests if possible or follow the guidelines given for the specific seeding mixtures.

Protect vegetation during its establishing period from traffic that will be harmful. If appropriate, use either temporary fences or barriers to protect areas that may be damaged by excessive traffic.

D. Temporary Seeding (TS)

Temporary Seeding (TS)



Practice Description

Temporary seeding is the establishment of fast-growing annual vegetation from seed on disturbed areas. Temporary vegetation provides economical erosion control for up to a year and reduces the amount of sediment moving off the site.

This practice applies where short-lived vegetation can be established before final grading or in a season not suitable for planting the desired permanent species. It helps prevent costly maintenance operations on other practices such as sediment basins and sediment barriers. In addition, it reduces problems of mud and dust production from bare soil surfaces during construction. Temporary or permanent seeding is necessary to protect earthen structures such as dikes, diversions, grass-lined channels and the banks and dams of sediment basins.

Planning Considerations

Temporary vegetative cover can provide significant short-term erosion and sediment reduction before establishing perennial vegetation.

Temporary vegetation will reduce the amount of maintenance associated with sediment basins.

Temporary vegetation is used to provide cover for no more than 1 year. Permanent vegetation should be established at the proper planting time for permanent vegetative cover.

Certain plants species used for temporary vegetation will produce large quantities of residue which can provide mulch for establishment of the permanent vegetation.

Proper seedbed preparation and selection of appropriate species are important with this practice. Failure to follow establishment guidelines and recommendations carefully may result in an inadequate or short-lived stand of vegetation that will not control erosion.

The selection of plants for temporary vegetation must be site specific. Factors that should be considered are type of soils, climate, establishment rate, and management requirements of the vegetation. Other factors that may be important are wear, mowing tolerance, and salt tolerance of vegetation.

Seeding properly carried out within the optimum dates has a higher probability of success. It is also possible to have satisfactory establishment when seeding outside these dates. However, as plantings are deviated from the optimum dates, the probability of failure increases rapidly. Seeding dates should be taken into account in scheduling land-disturbing activities.

Site quality impacts both short-term and long-term plant success. Sites that have compacted soils should be modified whenever practical to improve the potential for plant growth.

The operation of equipment is restricted on slopes steeper than 3:1, severely limiting the quality of the seedbed that can be prepared. Provisions for establishment of vegetation on steep slopes can be made during final grading. In construction of fill slopes, for example, the last 4-6" might not be compacted. A loose, rough seedbed with irregularities that hold seeds and fertilizer is essential for hydroseeding. Cut slopes should be roughened (see practice Land Grading).

Good mulching practices are critical to protect against erosion on steep slopes. When using straw, anchor with netting or asphalt. On slopes steeper than 2:1, either hydraulic mulch or erosion control blanket is more appropriate than straw to protect the slope.

The use of irrigation (temporary or permanent) will greatly improve the success of vegetation establishment.

Design Criteria

Plant Selection

Select plants that can be expected to meet planting objectives. To simplify plant selection, use Table TS-1, Commonly Used Plants for Temporary Cover and Figure TS-1, Geographical Areas for Species Adaptation and Seeding Dates. Seeding mixtures commonly specified by the Alabama Department of Transportation are an appropriate alternative for plantings on rights-of-ways. Additional information related to plantings in Alabama is found in Chapter 2 in the section Non-Woody Vegetation for Erosion and Sediment Control.



Figure TS-1 Geographical Areas for Species Adaptation and Seeding Dates

Note: Site conditions related to soils and aspect in counties adjacent to or close to county boundaries may justify adjustments in planting dates by qualified design professionals.

Table TS-1 Commonly Used Plants for Temporary Cover

| Species | Seeding Rate/AC PLS | North | Central | | South |
|-----------------------------------|------------------------|--------------|----------------|---------------|-------|
| | | | Seeding Dates | | |
| Millet, Browntop or German | 40 lbs | Apr1-Aug 1 | Apr1- Aug 15 | Apr 1-Aug 15 | |
| Rye | 3 bu | Sep 1-Nov 15 | Sep 15-Nov 15 | Sep 15-Nov 15 | |
| Ryegrass | 30 lbs | Aug 1-Sep 15 | Sep 1-Oct 15 | Sep 1-Oct 15 | |
| Sorghum-Sudan Hybrids | 40 lbs | May 1-Aug 1 | Apr 15-Aug 1 | Apr 1-Aug 15 | |
| Sudangrass | 40 lbs | May 1-Aug 1 | Apr 15-Aug 1 | Apr 1-Aug 15 | |
| Wheat | 3 bu | Sep 1-Nov 1 | Sep 15-Nov 15 | Sep 15-Nov 15 | |
| Common Bermudagrass | 10 lbs | Apr 1-July 1 | Mar 15-July 15 | Mar 1-July 15 | |
| Crimson Clover | 10lbs | Sept 1-Nov 1 | Sept 1-Nov 1 | Sept 1-Nov 1 | |

PLS means pure live seed and is used to adjust seeding rates. For example, to plant 10 lbs PLS of a species with germination of 80% and purity of 90%, $PLS = 0.8 \times 0.9 = 72\%$. 10 lbs PLS = $10/0.72 = 13.9$ lbs of the species to be planted.

Site Preparation and Soil Amendments

Complete grading and shaping before applying soil amendments if needed to provide a surface on which equipment can safely and efficiently be used to apply soil amendments and accomplish seedbed preparation and seeding.

Lime

Apply lime according to soil test recommendations. If a soil test is not available, use 1 ton of agricultural limestone or equivalent per acre on coarse textured soils and 2 tons per acre on fine textured soils. Do not apply lime to alkaline soils or to areas which have been limed during the preceding 2 years. Other liming materials that may be selected should be provided in amounts that provide equal value to the criteria listed for agricultural lime or be used in combination with agricultural limestone or Selma chalk to provide equivalent values to agricultural limestone.

Fertilizer

Apply fertilizer according to soil test results. If a soil test is not available, apply 8-24-24 fertilizer.

When vegetation has emerged to a stand and is growing, 30 to 40 lbs/acre (approximately 0.8 lbs/1000 ft²) of additional nitrogen fertilizer should be applied.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Application of Soil Amendments

Incorporate lime and fertilizer into the top 6" of soil during seedbed preparation.

Seedbed Preparation

Good seedbed preparation is essential to successful plant establishment. A good seedbed is well pulverized, loose, and smooth. If soils become compacted during grading, loosen them to a depth of 6" to 8" using a ripper or chisel plow.

If rainfall has caused the surface to become sealed or crusted, loosen it just prior to seeding by disking, raking, harrowing, or other suitable methods. When hydroseeding methods are used, the surface should be left with a more irregular surface of clods.

Planting Methods

Seeding

Evenly apply seed using a cyclone seeder (broadcast), drill seeder, cultipacker seeder, or hydroseeder. Broadcast seeding and hydroseeding are appropriate for steep slopes where equipment cannot operate safely. Small grains should be planted no more than 1" deep, and grasses and legumes no more than ½" deep. Seed that are broadcast must be covered by raking or chain dragging, and then lightly firmed with a roller or cultipacker.

Hydroseeding

Surface roughening is particularly important when hydroseeding, as a roughened slope will provide some natural coverage for lime, fertilizer, and seed. The surface should not be compacted or smooth. Fine seedbed preparation is not necessary for hydroseeding operations; large clods, stones, and irregularities provide cavities in which seeds can lodge.

Mix seed, inoculant if required, and a seed carrier with water and apply as slurry uniformly over the area to be treated. The seed carrier should be a cellulose fiber, natural wood fiber or other approved fiber mulch material which is dyed an appropriate color to facilitate uniform application of seed. Use the correct legume inoculant at 4 times the recommended rate when adding inoculant to hydroseeder slurry. The mixture should be applied within one hour after mixing to reduce damage to seed.

Fertilizer should not be mixed with the seed-inoculant mixture because fertilizer salts may damage seed and reduce germination and seedling vigor. Fertilizer may be applied with a hydro seeder as a separate operation after seedlings are established.

Mulching

The use of appropriate mulch provides instant cover and helps ensure establishment of vegetative cover under normal conditions and is essential to seeding success

under harsh site conditions (see the Mulching practice for guidance). Harsh site conditions include the following: slopes steeper than 3:1 and adverse soils (soils that are shallow to rock, rocky, or high in clay or sand). Areas with concentrated flow should be treated differently and require a practice appropriate for channel flow. (refer to Chapter 5 Runoff Conveyance for guidance).

E. Preservation of Vegetation (PV)

Preservation of Vegetation (PV)



Practice Description

Preservation of vegetation is the avoidance of an area during land disturbing and construction activity to prevent mechanical and other injury to desirable plants in the planned landscape. The practice provides erosion and sediment control and is applicable where vegetative cover is desired and the existing plant community is compatible with the planned landscape.

Planning Considerations

Preservation of vegetation requires good site management to minimize the impact of construction activities on existing vegetation.

Plants to save should be identified prior to any construction activity.

Proper maintenance, especially during construction, is important to ensure healthy vegetation that can control erosion.

Different species, soil types, and climatic conditions will require different maintenance activities.

Design Criteria

Mark Plant Area for Retention

Groups of plants and individual trees to be retained should be located on a plan map. Limits of clearing should be planned outside the drip line of groups or individual trees to be saved. The clearing should never be closer than 5 feet to the trunk of a tree.

Flagging or other appropriate means of marking the site of the groups of plants and individual trees to be retained should be required before construction begins. Individual trees to be retained should be marked with a highly visible paint or surveyor's ribbon in a band circling the tree at a height visible to equipment operators.

Plant Protection

Restrict construction equipment, vehicular traffic, stockpiles of construction materials, topsoil etc., from the areas where plants are retained and restrict these activities from occurring within the drip line of any tree to be retained. Trees being removed shall not be pushed into trees to be retained. Equipment operators shall not clean any of their equipment by slamming it against trees to be retained.

Restrict burning of debris within 100 feet of the plants being preserved. Fires shall be limited in size to prevent damage to any nearby trees.

Toxic material shall not be stored any closer than 100 feet to the drip line of any trees to be retained. Toxic materials shall be managed and disposed of according to state laws.

Fencing and Armoring

Groups of plants and trees should be protected by fencing or armoring where necessary (See Figure PV-1). The following types of fencing or armoring may be used:

- Board Fence-Board fence may be constructed with 4" square posts set securely in the ground and protruding at least 4 feet above the ground. A minimum of 2 horizontal boards should be placed between the posts. The fence should be placed at the limits of the clearing around the drip line of the tree. If it is not practical to erect a fence at the drip line, construct a triangular fence near the trunk. The limits of clearing will still be the drip line as the root zone within the drip line will still require protection.
- Cord Fence-Posts at least 2" square or 2" in diameter set securely in the ground and protruding at least 4 feet above the ground shall be placed at the limits of clearing with 2 rows of cord ¼" or thicker at least 2 feet apart running between posts with strips of surveyor's tape tied securely to the string at intervals of 3 feet or less.
- Earth Berms-Temporary earth berms may be constructed. The base of the berm on the tree side should be located along the limits of clearing. Earth berms may not be used for this purpose if their presence will create drainage patterns that cause erosion.
- Additional Trees-Additional trees may be left standing as protection between the trees to be retained and the limits of clearing. However, for this alternative to be used, trees in the buffer must be no more than 6 feet apart to prevent passage of equipment and material through the buffer.

- Plan for these additional trees to be evaluated prior to the completion of construction and either given sufficient treatment to ensure survival or be removed.
- Trunk Armoring-As a last resort, a tree may be armored with burlap wrapping and 2" studs wired vertically no more than 2" apart to a height of 5 feet. The armoring should encircle the tree trunk. Nothing should ever be nailed to a tree. The root zone within the drip line will still require protection.
- Fencing and armoring devices should be in place before any construction work is done and should be kept in good condition for the duration of construction activities. Fencing and armoring should not be removed until the completion of the construction project.

Raising the Grade

When the ground level must be raised around an existing tree or group of trees several methods may be used to insure survival.

A well may be created around a group of trees or an individual tree slightly beyond the drip line to retain the natural soil around the feeder roots (see Figure PV-2). When the well alternative is not practical or desirable, remove vegetation and organic matter from beneath the tree or trees for 3 feet beyond the drip line and loosen the surface soil to a depth of approximately 3" without damaging the roots.

Apply fertilizer in the root area of the tree to be retained. A soil test is the best way to determine what type of fertilizer to use. In the absence of a soil test, fertilizer should be applied at the rate of 1 to 2 pounds of 10-8-6 or 10-6-4 per inch of diameter at breast height (dbh) for trees under 6" dbh and at the rate of 2 to 4 pounds of 10-8-6 or 10-6-4 per inch of dbh for trees over 6" dbh.

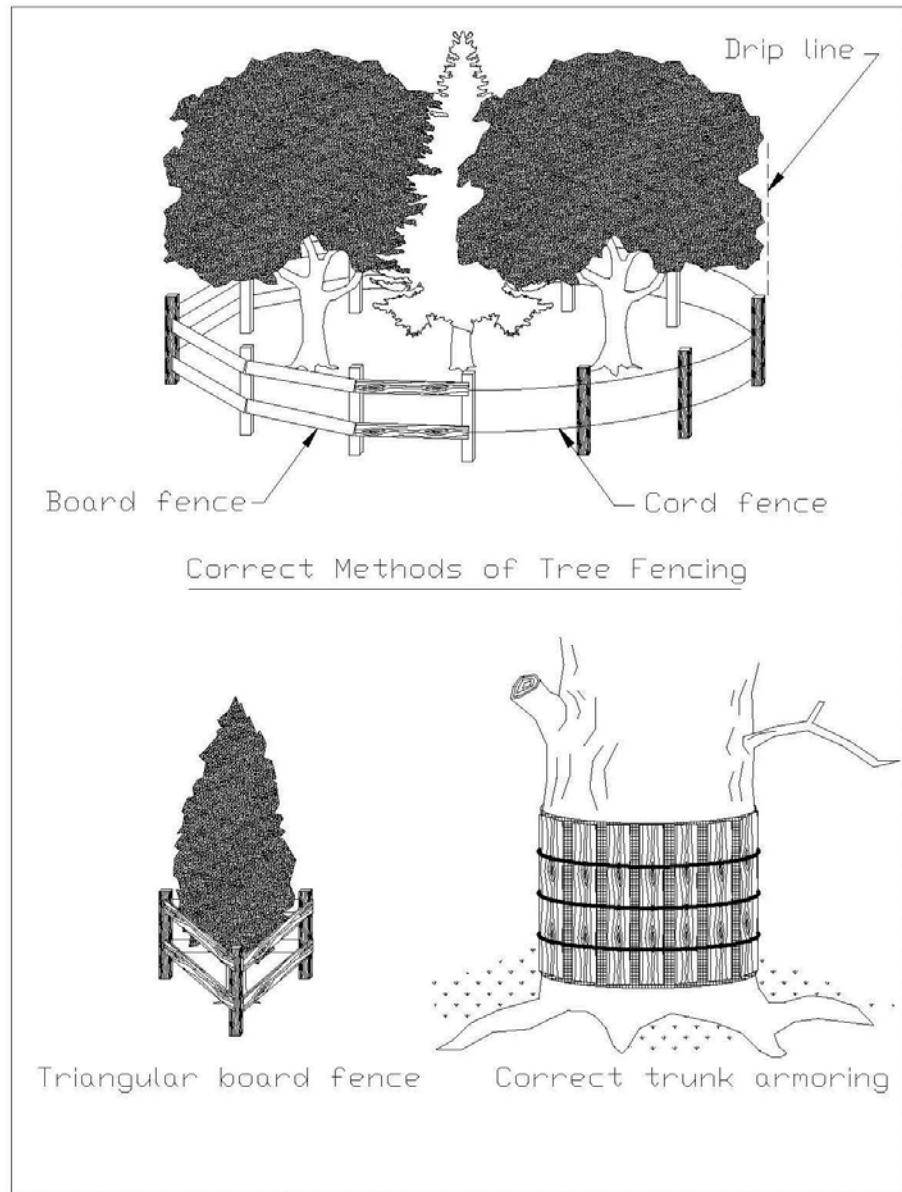


Figure PV-1 Fencing and Armoring

A dry well shall be constructed to allow for tree trunk diameter growth (see Figure PV-3). A space of at least 1 foot between the tree trunk and the well wall is adequate for old, slow growing trees. Clearance for younger trees shall be at least 2 feet. The well shall be high enough to bring the top just above the level of the proposed fill. The well wall shall taper slightly away from the tree trunk at a rate of 1" per foot of wall height.

The well wall shall be constructed of large stones, brick, building tile, concrete blocks, or cinder blocks. Openings should be left through the wall of the well to allow for free movement of air and water. Mortar shall only be used near the top of the well and only above the porous fill.

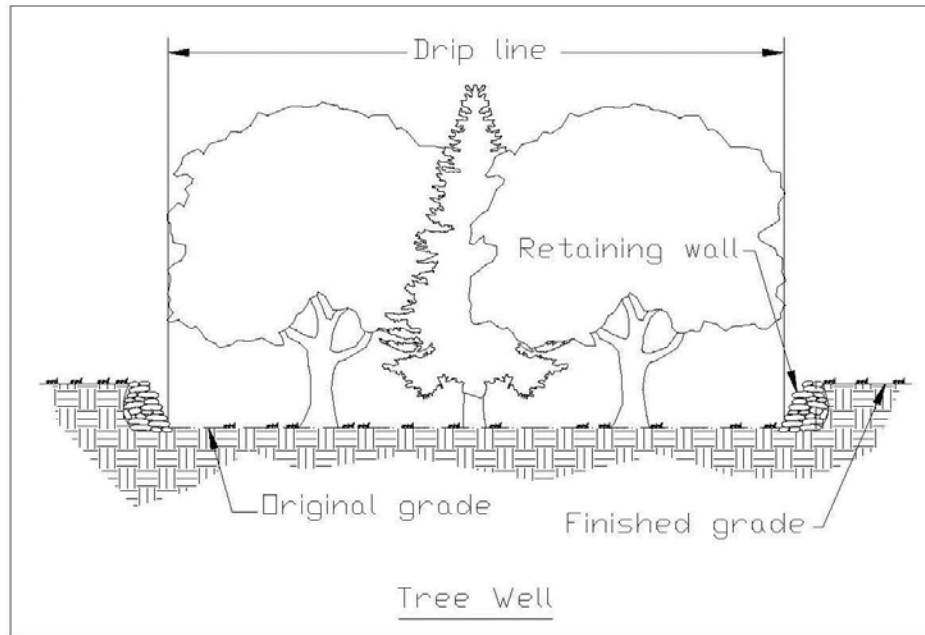


Figure PV-2 Tree Well

Drain lines composed of 4" high quality drain tiles shall begin at the lowest point inside the well and extend outward from the tree trunk in a wheel and spoke pattern with the trunk as the hub. Radial drain lines shall slope away from the well at a rate of $\frac{1}{8}$ " per foot. The circumference line of tiles should be located beneath the drip line of the trees. Vertical tiles or pipes shall be placed over the intersections of the two tile systems if a fill of more than 2 feet is contemplated. Vertical tiles shall be held in place with stone fill. Tile joints shall be tight. A few radial tiles shall extend beyond each intersection and shall slope sharply downward to insure good drainage. Tar paper or its approved equivalent shall be placed over the tile and/or pipe joints to prevent clogging and large stone shall be placed around and over drain tiles and/or pipes for protection.

A layer of 2" to 6" of stone shall be placed over the entire area under the tree from the well outward at least as far as the drip line. For fills up to 2 feet deep, a layer of stone 8" to 12" thick should be adequate.

A thick layer of this stone not to exceed 30" will be needed for deeper fills. A layer of $\frac{3}{4}$ " to 1" stone covered by straw, fiberglass mat or a manufactured filter fabric shall be used to prevent soil from clogging the space between stones. Cinders shall not be used as fill material. Filling shall be completed with porous soil such as topsoil until the desired grade is reached. This soil shall be suitable to sustain specified vegetation.

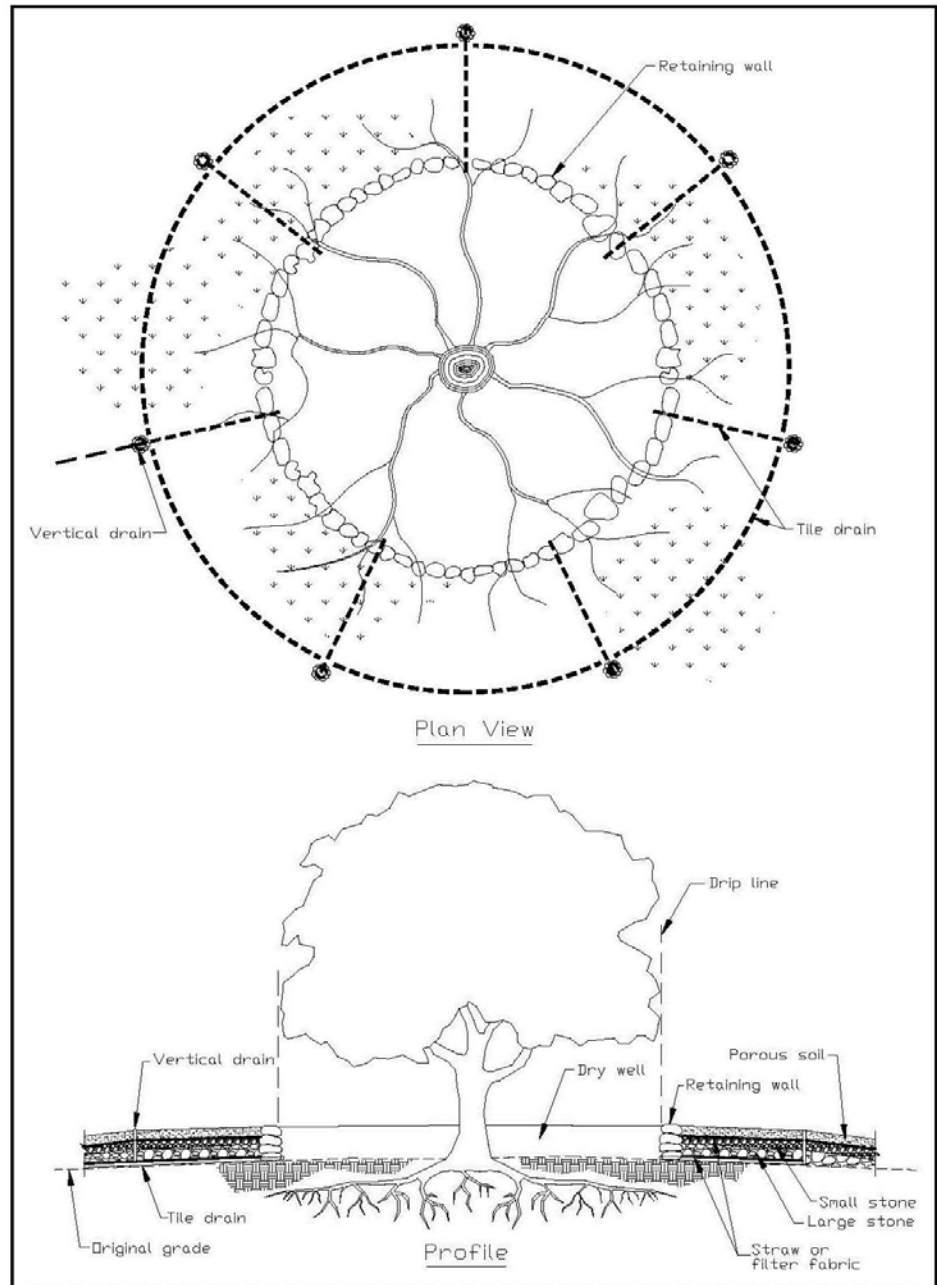


Figure PV-3 Tree Well Detail

Crushed stone shall be placed inside the dry well over the openings of the radial tiles to prevent clogging. The area between the trunk and the well wall shall either be covered by an iron grate or filled with a 50-50 mixture of crushed charcoal and sand to prevent anyone from falling into the dry well.

Where water drainage through the soil is not a problem, coarse gravel in the fill may be substituted for the tile. This material has sufficient porosity to ensure air drainage. Instead of the vertical tiles or pipes in the system, stones, crushed rock and gravel may be added so that the upper level of these porous materials slants toward the surface in the vicinity below the drip line.

Raising the grade on only one side of a tree or group of trees may be accomplished by constructing only half of one of these systems.

Lowering the Grade

Shrubs and trees shall be protected from the harmful grade cuts by the construction of a tree wall (see Figure PV-4). Following excavation, all tree roots that are exposed and/or damaged shall be trimmed cleanly and covered with moist peat moss, burlap or other suitable material to keep them from drying out.

The wall shall be constructed of large stones, brick, building tile, concrete block or cinder block. The wall should be backfilled with topsoil, peat moss, or other organic matter to retain moisture and aid in root development. Apply fertilizer and water thoroughly. The tree plants should be pruned to reduce the leaf surface in proportion to the amount of root loss. Drainage should be provided through the wall so water will not accumulate behind the wall. Lowering the grade on one side of the tree or group of trees can be accomplished by constructing only half of this system.

Trenching and Tunneling

Trenching should be done as far away from the trunks of trees as possible, preferably outside the branches or crown spreads of trees, to reduce the amount of root area damaged or killed by trenching activities. When possible, trenches should avoid large roots or root concentrations. This can be accomplished by curving the trench or by tunneling under large roots and areas of heavy root concentration. Tunneling under a species that does not have a large tap root may be preferable to trenching beside it as it has less impact on root systems (see Figure PV-5).

Roots should not be left exposed to the air but should be covered with soil as soon as possible or protected and kept moist with burlap or peat moss until the trench or tunnel can be filled. The ends of damaged and cut roots shall be cut off smoothly and moist peat moss, burlap or topsoil should be placed over the exposed area.

Trenches and tunnels shall be filled as soon as possible. Care should be taken to ensure that air spaces are not left in the soil. Peat moss or other organic matter shall be added to the fill material as an aid to inducing and developing root growth. The tree should be fertilized and mulched to stimulate new root growth and enhance general tree vigor. If a large part of the root system has been damaged the crown leaf surface area should be reduced in proportion to the root damage. This may be accomplished by pruning 20-30 percent of the crown foliage. If the roots are damaged during the winter the crown should be pruned before the next growing season. If roots are cut during the growing season, pruning should be done immediately.

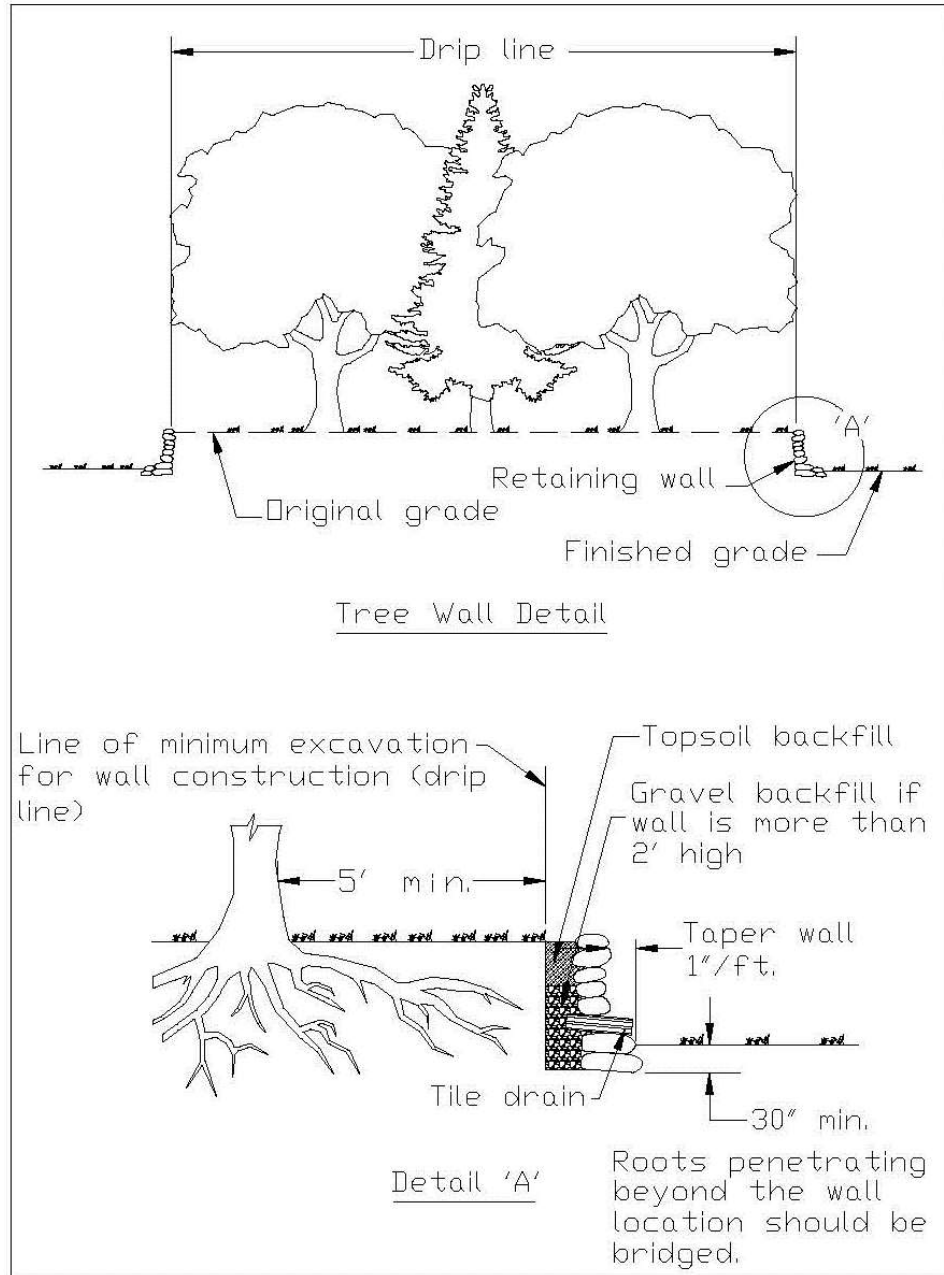


Figure PV-4 Tree Wall Detail

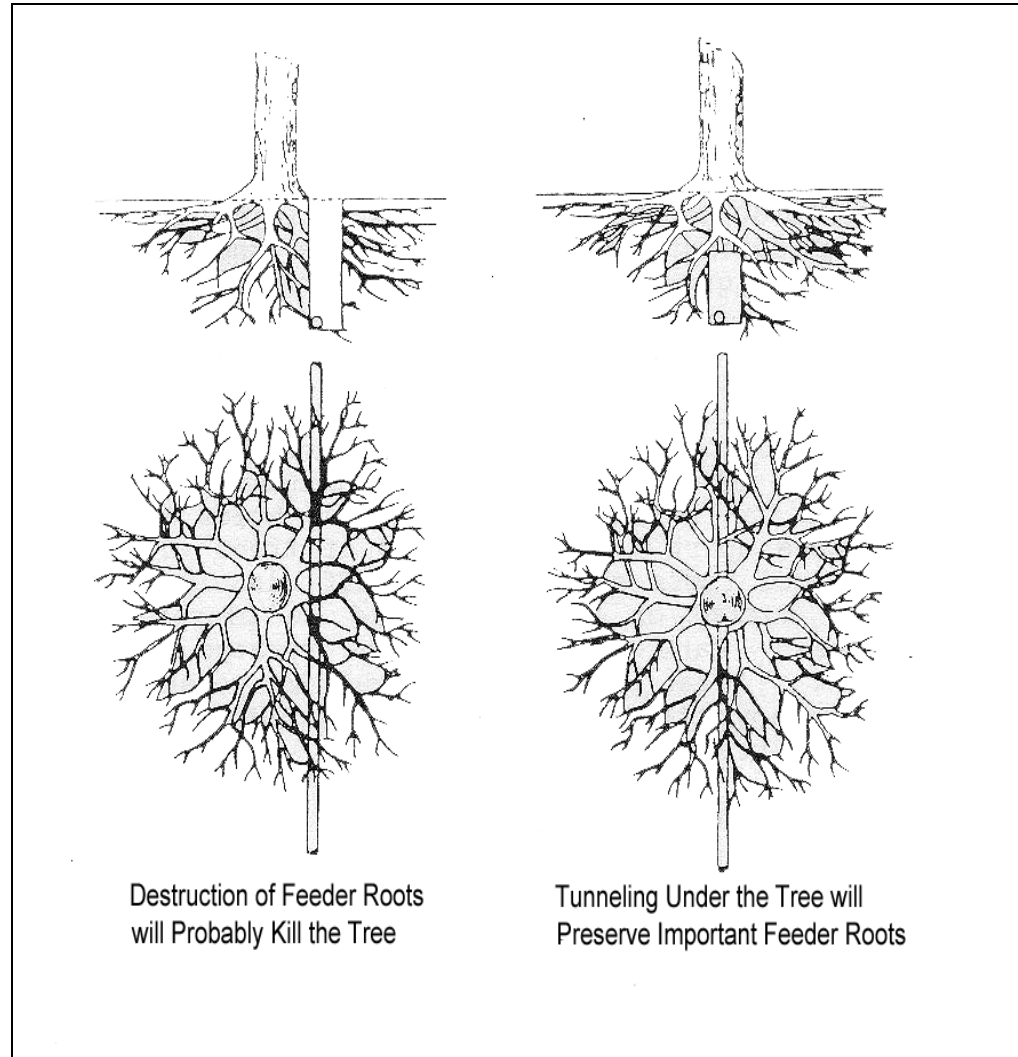


Figure PV-5 Trenching vs Tunneling

Treating Damaged Trees

When trees are damaged during construction activities certain maintenance practices can be applied to protect the health of the tree.

Soil aeration may be needed if the soil has been compacted. The soil around trees can be aerated by punching holes 1 foot deep and 18" apart under the crown of trees with an iron pipe.

Damaged roots should be cut off cleanly and moist peat moss, burlap or topsoil should be placed over the exposed area. Bark damage should be treated by removing loose bark.

Tree limbs damaged during construction or removed for any other reason shall be cut off above the collar at the branch junction.

Trees that have been stressed or damaged should be fertilized to aid their recovery.

Trees should be fertilized in the spring or fall. Fall applications are preferred.

Fertilizer should be applied to the soil over the feeder roots. In no case should it be applied closer than 3 feet to the trunk. Root systems of trees extend some distance beyond the drip line. The area to be fertilized should be increased by $\frac{1}{4}$ the area of the crown. A soil test is the best way to determine what type of fertilizer to use. In the absence of a soil test, fertilizer should be applied at the rate of 1 to 2 pounds of 10-8-6 or 10-6-4 per inch of dbh for trees under 6" dbh and at the rate of 2 to 4 pounds of 10-8-6 or 10-6-4 per inch of dbh for trees over 6" dbh.

A ground cover or organic mulch layer should be maintained around trees to prevent erosion, protect roots and to conserve water.

F. Check Dam (CD)

Check Dam (CD)



Practice Description

A check dam (also referred to as a “ditch check”) is a small barrier or dam constructed across a swale, drainage ditch or other area of concentrated flow for the purpose of reducing channel erosion. Channel erosion is reduced because check dams flatten the gradient of the flow channel and slow the velocity of channel flow. Check dams do not reduce turbidity of runoff. Check dams can be constructed of rock, wattles (sometimes referred to as tubes or rolls), sand bags, or other materials that may be acceptable to the design professional. Unless installed correctly, check dams will not capture a significant amount of sediment. When installed correctly, most check dams can capture the coarser grained material, which can be significant for sandy soils. Sediment capture increases as velocity in the channel decreases by creating impoundments with the check dams. This impoundment pool creates the flattening of the gradient, greatly reducing channel erosion.

This practice applies in small open channels and drainageways, including temporary and permanent swales. Check dams are not to be used in a live stream. Situations of use include areas in need of protection during establishment of grass and areas that cannot receive a temporary or permanent non-erodible lining for an extended period.

Planning Considerations

Check dams are used in concentrated flow areas to provide temporary channel stabilization with minimal sediment retention during rainfall runoff periods on construction sites. Check dams may be constructed of rock, wattles, sand bags, or other suitable material, including manufactured products. Water flowing over a check dam creates turbulent erosive forces (super critical flow) that must be addressed to prevent erosion downstream of the check dam. Inevitably water will likely flow under check dams due to limitation with ground contact. Therefore, it is of utmost importance to ensure the performance of the check dam that erosion and scour under the check dam be minimized. This is best achieved using an underlay such as an 8-oz. nonwoven filter fabric. If the underlay is extended downstream, it will also protect the channel from super critical flows from water flowing over and under the dam.

Check dams should be planned to be compatible with the other features such as streets, walkways, trails, sediment basins and rights-of-way or property lines. Check dams are installed with the center overflow area lower in elevation than the ends to ensure flow goes over the check dam and not around. Check dams are normally constructed in series and the dams should be located at a normal interval from other grade controls such as culverts or sediment basins.

Check dams are generally used as a temporary BMP that is removed following construction to allow for final long-term stabilization of the channel. Provisions should be made to establish permanent channel linings as early as possible.

Check dams can also be used for other purposes such as the capture of sediment upstream of other practices or flocculent dosing upstream of a sediment basin.

Extensive research has been conducted by The Auburn University Erosion and Sediment Control Test Facility. The research recommendations are incorporated in the following planning considerations:

Rock Check Dams

Many check dams are constructed of rock. Rock may not be acceptable in some installations and alternative types of check dams need to be considered. Rock check dams (Figures CD-1 and CD-2) are usually installed with mechanical equipment but hand labor is likely needed to complete most installations to the quality needed. The availability and cost of commercially produced rock should be considered. The use of rock should be considered carefully in areas to be mowed. Some rock may be washed downstream and should be removed before each mowing operation. The use of geotextile can be used on the upstream face of the rock check dam to increase the sediment trapping efficiency of the rock check dam. Measures must be taken to prevent undermining of the check dam and erosion below the check dam. A non-woven geotextile underlayment should be used to prevent this from happening. The geotextile meeting AASHTO M 288 requirement for separation Class II (minimum 8-oz. fabric) should extend approximately 3 ft. upstream and downstream, and pinned securely with the upstream edge buried.

Measures to prevent downstream erosion associated with a rock check dam include placing larger rock on the downstream face of a rock dam, and providing erosion protection material just downstream of the dam.

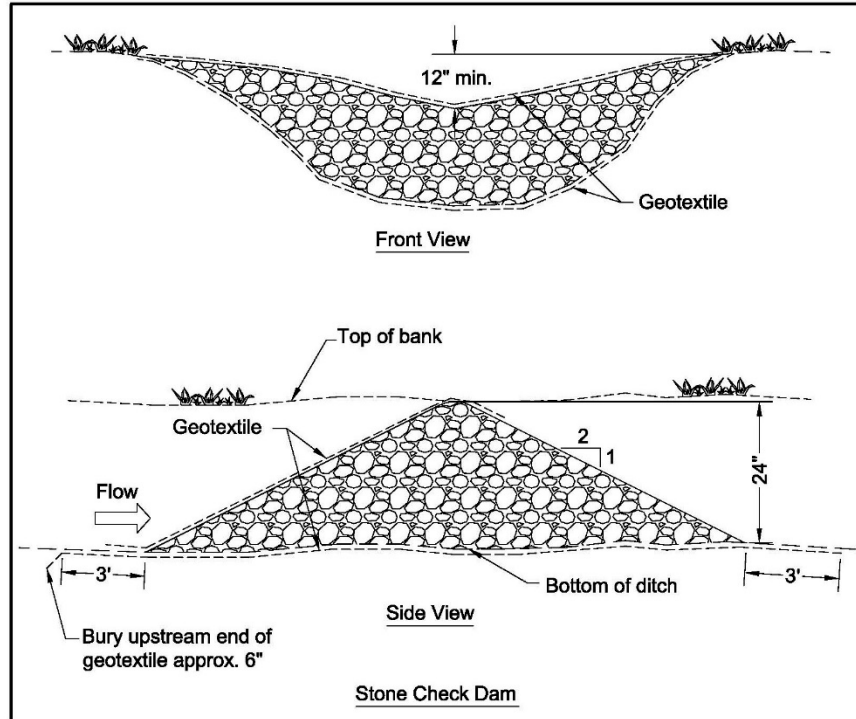


Figure CD-1 Profile and Cross-Section of Typical Rock Check Dams

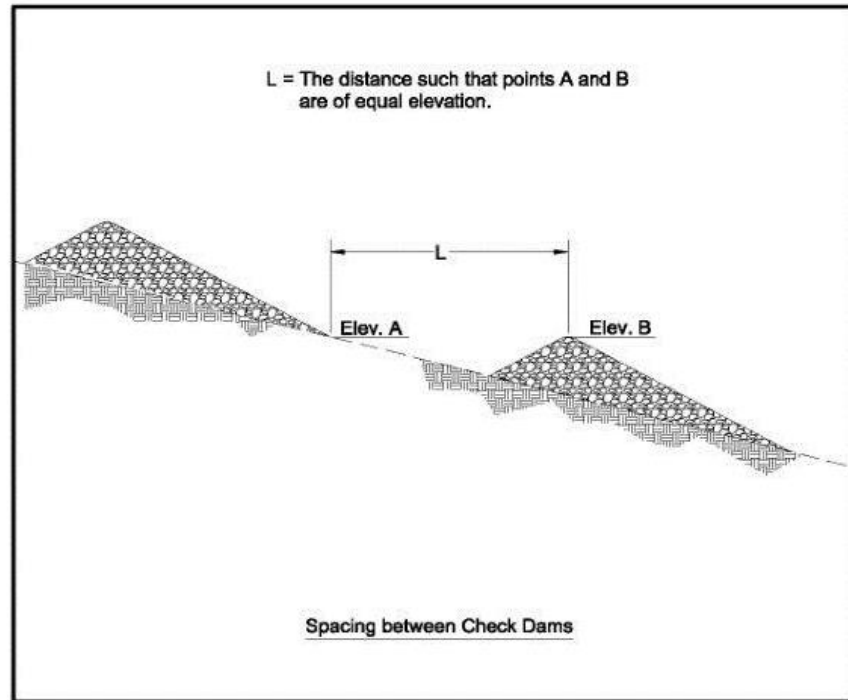


Figure CD-2 Profile of Typical Rock Check Dams

Wattle Check Dams

Wattles have been found to be best installed without trenching and on top of stapled geotextile underlayment that extends a minimum 3 ft. up and downstream from the wattle. Wattles must be properly stapled with sod staples on 10-inch centers on each side of the wattle to prevent flotation, and staked over the top using non-destructive tee-pee type staking. Wattles that provide less “flow through” create more ponding of water that increases the trapping of sediment (see Figures CD-3 and CD-4).

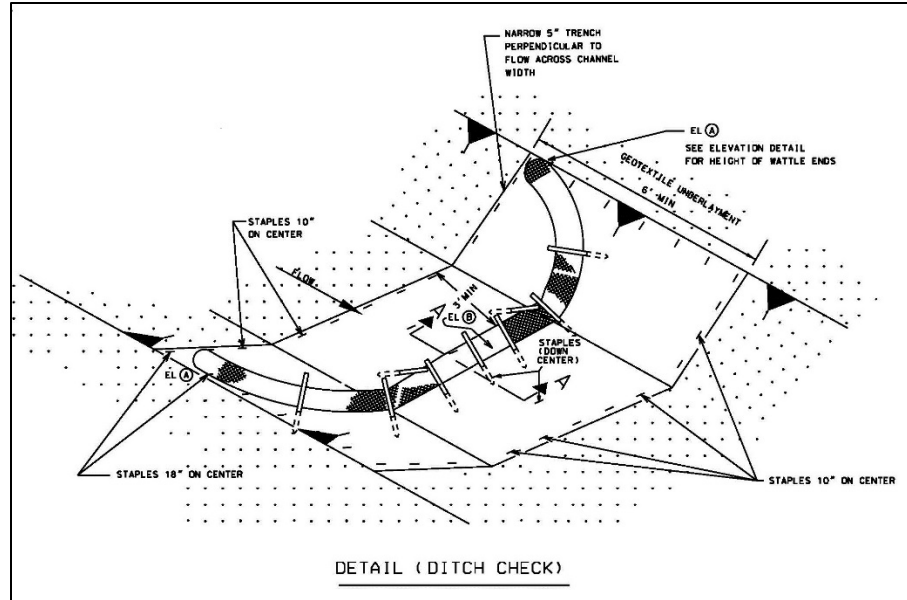


Figure CD-3 Wattle Check Dam (ditch check)



Figure CD-4 Wattle Check Dam (ditch check)
 (Photo courtesy of Auburn University Erosion and Sediment Control Test Facility)

Silt Fence Check Dam

When properly designed and installed, typical silt fence materials can be utilized to construct a check dam. Geotextile underlayment should be used and the fence notched as needed to ensure the maximum depth of flow is no greater than the depth of the channel. Figures CD-5 and CD-6 show the recommended details.

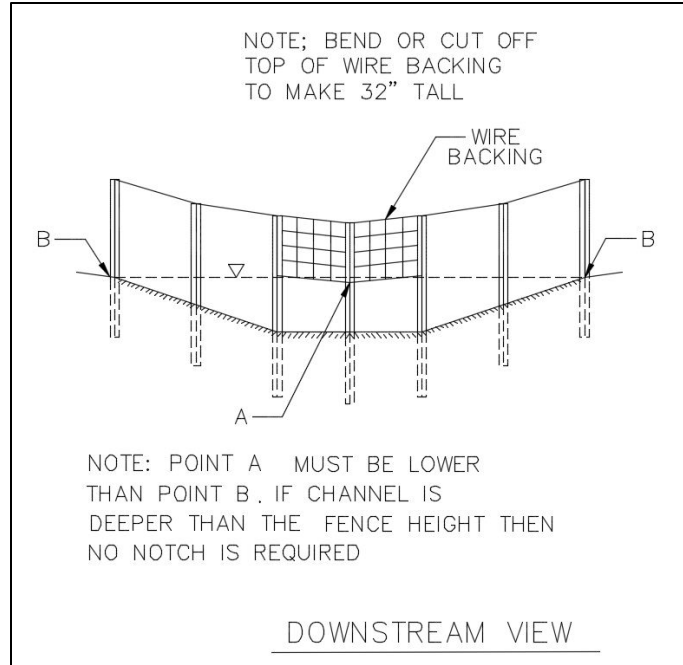


Figure CD-5 Silt Fence Check Dam Cross-Section

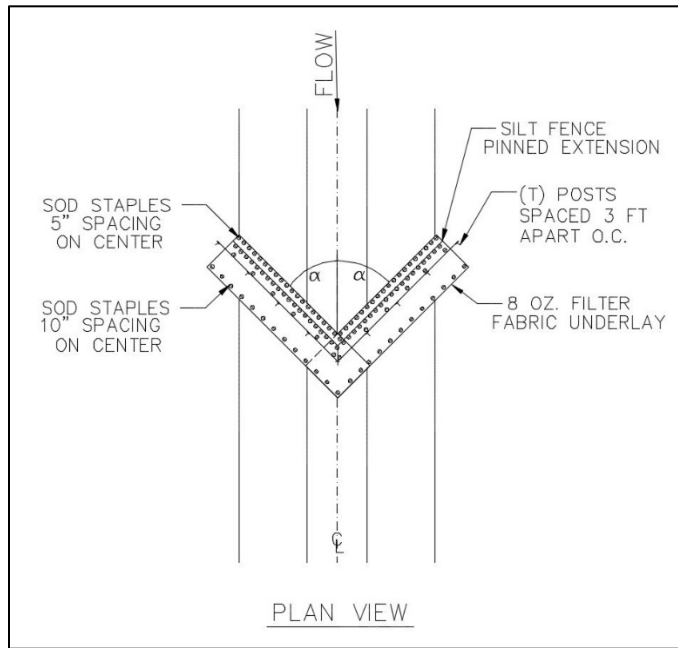


Figure CD-6 Silt Fence Check Dam Plan View



Figure CD-7 Silt Fence Check Dam
(Photo courtesy of Auburn University Erosion and Sediment Control Test Facility)

Sand Bag Check Dam

Sand bags have also been proven to be effective as check dams but only when the bags are properly oriented (See Figures CD-8 and CD-9). A geotextile underlayment that extends approximately 3 ft. upstream and downstream should also be used in earth channel situations to prevent undermining and scour.

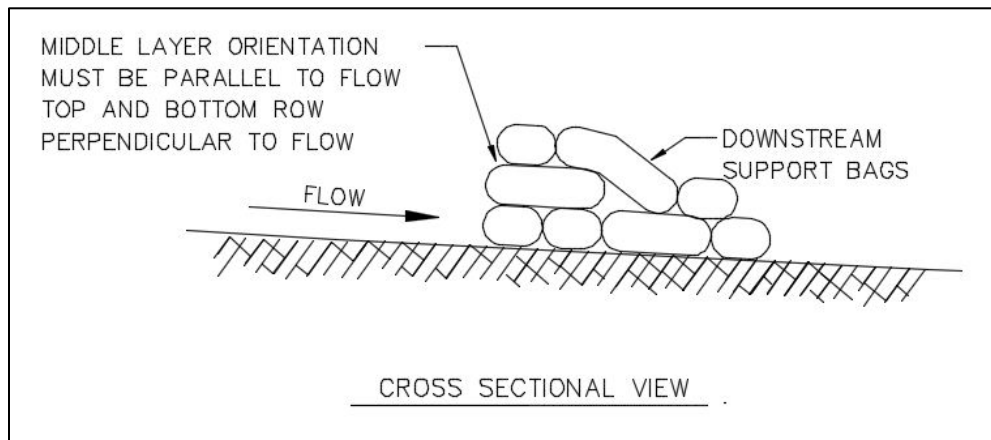


Figure CD-8 Sand Bag Check Dam Cross-Section

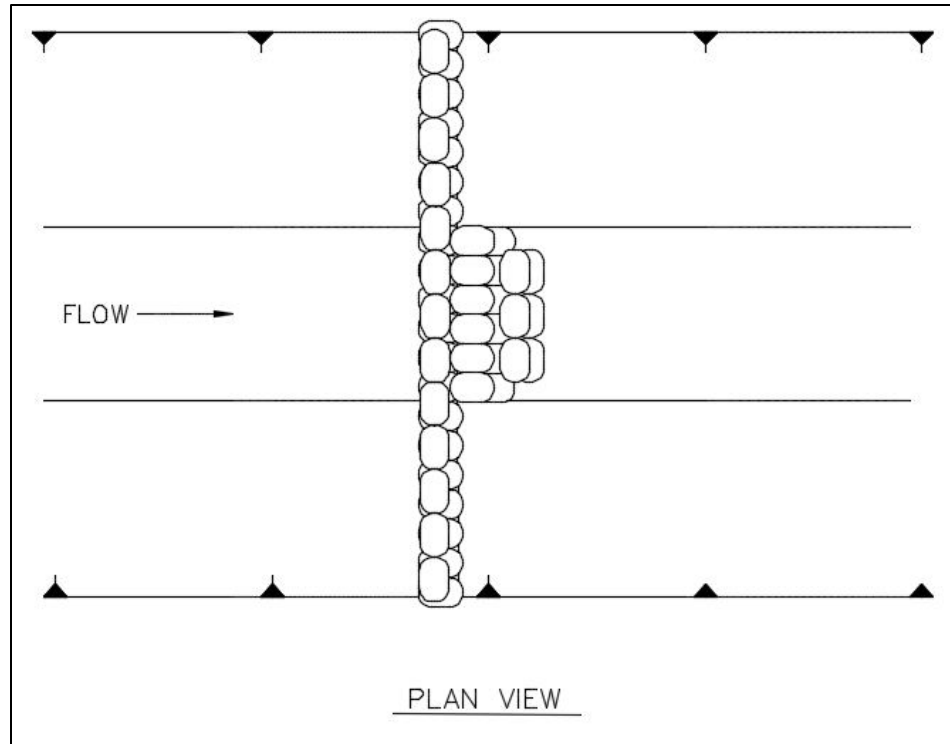


Figure CD-9 Sand Bag Check Dam Plan View

Design Criteria

Formal design is not required. The following factors should be considered when designing check dams.

Drainage Area

Generally, one acre or less.

Maximum Height

Check dam height is a function of channel geometry. Most check dams are 3 feet or less in height.

Depth of Flow

Depth of flow over a check dam is a function of the cross-section and porosity of the check dam. Generally, flows over a check dam are less than 1 foot.

The center of the dam should be constructed lower than the ends. The elevation of the center of the dam should be lower than the ends by the depth of design flow.

Side Slopes

2:1 or flatter (rock check dam).

Spacing

The elevation of the toe of the upstream dam should be at or below the elevation of crest of the downstream dam (Figure CD-2).

For example, if the channel is 3% grade, and the check dam height is 2 feet, The check dam spacing should be 67 feet:

$$\text{Spacing (ft)} = \text{dam height (ft)} / \text{channel grade}$$

$$\text{Spacing} = 2 \text{ ft} / 0.03 = 67 \text{ feet}$$

Geotextile

Generally, the non-woven geotextile should meet the requirements found in AASHTO M 288 Class II used for separation.

G. Diversion (DV)

Diversion (DV)



Practice Description

A diversion is a watercourse constructed across a slope consisting of an excavated channel, a compacted ridge or a combination of both. Most diversions are constructed by excavating a channel and using the excavated material to construct a ridge on the downslope side of the channel. Right-of-way diversions and temporary diversions are sometimes constructed by making a ridge, often called a berm, from fill material.

This practice applies to sites where stormwater runoff can be redirected to permanently protect structures or areas downslope from erosion, sediment, and excessive wetness or localized flooding. Diversions may be used to temporarily divert stormwater runoff to protect disturbed areas and slopes or to retain sediment on-site during construction.

Perimeter protection is sometimes used to describe both permanent and temporary diversions used at either the upslope or downslope side of a construction area.

Right-of-way diversions, sometimes referred to as water bars, are used to shorten the flow length on a sloping right-of-way and reduce the erosion potential of the stormwater runoff.

Planning Considerations

Diversions are designed to intercept and carry excess water to a stable outlet.

Diversions can be useful tools for managing surface water flows and preventing soil erosion. On moderately sloping areas, they may be placed at intervals to trap and divert sheet flow before it has a chance to concentrate and cause rill and gully erosion.

Diversions may be placed at the top of cut or fill slopes to keep runoff from upgradient drainage areas off the slope. The following picture illustrates the placement of a diversion near the top of the slope. Diversions are sometimes built at the base of steeper slopes to protect flatter developed areas which cannot withstand runoff water from outside areas. Also, they can be used to protect structures, parking lots, adjacent properties, and other special areas from flooding.



Figure DV-1 Diversion near the top of a slope

Diversions are preferable to other types of man-made stormwater conveyance systems because they more closely simulate natural flow patterns and characteristics. Flow velocities are generally kept to a minimum. When properly coordinated into the landscape design of a site, diversions can be visually pleasing as well as functional.

As with any earthen structure, it is very important to establish adequate vegetation as soon as possible after installation. It is usually important to stabilize the drainage area above the diversion so that sediment will not enter and accumulate in the diversion channel.

Design Criteria

Location

Diversion location should be determined by considering outlet conditions, topography, land use, soil type, length of slope, seepage (where seepage is a problem) and the development layout. Outlets must be stable after the diversion empties stormwater flow into it; therefore, care should be exercised in selecting the location of the diversion and its outlet.

Capacity

The diversion channel must have a minimum capacity to carry the runoff expected from a storm frequency meeting the requirements of Table DV-1 with a freeboard of at least 0.3 foot (Figure DV-1).

The storm frequency should be used to determine the required channel capacity, Q (peak rate of runoff). The peak rate of runoff should be determined using the Natural Resources Conservation Service runoff curve no. (RCN) method or other equivalent methods.

Table DV-1 Design Frequency

| Diversion Type | Typical Area of Protection | 24-Hour Design Storm Frequency |
|----------------|--|--------------------------------|
| Temporary | Construction Areas | 2-year |
| | Building Sites | 5-year |
| Permanent | Agricultural Land | 10-year |
| | Mined Reclamation Area | 10-year |
| | Recreation Areas | 10-year |
| | Isolated Buildings | 25-year |
| | Urban areas, Residential, School, Industrial Areas, etc. | 50-year |

Diversions designed to protect homes, schools, industrial buildings, roads, parking lots, and comparable high-risk areas, and those designed to function in connection with other structures, should have sufficient capacity to carry peak runoff expected from a storm frequency consistent with the hazard involved.

Velocities

Diversions should be designed so that the design velocities will be safe for the planned type of protective vegetation and the expected maintenance. Maximum permissible velocities are dependent upon the erosion resistance of the soil (Table DV-2) and the quality of the vegetation maintained.

Table DV-2 Permissible Velocities

| Soil Texture | Velocity in Feet/Second | | |
|-----------------------------------|--------------------------|------|------|
| | Conditions of Vegetation | | |
| | Poor | Fair | Good |
| Sand, Silt, Sandy Loam, Silt Loam | 1.5 | 2.0 | 3.0 |
| Silty Clay Loam, Sandy Clay Loam | 2.5 | 3.0 | 4.0 |
| Clay | 3.0 | 4.0 | 5.0 |

Channel Design

The diversion channel may be parabolic, trapezoidal or v-shaped as shown in Figure DV-2 and should be designed in accordance with the procedure provided in the Diversion Design section. Land slope must be considered when choosing channel dimensions. On steeper slopes, narrow and deep channels may be required. On more gentle slopes, broad, shallow channels can be used to facilitate maintenance.

Ridge Design

The supporting ridge cross section should meet the configuration and requirements of Figure DV-2.

The side slopes should be no steeper than 2:1. Side slopes should be flatter, 5:1 to 10:1, when the diversion is to be permanent with mowing and other maintenance activities performed on or around it.

The width of the ridge at the design water elevation should be a minimum of 4 feet.

The minimum freeboard should be 0.3 foot.

The design should include a 10% settlement factor.

Outlet

Diversions should have adequate outlets which will convey concentrated runoff without erosion. Acceptable outlets include practices such as Grassed Swale, Lined Swale, Drop Structure, Sediment Basin, and Stormwater Detention Basins.

Stabilization

Unless otherwise stabilized, the ridge and channel should be seeded within 13 days of installation in accordance with the applicable seeding practice, Permanent Seeding or Temporary Seeding.

Disturbed areas draining into the diversion should be seeded and mulched prior to or at the time the diversion is constructed in accordance with the Permanent Seeding or Temporary Seeding (whichever is applicable) practices.

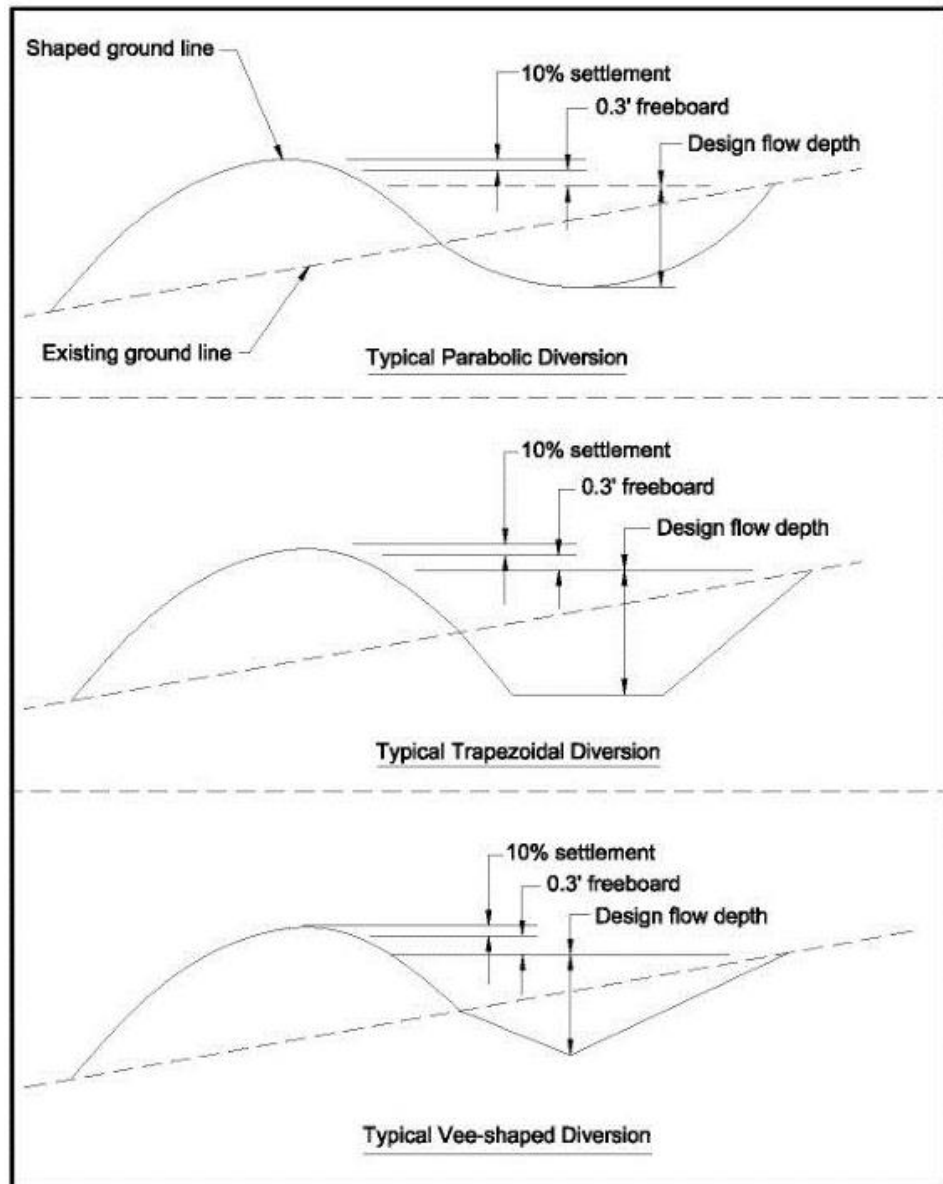


Figure DV-2 Typical Diversions Detail

Diversion Design

Note: This design example uses the Permissible Velocity approach. Diversion design using the Tractive Stress approach can also be used but is not discussed in this document.

Table DV-1 through DV-16 may be used to facilitate the design of grass-lined diversions with parabolic cross sections. These tables are based on a retardance of “D” (vegetation newly cut) to determine V_1 for stability considerations. To determine channel capacity, choose a retardance of “C” when proper maintenance is expected; otherwise, design channel capacity based on retardance “B”. Refer to Table DV-2 for maximum permissible velocities. The permissible velocities guide the selection of V_1 and should not be exceeded. It is good practice to use a value for V_1 that is significantly less than the maximum allowable when choosing a design cross section. When velocities approach the maximum allowable, flatter grades should be evaluated or a more erosion resistant liner such as erosion control blanket or riprap should be considered. After the diversion dimensions are selected in the design tables, the top width should be increased by 4 feet. and the depth by 0.3 foot. for freeboard.

Example Problem

Given

Q: 30 cfs
Grade: 1%
Soil: Sandy clay loam
Condition of vegetation expected: fair
Maintenance: low; will be cut only twice a year.
Site will allow a top width of 26 feet.

Find

Diversion top width and depth that will be stable and fit site conditions.

Solution

From Table DV-2 use maximum permissible velocity of 3.0 ft./sec.

Since maintenance will be low use “B” retardance for capacity.

From Table DV-4 use retardance “D” and “B”;
Grade 1.00 Percent. Top width = 21.0 feet + 4 feet = 25.0 feet.

Depth = 1.6 feet + 0.3 foot = 1.9 feet.

$V_2 = 1.3$ ft./sec.

Note: $V_1 < 3.0$ ft./sec.; Top width < 26 feet, design O.K.

Note: It is good practice to select a cross section that will give a velocity, V_1 , well below the maximum allowable whenever site conditions permit. Wide, shallow cross sections are more stable and require less maintenance. It is always prudent to evaluate flatter design grades to best fit diversions to the site and keep velocities well below maximum allowable.

Table DV-3 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 0.50%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"
Grade 0.50 Percent

| Q CFS | V1=2.0 | | | V1=2.5 | | | V1=3.0 | | | V1=3.5 | | | V1=4.0 | | | V1=4.5 | | | V1=5.0 | | | V1=5.5 | | | V1=6.0 | | | | | | |
|----------|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|---|----|--------|---|----|---|---|----|--|
| | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 10.0 | 2.2 | 1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 13.7 | 2.1 | 1.0 | 8.4 | 2.7 | 1.3 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | 17.4 | 2.1 | 1.0 | 11.3 | 2.4 | 1.4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 21.0 | 2.0 | 1.0 | 13.9 | 2.3 | 1.4 | | | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | 24.6 | 2.0 | 1.1 | 16.4 | 2.3 | 1.4 | 10.7 | 2.8 | 1.8 | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 28.5 | 2.0 | 1.0 | 18.9 | 2.3 | 1.4 | 12.6 | 2.7 | 1.8 | | | | | | | | | | | | | | | | | | | | | | |
| 45 | 31.9 | 2.0 | 1.1 | 21.4 | 2.3 | 1.4 | 14.4 | 2.6 | 1.8 | | | | | | | | | | | | | | | | | | | | | | |
| 50 | 35.5 | 2.0 | 1.1 | 23.9 | 2.2 | 1.4 | 16.2 | 2.5 | 1.8 | 9.9 | 3.4 | 2.2 | | | | | | | | | | | | | | | | | | | |
| 55 | 39.0 | 2.0 | 1.1 | 26.3 | 2.2 | 1.4 | 17.9 | 2.5 | 1.8 | 11.9 | 3.1 | 2.3 | | | | | | | | | | | | | | | | | | | |
| 60 | 42.5 | 2.0 | 1.1 | 28.8 | 2.2 | 1.4 | 19.7 | 2.5 | 1.8 | 13.2 | 3.0 | 2.3 | | | | | | | | | | | | | | | | | | | |
| 65 | 46.1 | 2.0 | 1.1 | 31.6 | 2.2 | 1.4 | 21.4 | 2.5 | 1.8 | 14.5 | 2.9 | 2.3 | | | | | | | | | | | | | | | | | | | |
| 70 | 49.6 | 2.0 | 1.1 | 34.0 | 2.2 | 1.4 | 23.1 | 2.5 | 1.8 | 15.8 | 2.9 | 2.3 | 11.0 | 3.6 | 2.6 | | | | | | | | | | | | | | | | |
| 75 | 53.1 | 2.0 | 1.1 | 36.4 | 2.2 | 1.4 | 24.9 | 2.5 | 1.8 | 17.1 | 2.8 | 2.3 | 12.7 | 3.4 | 2.7 | | | | | | | | | | | | | | | | |
| 80 | 56.6 | 2.0 | 1.1 | 38.8 | 2.2 | 1.4 | 26.6 | 2.5 | 1.8 | 18.4 | 2.8 | 2.3 | 13.7 | 3.3 | 2.7 | | | | | | | | | | | | | | | | |
| 85 | 60.2 | 2.0 | 1.1 | 41.2 | 2.2 | 1.4 | 28.3 | 2.5 | 1.8 | 19.7 | 2.8 | 2.3 | 14.8 | 3.2 | 2.7 | | | | | | | | | | | | | | | | |
| 90 | 63.7 | 2.0 | 1.1 | 43.6 | 2.2 | 1.4 | 30.0 | 2.4 | 1.8 | 20.9 | 2.8 | 2.3 | 15.9 | 3.2 | 2.7 | | | | | | | | | | | | | | | | |
| 95 | 67.2 | 2.0 | 1.1 | 46.1 | 2.2 | 1.4 | 31.7 | 2.4 | 1.8 | 22.1 | 2.8 | 2.3 | 16.9 | 3.1 | 2.7 | | | | | | | | | | | | | | | | |
| 100 | 70.8 | 2.0 | 1.1 | 48.5 | 2.2 | 1.4 | 33.7 | 2.4 | 1.8 | 23.4 | 2.8 | 2.3 | 17.9 | 3.1 | 2.7 | | | | | | | | | | | | | | | | |
| 105 | 74.3 | 2.0 | 1.1 | 50.9 | 2.2 | 1.4 | 35.8 | 2.4 | 1.8 | 24.5 | 2.7 | 2.4 | 18.9 | 3.1 | 2.7 | 12.3 | 3.9 | 3.1 | | | | | | | | | | | | | |
| 110 | 77.8 | 2.0 | 1.1 | 53.3 | 2.2 | 1.4 | 37.1 | 2.4 | 1.8 | 25.6 | 2.7 | 2.4 | 19.9 | 3.1 | 2.7 | 14.6 | 3.6 | 3.1 | | | | | | | | | | | | | |
| 115 | 81.4 | 2.0 | 1.1 | 55.7 | 2.2 | 1.4 | 38.7 | 2.4 | 1.8 | 27.0 | 2.7 | 2.4 | 20.8 | 3.0 | 2.7 | 15.4 | 3.6 | 3.1 | | | | | | | | | | | | | |
| 120 | 84.9 | 2.0 | 1.1 | 58.1 | 2.2 | 1.4 | 40.4 | 2.4 | 1.9 | 28.2 | 2.7 | 2.4 | 21.8 | 3.0 | 2.7 | 16.3 | 3.5 | 3.1 | | | | | | | | | | | | | |
| 125 | 88.4 | 2.0 | 1.1 | 60.6 | 2.2 | 1.4 | 42.1 | 2.4 | 1.9 | 29.4 | 2.7 | 2.4 | 22.8 | 3.0 | 2.7 | 17.1 | 3.5 | 3.1 | | | | | | | | | | | | | |
| 130 | 92.0 | 2.0 | 1.1 | 63.0 | 2.2 | 1.4 | 43.8 | 2.4 | 1.9 | 30.6 | 2.7 | 2.4 | 23.8 | 3.0 | 2.7 | 17.9 | 3.5 | 3.1 | | | | | | | | | | | | | |
| 135 | 95.5 | 2.0 | 1.1 | 65.4 | 2.2 | 1.4 | 45.4 | 2.4 | 1.9 | 31.8 | 2.7 | 2.4 | 24.8 | 3.0 | 2.7 | 18.7 | 3.4 | 3.2 | | | | | | | | | | | | | |
| 140 | 99.0 | 2.0 | 1.1 | 67.8 | 2.2 | 1.4 | 47.1 | 2.4 | 1.9 | 33.1 | 2.7 | 2.4 | 25.7 | 3.0 | 2.8 | 19.4 | 3.4 | 3.2 | | | | | | | | | | | | | |
| 145 | 102.5 | 2.0 | 1.1 | 70.2 | 2.2 | 1.4 | 48.8 | 2.4 | 1.9 | 34.3 | 2.7 | 2.4 | 26.7 | 3.0 | 2.8 | 20.2 | 3.4 | 3.2 | 13.5 | 4.4 | 3.6 | | | | | | | | | | |
| 150 | 106.1 | 2.0 | 1.1 | 72.6 | 2.2 | 1.4 | 50.5 | 2.4 | 1.9 | 35.5 | 2.7 | 2.4 | 27.7 | 3.0 | 2.8 | 21.0 | 3.4 | 3.2 | 14.4 | 4.3 | 3.6 | | | | | | | | | | |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-5 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 2.00%)

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | |
|----------|--------|-----|--------|-------|--------|-----|--------|-----|--------|------|--------|-----|--------|-----|--------|------|--------|-----|
| | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D |
| | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | |
| 5 | 7.1 | 1.2 | 0.9 | 9.5 | 1.3 | 1.2 | 7.0 | 1.4 | 1.5 | | | | | | | | | |
| 10 | 14.7 | 1.2 | 0.9 | 14.5 | 1.3 | 1.2 | 10.8 | 1.4 | 1.5 | 8.0 | 1.5 | 1.9 | 2.1 | | | | | |
| 15 | 22.0 | 1.2 | 0.9 | 19.6 | 1.2 | 1.2 | 14.8 | 1.3 | 1.5 | 10.9 | 1.5 | 1.9 | 8.1 | 1.6 | 2.3 | 5.5 | 2.1 | 2.6 |
| 20 | 28.3 | 1.2 | 0.9 | 24.4 | 1.2 | 1.2 | 18.5 | 1.3 | 1.5 | 13.8 | 1.4 | 1.9 | 10.4 | 1.8 | 2.3 | 7.9 | 1.8 | 2.7 |
| 25 | 34.6 | 1.2 | 0.9 | 29.3 | 1.2 | 1.2 | 22.2 | 1.3 | 1.6 | 16.6 | 1.4 | 1.9 | 12.7 | 1.5 | 2.3 | 9.7 | 1.7 | 2.7 |
| 30 | 40.9 | 1.2 | 0.9 | 34.2 | 1.2 | 1.2 | 25.8 | 1.3 | 1.6 | 19.6 | 1.4 | 1.9 | 14.9 | 1.5 | 2.3 | 11.5 | 1.7 | 2.7 |
| 35 | 47.2 | 1.2 | 0.9 | 39.0 | 1.2 | 1.2 | 29.5 | 1.3 | 1.6 | 22.4 | 1.4 | 1.9 | 17.1 | 1.5 | 2.3 | 13.3 | 1.8 | 2.8 |
| 40 | 53.5 | 1.2 | 0.9 | 43.9 | 1.2 | 1.2 | 33.2 | 1.3 | 1.6 | 25.2 | 1.4 | 1.9 | 19.3 | 1.5 | 2.3 | 15.0 | 1.8 | 2.8 |
| 45 | 59.8 | 1.2 | 0.9 | 48.8 | 1.2 | 1.2 | 36.8 | 1.3 | 1.6 | 28.0 | 1.4 | 1.9 | 21.7 | 1.5 | 2.3 | 16.7 | 1.8 | 2.8 |
| 50 | 66.1 | 1.2 | 0.9 | 53.8 | 1.2 | 1.2 | 40.5 | 1.3 | 1.6 | 30.7 | 1.4 | 1.9 | 23.9 | 1.5 | 2.3 | 18.5 | 1.8 | 2.8 |
| 55 | 72.4 | 1.2 | 0.9 | 58.8 | 1.2 | 1.2 | 44.2 | 1.3 | 1.6 | 33.5 | 1.4 | 1.9 | 26.0 | 1.5 | 2.3 | 20.2 | 1.8 | 2.8 |
| 60 | 78.7 | 1.2 | 0.9 | 63.8 | 1.2 | 1.2 | 47.9 | 1.3 | 1.6 | 36.3 | 1.4 | 1.9 | 28.2 | 1.5 | 2.3 | 22.1 | 1.8 | 2.8 |
| 65 | 85.0 | 1.2 | 0.9 | 68.8 | 1.2 | 1.2 | 51.6 | 1.3 | 1.6 | 39.1 | 1.4 | 1.9 | 30.5 | 1.5 | 2.3 | 23.8 | 1.8 | 2.8 |
| 70 | 91.3 | 1.2 | 0.9 | 73.8 | 1.2 | 1.2 | 55.2 | 1.3 | 1.6 | 41.9 | 1.4 | 1.9 | 32.5 | 1.5 | 2.3 | 25.5 | 1.8 | 2.8 |
| 75 | 97.6 | 1.2 | 0.9 | 78.8 | 1.2 | 1.2 | 58.9 | 1.3 | 1.6 | 44.7 | 1.4 | 1.9 | 34.6 | 1.5 | 2.3 | 27.2 | 1.8 | 2.8 |
| 80 | 103.9 | 1.2 | 0.9 | 83.8 | 1.2 | 1.2 | 62.6 | 1.3 | 1.6 | 47.4 | 1.4 | 1.9 | 36.8 | 1.5 | 2.3 | 28.9 | 1.8 | 2.8 |
| 85 | 110.2 | 1.2 | 0.9 | 88.8 | 1.2 | 1.2 | 66.3 | 1.3 | 1.6 | 50.2 | 1.4 | 1.9 | 39.0 | 1.5 | 2.3 | 30.5 | 1.8 | 2.8 |
| 90 | 116.5 | 1.2 | 0.9 | 93.8 | 1.2 | 1.2 | 69.9 | 1.3 | 1.6 | 53.0 | 1.4 | 1.9 | 41.1 | 1.5 | 2.3 | 32.3 | 1.8 | 2.8 |
| 95 | 122.8 | 1.2 | 0.9 | 98.8 | 1.2 | 1.2 | 73.6 | 1.3 | 1.6 | 55.8 | 1.4 | 1.9 | 43.3 | 1.5 | 2.3 | 34.0 | 1.8 | 2.8 |
| 100 | 129.1 | 1.2 | 0.9 | 103.8 | 1.2 | 1.2 | 77.3 | 1.3 | 1.6 | 58.6 | 1.4 | 1.9 | 45.4 | 1.5 | 2.3 | 35.7 | 1.8 | 2.8 |
| 105 | 135.4 | 1.2 | 0.9 | 108.8 | 1.2 | 1.2 | 81.0 | 1.3 | 1.6 | 61.4 | 1.4 | 1.9 | 47.6 | 1.5 | 2.3 | 37.3 | 1.8 | 2.8 |
| 110 | 141.7 | 1.2 | 0.9 | 113.8 | 1.2 | 1.2 | 84.7 | 1.3 | 1.6 | 64.2 | 1.4 | 1.9 | 49.8 | 1.5 | 2.3 | 39.0 | 1.8 | 2.8 |
| 115 | 148.0 | 1.2 | 0.9 | 118.8 | 1.2 | 1.2 | 88.3 | 1.3 | 1.6 | 67.0 | 1.4 | 1.9 | 51.9 | 1.5 | 2.3 | 40.7 | 1.8 | 2.8 |
| 120 | 154.3 | 1.2 | 0.9 | 123.8 | 1.2 | 1.2 | 92.0 | 1.3 | 1.6 | 69.7 | 1.4 | 1.9 | 54.1 | 1.5 | 2.3 | 42.4 | 1.8 | 2.8 |
| 125 | 160.6 | 1.2 | 0.9 | 128.8 | 1.2 | 1.2 | 95.7 | 1.3 | 1.6 | 72.5 | 1.4 | 1.9 | 56.2 | 1.5 | 2.3 | 44.1 | 1.8 | 2.8 |
| 130 | 166.9 | 1.2 | 0.9 | 133.8 | 1.2 | 1.2 | 99.4 | 1.3 | 1.6 | 75.3 | 1.4 | 1.9 | 58.4 | 1.5 | 2.3 | 45.8 | 1.8 | 2.8 |
| 135 | 173.2 | 1.2 | 0.9 | 138.8 | 1.2 | 1.2 | 103.1 | 1.3 | 1.6 | 78.1 | 1.4 | 1.9 | 60.6 | 1.5 | 2.3 | 47.5 | 1.8 | 2.8 |
| 140 | 179.5 | 1.2 | 0.9 | 143.8 | 1.2 | 1.2 | 106.7 | 1.3 | 1.6 | 80.9 | 1.4 | 1.9 | 62.7 | 1.5 | 2.3 | 49.2 | 1.8 | 2.8 |
| 145 | 185.8 | 1.2 | 0.9 | 148.8 | 1.2 | 1.2 | 110.4 | 1.3 | 1.6 | 83.7 | 1.4 | 1.9 | 64.9 | 1.5 | 2.3 | 50.9 | 1.8 | 2.8 |
| 150 | 192.1 | 1.2 | 0.9 | 153.8 | 1.2 | 1.2 | 114.1 | 1.3 | 1.6 | 86.5 | 1.4 | 1.9 | 67.0 | 1.5 | 2.3 | 52.6 | 1.8 | 2.8 |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet. Velocity measurements are in feet per second.
Depth "D" does not include allowance for freeboard or settlement.

Table DV-6 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 4.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"

Grade 4.00 Percent

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | |
|----------|--------|-----|--------|-----|--------|-----|--------|-------|--------|------|--------|-----|--------|-----|--------|------|--------|-----|
| | T | V2 | T | V2 | T | V2 | T | V2 | T | V2 | T | V2 | T | V2 | T | V2 | T | V2 |
| 5 | 10.1 | 0.9 | 7.0 | 1.1 | 4.9 | 1.1 | 1.4 | | | | | | | | | | | |
| 10 | 20.5 | 0.9 | 14.4 | 0.8 | 10.3 | 1.0 | 1.4 | 7.9 | 1.1 | 6.1 | 1.2 | 2.1 | 4.5 | 1.4 | 2.4 | | | |
| 15 | 30.7 | 0.9 | 21.5 | 0.9 | 15.7 | 1.0 | 1.4 | 12.0 | 1.1 | 9.4 | 1.1 | 2.1 | 7.4 | 1.2 | 2.5 | 6.8 | 1.4 | 2.8 |
| 20 | 40.9 | 0.9 | 28.6 | 0.9 | 20.9 | 1.0 | 1.4 | 16.3 | 1.0 | 12.8 | 1.1 | 2.1 | 10.1 | 1.2 | 2.5 | 8.0 | 1.3 | 2.9 |
| 25 | 51.1 | 0.9 | 35.8 | 0.9 | 26.1 | 1.0 | 1.4 | 20.3 | 1.0 | 16.0 | 1.1 | 2.1 | 12.7 | 1.2 | 2.5 | 10.2 | 1.3 | 2.9 |
| 30 | 61.3 | 0.9 | 42.9 | 0.9 | 31.4 | 1.0 | 1.4 | 24.4 | 1.0 | 19.2 | 1.1 | 2.1 | 15.2 | 1.2 | 2.5 | 12.3 | 1.3 | 2.9 |
| 35 | 71.5 | 0.9 | 50.1 | 0.9 | 36.6 | 1.0 | 1.4 | 28.3 | 1.0 | 22.4 | 1.1 | 2.1 | 18.0 | 1.2 | 2.5 | 14.4 | 1.2 | 2.9 |
| 40 | 81.8 | 0.9 | 57.2 | 0.9 | 41.8 | 1.0 | 1.5 | 32.4 | 1.0 | 25.6 | 1.1 | 2.1 | 20.6 | 1.2 | 2.5 | 16.5 | 1.2 | 2.9 |
| 45 | 92.0 | 0.9 | 64.4 | 0.9 | 47.0 | 1.0 | 1.5 | 36.4 | 1.0 | 28.8 | 1.1 | 2.1 | 23.1 | 1.2 | 2.5 | 18.6 | 1.2 | 2.9 |
| 50 | 102.2 | 0.9 | 71.5 | 0.9 | 52.2 | 1.0 | 1.5 | 40.5 | 1.0 | 32.0 | 1.1 | 2.1 | 25.7 | 1.2 | 2.5 | 20.9 | 1.2 | 2.9 |
| 55 | 112.4 | 0.9 | 78.7 | 0.9 | 57.5 | 1.0 | 1.5 | 44.5 | 1.0 | 35.2 | 1.1 | 2.1 | 28.2 | 1.2 | 2.5 | 23.0 | 1.2 | 2.9 |
| 60 | 122.6 | 0.9 | 85.8 | 0.9 | 62.7 | 1.0 | 1.5 | 48.5 | 1.0 | 38.4 | 1.1 | 2.2 | 30.8 | 1.2 | 2.5 | 25.1 | 1.2 | 2.9 |
| 65 | 132.8 | 0.9 | 93.0 | 0.9 | 67.9 | 1.0 | 1.5 | 52.6 | 1.0 | 41.5 | 1.1 | 2.2 | 33.4 | 1.2 | 2.5 | 27.2 | 1.2 | 2.9 |
| 70 | 143.1 | 0.9 | 100.1 | 0.9 | 73.1 | 1.0 | 1.5 | 56.8 | 1.0 | 44.7 | 1.1 | 2.2 | 35.9 | 1.2 | 2.5 | 29.2 | 1.2 | 2.9 |
| 75 | 153.3 | 0.9 | 107.3 | 0.9 | 78.3 | 1.0 | 1.5 | 60.7 | 1.0 | 47.9 | 1.1 | 2.2 | 38.5 | 1.2 | 2.5 | 31.3 | 1.2 | 2.9 |
| 80 | 163.5 | 0.9 | 114.4 | 0.9 | 83.6 | 1.0 | 1.5 | 64.7 | 1.0 | 51.1 | 1.1 | 2.2 | 41.0 | 1.2 | 2.5 | 33.4 | 1.2 | 2.9 |
| 85 | 173.7 | 0.9 | 121.6 | 0.9 | 88.8 | 1.0 | 1.5 | 68.8 | 1.0 | 54.3 | 1.1 | 2.2 | 43.6 | 1.2 | 2.5 | 35.5 | 1.2 | 2.9 |
| 90 | 183.9 | 0.9 | 128.7 | 0.9 | 94.0 | 1.0 | 1.5 | 72.8 | 1.0 | 57.5 | 1.1 | 2.2 | 46.2 | 1.2 | 2.5 | 37.6 | 1.2 | 2.9 |
| 95 | 194.1 | 0.9 | 135.9 | 0.9 | 99.2 | 1.0 | 1.5 | 76.8 | 1.0 | 60.7 | 1.1 | 2.2 | 48.7 | 1.2 | 2.5 | 39.7 | 1.2 | 2.9 |
| 100 | 204.4 | 0.9 | 143.0 | 0.9 | 104.4 | 1.0 | 1.5 | 80.9 | 1.0 | 63.9 | 1.1 | 2.2 | 51.3 | 1.2 | 2.5 | 41.7 | 1.2 | 2.9 |
| 105 | 214.6 | 0.9 | 150.2 | 0.9 | 109.7 | 1.0 | 1.5 | 84.9 | 1.0 | 67.1 | 1.1 | 2.2 | 53.9 | 1.2 | 2.5 | 43.6 | 1.2 | 2.9 |
| 110 | 224.8 | 0.9 | 157.4 | 0.9 | 114.9 | 1.0 | 1.5 | 89.0 | 1.0 | 70.3 | 1.1 | 2.2 | 56.4 | 1.2 | 2.5 | 45.9 | 1.2 | 2.9 |
| 115 | 235.0 | 0.9 | 164.5 | 0.9 | 120.1 | 1.0 | 1.5 | 93.0 | 1.0 | 73.5 | 1.1 | 2.2 | 59.0 | 1.2 | 2.5 | 48.0 | 1.2 | 2.9 |
| 120 | 245.2 | 0.9 | 171.7 | 0.9 | 125.3 | 1.0 | 1.5 | 97.1 | 1.0 | 76.7 | 1.1 | 2.2 | 61.5 | 1.2 | 2.5 | 49.9 | 1.2 | 3.0 |
| 125 | 255.5 | 0.9 | 178.8 | 0.9 | 130.5 | 1.0 | 1.5 | 101.1 | 1.0 | 79.9 | 1.1 | 2.2 | 64.1 | 1.2 | 2.5 | 52.0 | 1.2 | 3.0 |
| 130 | 265.7 | 0.9 | 186.0 | 0.9 | 135.8 | 1.0 | 1.5 | 105.1 | 1.0 | 83.0 | 1.1 | 2.2 | 66.7 | 1.2 | 2.5 | 54.1 | 1.2 | 3.0 |
| 135 | 275.9 | 0.9 | 193.1 | 0.9 | 141.0 | 1.0 | 1.5 | 109.2 | 1.0 | 86.2 | 1.1 | 2.2 | 69.2 | 1.2 | 2.5 | 56.1 | 1.2 | 3.0 |
| 140 | 286.1 | 0.9 | 200.3 | 0.9 | 146.2 | 1.0 | 1.5 | 113.2 | 1.0 | 89.4 | 1.1 | 2.2 | 71.8 | 1.2 | 2.5 | 58.2 | 1.2 | 3.0 |
| 145 | 296.3 | 0.9 | 207.4 | 0.9 | 151.4 | 1.0 | 1.5 | 117.3 | 1.0 | 92.6 | 1.1 | 2.2 | 74.4 | 1.2 | 2.5 | 60.3 | 1.2 | 3.0 |
| 150 | 306.5 | 0.9 | 214.6 | 0.9 | 156.7 | 1.0 | 1.5 | 121.3 | 1.0 | 95.8 | 1.1 | 2.2 | 76.9 | 1.2 | 2.5 | 62.4 | 1.2 | 3.0 |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-7 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 6.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"
Grade 6.00 Percent

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | | |
|----------|--------|-----|--------|-------|--------|-----|--------|-----|--------|-------|--------|-----|--------|-----|--------|------|--------|-----|------|
| | Y | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T |
| 5 | 12.4 | 0.7 | 0.8 | 8.7 | 0.8 | 1.0 | 6.2 | 0.9 | 1.4 | 4.7 | 1.0 | 1.8 | 3.5 | 1.2 | 1.9 | | | | |
| 10 | 24.7 | 0.7 | 0.8 | 17.6 | 0.8 | 1.4 | 9.8 | 0.9 | 1.7 | 7.8 | 1.0 | 2.0 | 6.2 | 1.0 | 2.3 | 4.9 | 1.1 | 2.7 | |
| 15 | 37.1 | 0.7 | 0.8 | 26.4 | 0.8 | 1.1 | 19.2 | 0.8 | 1.4 | 15.0 | 0.9 | 1.7 | 11.8 | 0.9 | 2.0 | 9.5 | 1.0 | 2.4 | 7.7 |
| 20 | 49.4 | 0.7 | 0.8 | 36.1 | 0.8 | 1.1 | 25.6 | 0.8 | 1.4 | 19.9 | 0.9 | 1.7 | 16.0 | 0.9 | 2.0 | 12.9 | 1.0 | 2.4 | 10.4 |
| 25 | 61.8 | 0.7 | 0.8 | 43.9 | 0.8 | 1.1 | 32.0 | 0.8 | 1.4 | 24.9 | 0.9 | 1.7 | 19.9 | 0.9 | 2.0 | 15.1 | 1.0 | 2.4 | 13.1 |
| 30 | 74.1 | 0.7 | 0.8 | 52.7 | 0.8 | 1.1 | 38.4 | 0.8 | 1.4 | 29.9 | 0.9 | 1.7 | 23.8 | 0.9 | 2.1 | 19.3 | 1.0 | 2.4 | 15.9 |
| 35 | 86.5 | 0.7 | 0.8 | 61.5 | 0.8 | 1.1 | 44.8 | 0.8 | 1.4 | 34.8 | 0.9 | 1.7 | 27.8 | 0.9 | 2.1 | 22.5 | 1.0 | 2.4 | 18.5 |
| 40 | 98.9 | 0.7 | 0.8 | 70.2 | 0.8 | 1.1 | 51.2 | 0.8 | 1.4 | 39.8 | 0.9 | 1.7 | 31.8 | 0.9 | 2.1 | 25.7 | 1.0 | 2.4 | 21.2 |
| 45 | 111.2 | 0.7 | 0.8 | 79.0 | 0.8 | 1.1 | 57.6 | 0.8 | 1.4 | 44.8 | 0.9 | 1.7 | 35.7 | 0.9 | 2.1 | 29.0 | 1.0 | 2.4 | 23.8 |
| 50 | 123.6 | 0.7 | 0.8 | 87.8 | 0.8 | 1.1 | 64.0 | 0.8 | 1.4 | 49.7 | 0.9 | 1.7 | 39.7 | 0.9 | 2.1 | 32.2 | 1.0 | 2.4 | 26.4 |
| 55 | 135.9 | 0.7 | 0.8 | 96.6 | 0.8 | 1.1 | 70.4 | 0.8 | 1.4 | 54.7 | 0.9 | 1.7 | 43.6 | 0.9 | 2.1 | 35.4 | 1.0 | 2.4 | 29.1 |
| 60 | 148.3 | 0.7 | 0.8 | 105.3 | 0.8 | 1.1 | 76.8 | 0.8 | 1.4 | 59.7 | 0.9 | 1.7 | 47.6 | 0.9 | 2.1 | 38.6 | 1.0 | 2.4 | 31.7 |
| 65 | 160.6 | 0.7 | 0.8 | 114.1 | 0.8 | 1.1 | 83.2 | 0.8 | 1.4 | 64.7 | 0.9 | 1.7 | 51.6 | 0.9 | 2.1 | 41.8 | 1.0 | 2.4 | 34.3 |
| 70 | 173.0 | 0.7 | 0.8 | 122.9 | 0.8 | 1.1 | 89.6 | 0.8 | 1.4 | 69.6 | 0.9 | 1.7 | 55.5 | 0.9 | 2.1 | 45.0 | 1.0 | 2.4 | 37.0 |
| 75 | 185.4 | 0.7 | 0.8 | 131.7 | 0.8 | 1.1 | 96.0 | 0.8 | 1.4 | 74.6 | 0.9 | 1.7 | 59.5 | 0.9 | 2.1 | 48.2 | 1.0 | 2.4 | 39.7 |
| 80 | 197.7 | 0.7 | 0.8 | 140.4 | 0.8 | 1.1 | 102.3 | 0.8 | 1.4 | 79.6 | 0.9 | 1.7 | 63.5 | 0.9 | 2.1 | 51.4 | 1.0 | 2.4 | 42.2 |
| 85 | 210.1 | 0.7 | 0.8 | 149.2 | 0.8 | 1.1 | 108.7 | 0.8 | 1.4 | 84.5 | 0.9 | 1.7 | 67.4 | 0.9 | 2.1 | 54.7 | 1.0 | 2.4 | 44.9 |
| 90 | 222.4 | 0.7 | 0.8 | 158.0 | 0.8 | 1.1 | 115.1 | 0.8 | 1.4 | 89.5 | 0.9 | 1.7 | 71.4 | 0.9 | 2.1 | 57.9 | 1.0 | 2.4 | 47.5 |
| 95 | 234.8 | 0.7 | 0.8 | 166.8 | 0.8 | 1.1 | 121.5 | 0.8 | 1.4 | 94.5 | 0.9 | 1.7 | 75.4 | 0.9 | 2.1 | 61.1 | 1.0 | 2.4 | 50.2 |
| 100 | 247.1 | 0.7 | 0.8 | 175.5 | 0.8 | 1.1 | 127.9 | 0.8 | 1.4 | 99.5 | 0.9 | 1.7 | 79.3 | 0.9 | 2.1 | 64.3 | 1.0 | 2.4 | 52.8 |
| 105 | 259.5 | 0.7 | 0.8 | 184.3 | 0.8 | 1.1 | 134.3 | 0.8 | 1.4 | 104.4 | 0.9 | 1.7 | 83.3 | 0.9 | 2.1 | 67.5 | 1.0 | 2.4 | 55.4 |
| 110 | 271.8 | 0.7 | 0.8 | 193.1 | 0.8 | 1.1 | 140.7 | 0.8 | 1.4 | 109.4 | 0.9 | 1.7 | 87.3 | 0.9 | 2.1 | 70.7 | 1.0 | 2.4 | 58.1 |
| 115 | 284.2 | 0.7 | 0.8 | 201.9 | 0.8 | 1.1 | 147.1 | 0.8 | 1.4 | 114.4 | 0.9 | 1.7 | 91.2 | 0.9 | 2.1 | 73.9 | 1.0 | 2.4 | 60.7 |
| 120 | 296.6 | 0.7 | 0.8 | 210.7 | 0.8 | 1.1 | 153.5 | 0.8 | 1.4 | 119.3 | 0.9 | 1.7 | 95.2 | 0.9 | 2.1 | 77.2 | 1.0 | 2.4 | 63.3 |
| 125 | 308.9 | 0.7 | 0.8 | 219.4 | 0.8 | 1.1 | 159.9 | 0.8 | 1.4 | 124.3 | 0.9 | 1.7 | 99.2 | 0.9 | 2.1 | 80.4 | 1.0 | 2.4 | 66.0 |
| 130 | 321.3 | 0.7 | 0.8 | 228.2 | 0.8 | 1.1 | 166.3 | 0.8 | 1.4 | 129.3 | 0.9 | 1.7 | 103.1 | 0.9 | 2.1 | 83.6 | 1.0 | 2.4 | 68.6 |
| 135 | 333.6 | 0.7 | 0.8 | 237.0 | 0.8 | 1.1 | 172.7 | 0.8 | 1.4 | 134.3 | 0.9 | 1.7 | 107.1 | 0.9 | 2.1 | 86.8 | 1.0 | 2.4 | 71.3 |
| 140 | 346.0 | 0.7 | 0.8 | 245.8 | 0.8 | 1.1 | 179.1 | 0.8 | 1.4 | 139.2 | 0.9 | 1.7 | 111.0 | 0.9 | 2.1 | 90.0 | 1.0 | 2.4 | 73.9 |
| 145 | 358.3 | 0.7 | 0.8 | 254.5 | 0.8 | 1.1 | 185.5 | 0.8 | 1.4 | 144.2 | 0.9 | 1.7 | 115.0 | 0.9 | 2.1 | 93.2 | 1.0 | 2.4 | 76.5 |
| 150 | 370.7 | 0.7 | 0.8 | 263.3 | 0.8 | 1.1 | 191.9 | 0.8 | 1.4 | 149.2 | 0.9 | 1.7 | 119.0 | 0.9 | 2.1 | 96.4 | 1.0 | 2.4 | 79.2 |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-8 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 8.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"
Grade 8.00 Percent

| Q CFS | V1=2.0 | | | V1=2.5 | | | V1=3.0 | | | V1=3.5 | | | V1=4.0 | | | V1=4.5 | | | V1=5.0 | | | V1=5.5 | | | V1=6.0 | | | |
|----------|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--|
| | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | |
| 5 | 14.0 | 0.7 | 0.8 | 10.1 | 0.7 | 1.0 | 7.4 | 0.8 | 1.3 | 5.5 | 0.8 | 1.8 | 4.4 | 0.9 | 1.9 | 3.4 | 1.0 | 2.1 | | | | | | | | | | |
| 10 | 24.0 | 0.7 | 0.8 | 20.1 | 0.7 | 1.0 | 15.0 | 0.8 | 1.3 | 11.3 | 0.8 | 1.7 | 8.1 | 0.8 | 2.0 | 7.4 | 0.9 | 2.3 | 8.0 | 0.9 | 2.8 | 4.9 | 1.0 | 3.0 | 3.8 | 1.2 | 3.3 | |
| 15 | 41.9 | 0.7 | 0.8 | 30.1 | 0.7 | 1.0 | 22.4 | 0.8 | 1.3 | 17.0 | 0.8 | 1.7 | 13.9 | 0.8 | 2.0 | 11.4 | 0.9 | 2.3 | 9.2 | 0.9 | 2.7 | 7.6 | 1.0 | 3.0 | 6.3 | 1.0 | 3.4 | |
| 20 | 65.9 | 0.7 | 0.8 | 40.1 | 0.7 | 1.0 | 29.9 | 0.8 | 1.3 | 22.8 | 0.8 | 1.7 | 18.5 | 0.8 | 2.0 | 15.1 | 0.9 | 2.3 | 12.5 | 0.9 | 2.7 | 10.2 | 1.0 | 3.1 | 8.5 | 1.0 | 3.5 | |
| 25 | 86.9 | 0.7 | 0.8 | 50.1 | 0.7 | 1.0 | 37.3 | 0.8 | 1.3 | 28.2 | 0.8 | 1.7 | 23.1 | 0.8 | 2.0 | 18.8 | 0.9 | 2.3 | 15.8 | 0.9 | 2.7 | 13.0 | 0.9 | 3.1 | 10.8 | 1.0 | 3.5 | |
| 30 | 111.8 | 0.7 | 0.8 | 60.1 | 0.7 | 1.0 | 44.8 | 0.8 | 1.3 | 33.9 | 0.8 | 1.7 | 27.7 | 0.8 | 2.0 | 22.6 | 0.8 | 2.3 | 18.6 | 0.9 | 2.7 | 15.8 | 0.9 | 3.1 | 13.0 | 1.0 | 3.5 | |
| 35 | 137.9 | 0.7 | 0.8 | 70.1 | 0.7 | 1.0 | 52.3 | 0.8 | 1.3 | 39.5 | 0.8 | 1.7 | 32.3 | 0.8 | 2.0 | 26.3 | 0.8 | 2.3 | 21.7 | 0.9 | 2.7 | 18.2 | 0.9 | 3.1 | 15.3 | 1.0 | 3.5 | |
| 40 | 164.8 | 0.7 | 0.8 | 80.2 | 0.7 | 1.0 | 60.7 | 0.8 | 1.3 | 45.1 | 0.8 | 1.7 | 36.9 | 0.8 | 2.0 | 30.1 | 0.8 | 2.3 | 24.8 | 0.9 | 2.7 | 20.8 | 0.9 | 3.1 | 17.5 | 1.0 | 3.5 | |
| 45 | 192.6 | 0.7 | 0.8 | 90.2 | 0.7 | 1.0 | 67.2 | 0.8 | 1.3 | 50.8 | 0.8 | 1.7 | 41.5 | 0.8 | 2.0 | 33.8 | 0.9 | 2.3 | 27.9 | 0.9 | 2.7 | 23.3 | 0.9 | 3.1 | 19.7 | 1.0 | 3.5 | |
| 50 | 221.3 | 0.7 | 0.8 | 100.2 | 0.7 | 1.0 | 74.7 | 0.8 | 1.3 | 56.4 | 0.8 | 1.7 | 46.1 | 0.8 | 2.0 | 37.6 | 0.9 | 2.3 | 31.0 | 0.9 | 2.7 | 25.8 | 0.9 | 3.1 | 21.9 | 1.0 | 3.5 | |
| 55 | 250.9 | 0.7 | 0.8 | 110.2 | 0.7 | 1.0 | 82.1 | 0.8 | 1.3 | 62.1 | 0.8 | 1.7 | 50.7 | 0.8 | 2.0 | 41.3 | 0.9 | 2.3 | 34.1 | 0.9 | 2.7 | 28.5 | 0.9 | 3.1 | 24.0 | 1.0 | 3.5 | |
| 60 | 281.7 | 0.7 | 0.8 | 120.2 | 0.7 | 1.0 | 89.6 | 0.8 | 1.3 | 67.7 | 0.8 | 1.7 | 55.3 | 0.8 | 2.0 | 45.1 | 0.9 | 2.3 | 37.2 | 0.9 | 2.7 | 31.1 | 0.9 | 3.1 | 26.2 | 1.0 | 3.5 | |
| 65 | 313.7 | 0.7 | 0.8 | 130.3 | 0.7 | 1.0 | 97.0 | 0.8 | 1.3 | 73.3 | 0.8 | 1.7 | 60.0 | 0.8 | 2.0 | 48.8 | 0.9 | 2.3 | 40.3 | 0.9 | 2.7 | 33.7 | 0.9 | 3.1 | 28.4 | 1.0 | 3.5 | |
| 70 | 346.7 | 0.7 | 0.8 | 140.3 | 0.7 | 1.0 | 104.5 | 0.8 | 1.3 | 79.0 | 0.8 | 1.7 | 64.6 | 0.8 | 2.0 | 52.6 | 0.9 | 2.3 | 43.4 | 0.9 | 2.7 | 36.3 | 0.9 | 3.1 | 30.6 | 1.0 | 3.5 | |
| 75 | 380.7 | 0.7 | 0.8 | 150.3 | 0.7 | 1.0 | 112.0 | 0.8 | 1.3 | 84.6 | 0.8 | 1.7 | 69.2 | 0.8 | 2.0 | 56.3 | 0.9 | 2.3 | 46.6 | 0.9 | 2.7 | 38.9 | 0.9 | 3.1 | 32.8 | 1.0 | 3.5 | |
| 80 | 415.7 | 0.7 | 0.8 | 160.3 | 0.7 | 1.0 | 119.4 | 0.8 | 1.3 | 90.3 | 0.8 | 1.7 | 73.8 | 0.8 | 2.0 | 60.1 | 0.9 | 2.3 | 49.6 | 0.9 | 2.7 | 41.4 | 0.9 | 3.1 | 35.0 | 1.0 | 3.5 | |
| 85 | 451.7 | 0.7 | 0.8 | 170.3 | 0.7 | 1.0 | 126.9 | 0.8 | 1.3 | 95.9 | 0.8 | 1.7 | 78.4 | 0.8 | 2.0 | 63.8 | 0.9 | 2.3 | 52.7 | 0.9 | 2.7 | 44.0 | 0.9 | 3.1 | 37.1 | 1.0 | 3.5 | |
| 90 | 488.6 | 0.7 | 0.8 | 180.3 | 0.7 | 1.0 | 134.4 | 0.8 | 1.3 | 101.8 | 0.8 | 1.7 | 83.0 | 0.8 | 2.0 | 67.6 | 0.9 | 2.3 | 55.8 | 0.9 | 2.7 | 46.6 | 0.9 | 3.1 | 39.3 | 1.0 | 3.5 | |
| 95 | 526.6 | 0.7 | 0.8 | 190.4 | 0.7 | 1.0 | 141.8 | 0.8 | 1.3 | 107.2 | 0.8 | 1.7 | 87.6 | 0.8 | 2.0 | 71.3 | 0.9 | 2.3 | 58.9 | 0.9 | 2.7 | 49.2 | 0.9 | 3.1 | 41.5 | 1.0 | 3.5 | |
| 100 | 565.6 | 0.7 | 0.8 | 200.4 | 0.7 | 1.0 | 149.3 | 0.8 | 1.3 | 112.6 | 0.8 | 1.7 | 92.2 | 0.8 | 2.0 | 75.1 | 0.9 | 2.3 | 62.0 | 0.9 | 2.7 | 51.8 | 0.9 | 3.1 | 43.7 | 1.0 | 3.5 | |
| 105 | 605.6 | 0.7 | 0.8 | 210.4 | 0.7 | 1.0 | 156.8 | 0.8 | 1.3 | 118.5 | 0.8 | 1.7 | 96.8 | 0.8 | 2.0 | 78.9 | 0.9 | 2.3 | 65.1 | 0.9 | 2.7 | 54.4 | 0.9 | 3.1 | 45.9 | 1.0 | 3.5 | |
| 110 | 646.6 | 0.7 | 0.8 | 220.4 | 0.7 | 1.0 | 164.2 | 0.8 | 1.3 | 124.1 | 0.8 | 1.7 | 101.4 | 0.8 | 2.0 | 82.6 | 0.9 | 2.3 | 68.2 | 0.9 | 2.7 | 57.0 | 0.9 | 3.1 | 48.0 | 1.0 | 3.5 | |
| 115 | 688.6 | 0.7 | 0.8 | 230.4 | 0.7 | 1.0 | 171.7 | 0.8 | 1.3 | 129.8 | 0.8 | 1.7 | 106.1 | 0.8 | 2.0 | 86.4 | 0.9 | 2.3 | 71.3 | 0.9 | 2.7 | 59.6 | 0.9 | 3.1 | 50.2 | 1.0 | 3.5 | |
| 120 | 731.6 | 0.7 | 0.8 | 240.5 | 0.7 | 1.0 | 179.1 | 0.8 | 1.3 | 135.4 | 0.8 | 1.7 | 110.7 | 0.8 | 2.0 | 90.1 | 0.9 | 2.3 | 74.4 | 0.9 | 2.7 | 62.2 | 0.9 | 3.1 | 52.4 | 1.0 | 3.5 | |
| 125 | 775.6 | 0.7 | 0.8 | 250.5 | 0.7 | 1.0 | 186.6 | 0.8 | 1.3 | 141.0 | 0.8 | 1.7 | 115.3 | 0.8 | 2.0 | 93.9 | 0.9 | 2.3 | 77.5 | 0.9 | 2.7 | 64.7 | 0.9 | 3.1 | 54.6 | 1.0 | 3.5 | |
| 130 | 820.6 | 0.7 | 0.8 | 260.5 | 0.7 | 1.0 | 194.1 | 0.8 | 1.3 | 146.7 | 0.8 | 1.7 | 119.9 | 0.8 | 2.0 | 97.8 | 0.9 | 2.3 | 80.6 | 0.9 | 2.7 | 67.3 | 0.9 | 3.1 | 56.8 | 1.0 | 3.5 | |
| 135 | 866.6 | 0.7 | 0.8 | 270.5 | 0.7 | 1.0 | 201.6 | 0.8 | 1.3 | 152.3 | 0.8 | 1.7 | 124.5 | 0.8 | 2.0 | 101.4 | 0.9 | 2.3 | 83.7 | 0.9 | 2.7 | 69.9 | 0.9 | 3.1 | 59.0 | 1.0 | 3.5 | |
| 140 | 913.6 | 0.7 | 0.8 | 280.5 | 0.7 | 1.0 | 209.0 | 0.8 | 1.3 | 158.0 | 0.8 | 1.7 | 129.1 | 0.8 | 2.0 | 105.1 | 0.9 | 2.3 | 86.8 | 0.9 | 2.7 | 72.5 | 0.9 | 3.1 | 61.1 | 1.0 | 3.5 | |
| 145 | 961.6 | 0.7 | 0.8 | 290.6 | 0.7 | 1.0 | 216.5 | 0.8 | 1.3 | 163.6 | 0.8 | 1.7 | 133.7 | 0.8 | 2.0 | 108.9 | 0.9 | 2.3 | 89.9 | 0.9 | 2.7 | 75.1 | 0.9 | 3.1 | 63.3 | 1.0 | 3.5 | |
| 150 | 1010.6 | 0.7 | 0.8 | 300.6 | 0.7 | 1.0 | 223.9 | 0.8 | 1.3 | 169.3 | 0.8 | 1.7 | 138.3 | 0.8 | 2.0 | 112.6 | 0.9 | 2.3 | 93.0 | 0.9 | 2.7 | 77.7 | 0.9 | 3.1 | 65.5 | 1.0 | 3.5 | |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-9 Parabolic Diversion Design Chart (Retardance "D" and "B", Grade 10.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "B"
Grade 10.00 Percent

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | |
|----------|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-----|--------|-------|--------|-------|--------|------|
| | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D |
| 5 | 15.3 | 0.6 | 11.1 | 0.7 | 8.1 | 0.7 | 6.3 | 0.7 | 4.8 | 0.8 | 3.6 | 0.9 | 2.2 | 3.1 | 1.9 | 2.4 | | |
| 10 | 30.6 | 0.6 | 22.1 | 0.7 | 16.5 | 0.7 | 12.8 | 0.7 | 10.0 | 0.8 | 7.4 | 0.9 | 4.8 | 6.5 | 3.8 | 4.7 | 2.9 | 3.3 |
| 15 | 45.9 | 0.6 | 33.2 | 0.7 | 24.7 | 0.7 | 19.2 | 0.7 | 15.0 | 0.8 | 11.1 | 0.9 | 7.4 | 10.0 | 6.0 | 7.3 | 4.8 | 5.4 |
| 20 | 61.2 | 0.6 | 44.2 | 0.7 | 32.9 | 0.7 | 25.6 | 0.7 | 20.0 | 0.8 | 14.7 | 0.9 | 10.0 | 13.8 | 9.0 | 11.1 | 7.3 | 8.1 |
| 25 | 76.5 | 0.6 | 55.3 | 0.7 | 41.1 | 0.7 | 32.0 | 0.7 | 25.0 | 0.8 | 18.8 | 0.9 | 13.8 | 18.8 | 12.5 | 14.7 | 10.0 | 11.1 |
| 30 | 91.8 | 0.6 | 66.3 | 0.7 | 49.3 | 0.7 | 40.3 | 0.7 | 32.0 | 0.8 | 23.8 | 0.9 | 18.8 | 25.6 | 15.0 | 18.8 | 12.5 | 13.8 |
| 35 | 107.1 | 0.6 | 77.4 | 0.7 | 57.5 | 0.7 | 48.7 | 0.7 | 39.9 | 0.8 | 28.7 | 0.9 | 23.8 | 32.9 | 17.5 | 23.8 | 15.0 | 16.5 |
| 40 | 122.4 | 0.6 | 88.4 | 0.7 | 65.7 | 0.7 | 57.1 | 0.7 | 47.9 | 0.8 | 33.9 | 0.9 | 28.7 | 40.3 | 20.0 | 28.7 | 17.5 | 19.2 |
| 45 | 137.8 | 0.6 | 99.5 | 0.7 | 73.9 | 0.7 | 65.7 | 0.7 | 56.2 | 0.8 | 38.8 | 0.9 | 33.9 | 47.9 | 22.5 | 33.9 | 20.0 | 21.9 |
| 50 | 153.1 | 0.6 | 110.6 | 0.7 | 82.1 | 0.7 | 73.9 | 0.7 | 64.8 | 0.8 | 43.8 | 0.9 | 38.8 | 56.2 | 25.0 | 40.3 | 22.5 | 24.7 |
| 55 | 168.4 | 0.6 | 121.6 | 0.7 | 90.3 | 0.7 | 82.1 | 0.7 | 72.9 | 0.8 | 48.7 | 0.9 | 43.8 | 64.8 | 27.5 | 47.9 | 25.0 | 27.5 |
| 60 | 183.7 | 0.6 | 132.7 | 0.7 | 98.5 | 0.7 | 90.3 | 0.7 | 80.9 | 0.8 | 53.7 | 0.9 | 48.7 | 72.9 | 30.0 | 56.2 | 27.5 | 30.0 |
| 65 | 199.0 | 0.6 | 143.7 | 0.7 | 106.7 | 0.7 | 98.5 | 0.7 | 88.9 | 0.8 | 58.7 | 0.9 | 53.7 | 80.9 | 32.5 | 64.8 | 30.0 | 32.5 |
| 70 | 214.3 | 0.6 | 154.8 | 0.7 | 115.0 | 0.7 | 106.7 | 0.7 | 97.0 | 0.8 | 63.7 | 0.9 | 58.7 | 88.9 | 35.0 | 72.9 | 32.5 | 35.0 |
| 75 | 229.6 | 0.6 | 165.8 | 0.7 | 123.2 | 0.7 | 113.2 | 0.7 | 105.1 | 0.8 | 68.7 | 0.9 | 63.7 | 97.0 | 37.5 | 80.9 | 35.0 | 37.5 |
| 80 | 244.9 | 0.6 | 176.8 | 0.7 | 131.4 | 0.7 | 121.4 | 0.7 | 113.2 | 0.8 | 73.7 | 0.9 | 68.7 | 105.1 | 40.0 | 88.9 | 37.5 | 40.0 |
| 85 | 260.2 | 0.6 | 187.8 | 0.7 | 139.6 | 0.7 | 129.6 | 0.7 | 121.4 | 0.8 | 78.7 | 0.9 | 73.7 | 113.2 | 42.5 | 97.0 | 40.0 | 42.5 |
| 90 | 275.5 | 0.6 | 198.8 | 0.7 | 147.8 | 0.7 | 137.8 | 0.7 | 129.6 | 0.8 | 83.7 | 0.9 | 78.7 | 121.4 | 45.0 | 105.1 | 42.5 | 45.0 |
| 95 | 290.8 | 0.6 | 210.0 | 0.7 | 156.0 | 0.7 | 146.0 | 0.7 | 137.8 | 0.8 | 88.7 | 0.9 | 83.7 | 129.6 | 47.5 | 113.2 | 45.0 | 47.5 |
| 100 | 306.1 | 0.6 | 221.1 | 0.7 | 164.2 | 0.7 | 154.2 | 0.7 | 146.0 | 0.8 | 93.7 | 0.9 | 88.7 | 137.8 | 50.0 | 121.4 | 47.5 | 50.0 |
| 105 | 321.4 | 0.6 | 232.2 | 0.7 | 172.4 | 0.7 | 162.4 | 0.7 | 154.2 | 0.8 | 98.7 | 0.9 | 93.7 | 146.0 | 52.5 | 129.6 | 50.0 | 52.5 |
| 110 | 336.7 | 0.6 | 243.2 | 0.7 | 180.6 | 0.7 | 170.6 | 0.7 | 162.4 | 0.8 | 103.7 | 0.9 | 98.7 | 154.2 | 55.0 | 137.8 | 52.5 | 55.0 |
| 115 | 352.0 | 0.6 | 254.3 | 0.7 | 188.8 | 0.7 | 178.8 | 0.7 | 170.6 | 0.8 | 108.7 | 0.9 | 103.7 | 162.4 | 57.5 | 146.0 | 55.0 | 57.5 |
| 120 | 367.3 | 0.6 | 265.3 | 0.7 | 197.1 | 0.7 | 187.1 | 0.7 | 178.8 | 0.8 | 113.7 | 0.9 | 108.7 | 170.6 | 60.0 | 154.2 | 57.5 | 60.0 |
| 125 | 382.6 | 0.6 | 276.4 | 0.7 | 205.3 | 0.7 | 195.3 | 0.7 | 187.1 | 0.8 | 118.7 | 0.9 | 113.7 | 178.8 | 62.5 | 162.4 | 60.0 | 62.5 |
| 130 | 397.9 | 0.6 | 287.4 | 0.7 | 213.5 | 0.7 | 203.5 | 0.7 | 195.3 | 0.8 | 123.7 | 0.9 | 118.7 | 187.1 | 65.0 | 170.6 | 62.5 | 65.0 |
| 135 | 413.2 | 0.6 | 298.5 | 0.7 | 221.7 | 0.7 | 211.7 | 0.7 | 203.5 | 0.8 | 128.7 | 0.9 | 123.7 | 195.3 | 67.5 | 178.8 | 65.0 | 67.5 |
| 140 | 428.6 | 0.6 | 309.5 | 0.7 | 229.9 | 0.7 | 219.9 | 0.7 | 211.7 | 0.8 | 133.7 | 0.9 | 128.7 | 203.5 | 70.0 | 187.1 | 67.5 | 70.0 |
| 145 | 443.9 | 0.6 | 320.6 | 0.7 | 238.1 | 0.7 | 228.1 | 0.7 | 219.9 | 0.8 | 138.7 | 0.9 | 133.7 | 211.7 | 72.5 | 195.3 | 70.0 | 72.5 |
| 150 | 459.2 | 0.6 | 331.7 | 0.7 | 246.3 | 0.7 | 236.3 | 0.7 | 228.1 | 0.8 | 143.7 | 0.9 | 138.7 | 219.9 | 75.0 | 203.5 | 72.5 | 75.0 |

RETARDANCE "D" AND "B"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-10 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade .50%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"
Grade 0.50 Percent

| Q CFS | V1=2.0 | | | V1=2.5 | | | V1=3.0 | | | V1=3.5 | | | V1=4.0 | | | V1=4.5 | | | V1=5.0 | | | V1=5.5 | | | V1=6.0 | | | | |
|----------|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|---|----|--------|---|----|--|--|
| | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 8.4 | 1.6 | 1.7 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 11.7 | 1.5 | 1.7 | 7.1 | 2.0 | 2.2 | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | 14.9 | 1.5 | 1.7 | 9.7 | 1.8 | 2.2 | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | 18.0 | 1.5 | 1.7 | 12.0 | 1.7 | 2.2 | | | | | | | | | | | | | | | | | | | | | | | |
| 35 | 21.0 | 1.5 | 1.7 | 14.2 | 1.7 | 2.2 | 9.3 | 2.1 | 2.7 | | | | | | | | | | | | | | | | | | | | |
| 40 | 24.4 | 1.5 | 1.7 | 16.3 | 1.7 | 2.2 | 10.9 | 2.0 | 2.7 | | | | | | | | | | | | | | | | | | | | |
| 45 | 27.4 | 1.5 | 1.7 | 18.5 | 1.7 | 2.2 | 12.5 | 2.0 | 2.7 | | | | | | | | | | | | | | | | | | | | |
| 50 | 30.5 | 1.5 | 1.7 | 20.6 | 1.7 | 2.2 | 14.1 | 1.9 | 2.7 | 8.7 | 2.6 | 3.3 | | | | | | | | | | | | | | | | | |
| 55 | 33.5 | 1.5 | 1.7 | 22.7 | 1.7 | 2.2 | 15.7 | 1.9 | 2.7 | 10.4 | 2.4 | 3.3 | | | | | | | | | | | | | | | | | |
| 60 | 36.6 | 1.5 | 1.7 | 24.8 | 1.7 | 2.2 | 17.2 | 1.9 | 2.7 | 11.7 | 2.3 | 3.3 | | | | | | | | | | | | | | | | | |
| 65 | 39.6 | 1.5 | 1.7 | 27.3 | 1.7 | 2.2 | 18.8 | 1.9 | 2.7 | 12.9 | 2.3 | 3.3 | | | | | | | | | | | | | | | | | |
| 70 | 42.6 | 1.5 | 1.7 | 29.4 | 1.7 | 2.2 | 20.3 | 1.9 | 2.7 | 14.0 | 2.2 | 3.3 | 9.8 | 2.8 | 3.8 | | | | | | | | | | | | | | |
| 75 | 45.7 | 1.5 | 1.7 | 31.4 | 1.7 | 2.2 | 21.8 | 1.9 | 2.7 | 15.2 | 2.2 | 3.3 | 11.3 | 2.7 | 3.8 | | | | | | | | | | | | | | |
| 80 | 48.7 | 1.5 | 1.7 | 33.5 | 1.7 | 2.2 | 23.3 | 1.9 | 2.7 | 16.3 | 2.2 | 3.3 | 12.2 | 2.6 | 3.8 | | | | | | | | | | | | | | |
| 85 | 51.7 | 1.5 | 1.7 | 35.6 | 1.6 | 2.2 | 24.8 | 1.9 | 2.7 | 17.4 | 2.2 | 3.3 | 13.2 | 2.5 | 3.8 | | | | | | | | | | | | | | |
| 90 | 54.8 | 1.5 | 1.7 | 37.7 | 1.6 | 2.2 | 26.3 | 1.9 | 2.7 | 18.5 | 2.2 | 3.3 | 14.2 | 2.5 | 3.8 | | | | | | | | | | | | | | |
| 95 | 57.8 | 1.5 | 1.7 | 39.8 | 1.6 | 2.2 | 27.8 | 1.9 | 2.7 | 19.6 | 2.2 | 3.3 | 15.1 | 2.5 | 3.8 | | | | | | | | | | | | | | |
| 100 | 60.9 | 1.5 | 1.7 | 41.9 | 1.6 | 2.2 | 29.7 | 1.9 | 2.7 | 20.7 | 2.2 | 3.3 | 16.0 | 2.5 | 3.8 | 11.0 | 3.2 | 4.3 | | | | | | | | | | | |
| 105 | 63.9 | 1.5 | 1.7 | 44.0 | 1.6 | 2.2 | 31.2 | 1.9 | 2.7 | 21.8 | 2.2 | 3.3 | 16.9 | 2.5 | 3.8 | 12.3 | 3.0 | 4.3 | | | | | | | | | | | |
| 110 | 66.9 | 1.5 | 1.7 | 46.1 | 1.6 | 2.2 | 32.6 | 1.9 | 2.7 | 22.9 | 2.2 | 3.3 | 17.8 | 2.4 | 3.8 | 13.1 | 2.9 | 4.3 | | | | | | | | | | | |
| 115 | 70.0 | 1.5 | 1.7 | 48.1 | 1.6 | 2.2 | 34.1 | 1.9 | 2.7 | 24.0 | 2.1 | 3.3 | 18.7 | 2.4 | 3.8 | 13.9 | 2.9 | 4.3 | | | | | | | | | | | |
| 120 | 73.0 | 1.5 | 1.7 | 50.2 | 1.6 | 2.2 | 35.6 | 1.9 | 2.7 | 25.1 | 2.1 | 3.3 | 19.6 | 2.4 | 3.8 | 14.6 | 2.9 | 4.3 | | | | | | | | | | | |
| 125 | 76.1 | 1.5 | 1.7 | 52.3 | 1.6 | 2.2 | 37.1 | 1.9 | 2.7 | 26.2 | 2.1 | 3.3 | 20.5 | 2.4 | 3.8 | 15.4 | 2.8 | 4.3 | | | | | | | | | | | |
| 130 | 79.1 | 1.5 | 1.7 | 54.4 | 1.6 | 2.2 | 38.5 | 1.9 | 2.7 | 27.3 | 2.1 | 3.3 | 21.3 | 2.4 | 3.8 | 16.1 | 2.8 | 4.3 | | | | | | | | | | | |
| 135 | 82.1 | 1.5 | 1.7 | 56.5 | 1.6 | 2.2 | 40.0 | 1.9 | 2.7 | 28.4 | 2.1 | 3.3 | 22.2 | 2.4 | 3.8 | 16.9 | 2.8 | 4.3 | | | | | | | | | | | |
| 140 | 85.2 | 1.5 | 1.7 | 58.6 | 1.6 | 2.2 | 41.5 | 1.9 | 2.7 | 29.4 | 2.1 | 3.3 | 23.1 | 2.4 | 3.8 | 17.6 | 2.8 | 4.3 | | | | | | | | | | | |
| 145 | 88.2 | 1.5 | 1.7 | 60.7 | 1.6 | 2.2 | 43.0 | 1.9 | 2.7 | 30.5 | 2.1 | 3.3 | 24.0 | 2.4 | 3.8 | 18.3 | 2.8 | 4.3 | 12.3 | 3.7 | 4.9 | | | | | | | | |
| 150 | 91.3 | 1.6 | 1.7 | 62.8 | 1.6 | 2.2 | 44.5 | 1.9 | 2.7 | 31.6 | 2.1 | 3.3 | 24.8 | 2.4 | 3.8 | 19.0 | 2.7 | 4.3 | 13.1 | 3.5 | 4.9 | | | | | | | | |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-11 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 1.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"
Grade 1.00 Percent

| Q CFS | V1=2.0 | | | V1=2.5 | | | V1=3.0 | | | V1=3.5 | | | V1=4.0 | | | V1=4.5 | | | V1=5.0 | | | V1=5.5 | | | V1=6.0 | | | | | |
|----------|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|---|----|---|---|----|
| | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 8.2 | 1.2 | 1.6 | 5.2 | 1.4 | 2.0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | 12.6 | 1.1 | 1.6 | 8.7 | 1.3 | 2.1 | 5.5 | 1.6 | 2.6 | | | | | | | | | | | | | | | | | | | | | |
| 20 | 17.1 | 1.1 | 1.6 | 11.8 | 1.2 | 2.1 | 8.2 | 1.4 | 2.6 | | | | | | | | | | | | | | | | | | | | | |
| 25 | 21.4 | 1.1 | 1.6 | 14.9 | 1.2 | 2.1 | 10.5 | 1.4 | 2.6 | 7.3 | 1.6 | 3.1 | | | | | | | | | | | | | | | | | | |
| 30 | 25.7 | 1.1 | 1.6 | 18.0 | 1.2 | 2.1 | 12.8 | 1.4 | 2.6 | 9.1 | 1.6 | 3.2 | | | | | | | | | | | | | | | | | | |
| 35 | 29.9 | 1.1 | 1.6 | 21.2 | 1.2 | 2.1 | 15.0 | 1.3 | 2.6 | 10.9 | 1.5 | 3.1 | 7.8 | 1.8 | 3.7 | | | | | | | | | | | | | | | |
| 40 | 34.2 | 1.1 | 1.6 | 24.3 | 1.2 | 2.1 | 17.3 | 1.3 | 2.6 | 12.6 | 1.5 | 3.1 | 9.2 | 1.7 | 3.7 | | | | | | | | | | | | | | | |
| 45 | 38.5 | 1.1 | 1.6 | 27.3 | 1.2 | 2.1 | 19.5 | 1.3 | 2.6 | 14.3 | 1.5 | 3.1 | 10.6 | 1.7 | 3.7 | 7.2 | 2.2 | 4.3 | | | | | | | | | | | | |
| 50 | 42.7 | 1.1 | 1.6 | 30.3 | 1.2 | 2.1 | 21.9 | 1.3 | 2.6 | 16.0 | 1.5 | 3.2 | 11.9 | 1.7 | 3.7 | 8.8 | 2.0 | 4.3 | | | | | | | | | | | | |
| 55 | 47.0 | 1.1 | 1.6 | 33.3 | 1.2 | 2.1 | 24.1 | 1.3 | 2.6 | 17.7 | 1.5 | 3.2 | 13.3 | 1.7 | 3.7 | 9.9 | 1.9 | 4.3 | | | | | | | | | | | | |
| 60 | 51.3 | 1.1 | 1.6 | 36.3 | 1.2 | 2.1 | 26.3 | 1.3 | 2.6 | 19.3 | 1.5 | 3.2 | 14.6 | 1.7 | 3.7 | 11.0 | 1.9 | 4.3 | | | | | | | | | | | | |
| 65 | 55.5 | 1.1 | 1.6 | 39.4 | 1.2 | 2.1 | 28.5 | 1.3 | 2.6 | 21.0 | 1.5 | 3.2 | 15.9 | 1.6 | 3.7 | 12.1 | 1.9 | 4.3 | 8.0 | 2.5 | 4.9 | | | | | | | | | |
| 70 | 59.8 | 1.1 | 1.6 | 42.4 | 1.2 | 2.1 | 30.7 | 1.3 | 2.6 | 22.7 | 1.5 | 3.2 | 17.1 | 1.6 | 3.7 | 13.2 | 1.9 | 4.3 | 9.5 | 2.3 | 4.8 | | | | | | | | | |
| 75 | 64.1 | 1.1 | 1.6 | 45.4 | 1.2 | 2.1 | 32.9 | 1.3 | 2.6 | 24.6 | 1.5 | 3.1 | 18.5 | 1.6 | 3.7 | 14.2 | 1.8 | 4.3 | 10.4 | 2.2 | 4.9 | | | | | | | | | |
| 80 | 68.3 | 1.1 | 1.6 | 48.4 | 1.2 | 2.1 | 35.0 | 1.3 | 2.6 | 26.2 | 1.5 | 3.1 | 19.8 | 1.6 | 3.7 | 15.2 | 1.8 | 4.3 | 11.3 | 2.2 | 4.9 | 8.8 | 2.7 | 5.4 | | | | | | |
| 85 | 72.6 | 1.1 | 1.6 | 51.5 | 1.2 | 2.1 | 37.2 | 1.3 | 2.6 | 27.9 | 1.5 | 3.1 | 21.0 | 1.6 | 3.7 | 16.3 | 1.8 | 4.3 | 12.1 | 2.2 | 4.9 | 9.8 | 2.6 | 5.4 | | | | | | |
| 90 | 76.9 | 1.1 | 1.6 | 54.5 | 1.2 | 2.1 | 39.4 | 1.3 | 2.6 | 29.5 | 1.5 | 3.1 | 22.3 | 1.6 | 3.7 | 17.3 | 1.8 | 4.3 | 13.0 | 2.1 | 4.9 | 10.9 | 2.5 | 5.3 | | | | | | |
| 95 | 81.1 | 1.1 | 1.6 | 57.5 | 1.2 | 2.1 | 41.6 | 1.3 | 2.6 | 31.1 | 1.5 | 3.1 | 23.6 | 1.6 | 3.7 | 18.3 | 1.8 | 4.3 | 13.8 | 2.1 | 4.9 | 11.6 | 2.4 | 5.4 | | | | | | |
| 100 | 85.4 | 1.1 | 1.6 | 60.5 | 1.2 | 2.1 | 43.8 | 1.3 | 2.6 | 32.7 | 1.5 | 3.1 | 24.9 | 1.6 | 3.7 | 19.3 | 1.8 | 4.3 | 14.6 | 2.1 | 4.9 | 12.4 | 2.4 | 5.4 | | | | | | |
| 105 | 89.7 | 1.1 | 1.6 | 63.6 | 1.2 | 2.1 | 46.0 | 1.3 | 2.6 | 34.4 | 1.5 | 3.1 | 26.5 | 1.6 | 3.7 | 20.3 | 1.8 | 4.3 | 15.4 | 2.1 | 4.9 | 13.1 | 2.4 | 5.4 | | | | | | |
| 110 | 94.0 | 1.1 | 1.6 | 66.6 | 1.2 | 2.1 | 48.2 | 1.3 | 2.6 | 36.0 | 1.5 | 3.1 | 27.7 | 1.6 | 3.7 | 21.3 | 1.8 | 4.3 | 16.2 | 2.1 | 4.9 | 13.8 | 2.3 | 5.4 | | | | | | |
| 115 | 98.2 | 1.1 | 1.6 | 69.6 | 1.2 | 2.1 | 50.4 | 1.3 | 2.6 | 37.6 | 1.5 | 3.1 | 29.0 | 1.6 | 3.7 | 22.3 | 1.8 | 4.3 | 17.0 | 2.1 | 4.9 | 14.5 | 2.3 | 5.4 | | | | | | |
| 120 | 102.5 | 1.1 | 1.6 | 72.6 | 1.2 | 2.1 | 52.5 | 1.3 | 2.6 | 39.3 | 1.5 | 3.1 | 30.2 | 1.6 | 3.7 | 23.3 | 1.8 | 4.3 | 17.9 | 2.1 | 4.9 | 15.2 | 2.3 | 5.4 | | | | | | |
| 125 | 106.8 | 1.1 | 1.6 | 75.7 | 1.2 | 2.1 | 54.7 | 1.3 | 2.6 | 40.9 | 1.5 | 3.1 | 31.5 | 1.6 | 3.7 | 24.3 | 1.8 | 4.3 | 18.7 | 2.1 | 4.9 | 15.9 | 2.3 | 5.4 | | | | | | |
| 130 | 111.0 | 1.1 | 1.6 | 78.7 | 1.2 | 2.1 | 56.9 | 1.3 | 2.6 | 42.5 | 1.5 | 3.1 | 32.7 | 1.6 | 3.7 | 25.3 | 1.8 | 4.3 | 19.4 | 2.1 | 4.9 | 16.6 | 2.3 | 5.4 | | | | | | |
| 135 | 115.3 | 1.1 | 1.6 | 81.7 | 1.2 | 2.1 | 59.1 | 1.3 | 2.6 | 44.2 | 1.5 | 3.1 | 34.0 | 1.6 | 3.7 | 26.3 | 1.8 | 4.3 | 20.2 | 2.0 | 4.9 | 17.2 | 2.3 | 5.4 | | | | | | |
| 140 | 119.6 | 1.1 | 1.6 | 84.7 | 1.2 | 2.1 | 61.3 | 1.3 | 2.6 | 45.8 | 1.5 | 3.1 | 35.2 | 1.6 | 3.7 | 27.3 | 1.8 | 4.3 | 21.0 | 2.0 | 4.9 | 17.9 | 2.3 | 5.4 | | | | | | |
| 145 | 123.8 | 1.1 | 1.6 | 87.8 | 1.2 | 2.1 | 63.5 | 1.3 | 2.6 | 47.5 | 1.5 | 3.1 | 36.5 | 1.6 | 3.7 | 28.7 | 1.8 | 4.3 | 21.8 | 2.0 | 4.9 | 18.6 | 2.3 | 5.4 | | | | | | |
| 150 | 128.1 | 1.1 | 1.6 | 90.8 | 1.2 | 2.1 | 65.7 | 1.3 | 2.6 | 49.1 | 1.5 | 3.1 | 37.8 | 1.6 | 3.7 | 29.7 | 1.8 | 4.3 | 22.6 | 2.0 | 4.9 | 19.4 | 2.3 | 5.4 | | | | | | |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-12 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 2.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"
Grade 2.00 Percent

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | | |
|----------|--------|-----|--------|-------|--------|-----|--------|-----|--------|------|--------|-----|--------|-----|--------|------|--------|-----|------|
| | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | |
| 5 | 5.9 | 0.9 | 1.5 | | | | | | | | | | | | | | | | |
| 10 | 12.4 | 0.8 | 1.5 | 8.1 | 0.9 | 2.0 | 5.9 | 1.0 | 2.5 | | | | | | | | | | |
| 15 | 18.5 | 0.8 | 1.5 | 12.3 | 0.9 | 2.0 | 9.3 | 1.0 | 2.5 | 6.8 | 1.1 | 3.0 | 4.7 | 1.4 | 3.5 | | | | |
| 20 | 24.7 | 0.8 | 1.5 | 16.7 | 0.9 | 2.0 | 12.5 | 1.0 | 2.5 | 9.4 | 1.1 | 3.0 | 7.0 | 1.2 | 3.6 | 4.7 | 1.5 | 4.1 | |
| 25 | 30.8 | 0.8 | 1.5 | 20.8 | 0.9 | 2.0 | 15.9 | 1.0 | 2.4 | 11.8 | 1.1 | 3.0 | 9.0 | 1.2 | 3.5 | 6.8 | 1.3 | 4.1 | |
| 30 | 37.0 | 0.8 | 1.5 | 25.0 | 0.9 | 2.0 | 19.0 | 1.0 | 2.5 | 14.3 | 1.1 | 3.0 | 11.0 | 1.2 | 3.5 | 8.5 | 1.3 | 4.1 | 6.4 |
| 35 | 43.2 | 0.8 | 1.5 | 29.1 | 0.9 | 2.0 | 22.2 | 1.0 | 2.5 | 16.9 | 1.0 | 3.0 | 12.9 | 1.1 | 3.5 | 10.1 | 1.3 | 4.1 | 7.8 |
| 40 | 49.3 | 0.8 | 1.5 | 33.3 | 0.9 | 2.0 | 25.3 | 1.0 | 2.5 | 19.3 | 1.0 | 3.0 | 14.8 | 1.1 | 3.5 | 11.6 | 1.3 | 4.1 | 9.1 |
| 45 | 55.5 | 0.8 | 1.5 | 37.4 | 0.9 | 2.0 | 28.5 | 1.0 | 2.5 | 21.7 | 1.0 | 3.0 | 16.7 | 1.1 | 3.5 | 13.1 | 1.3 | 4.1 | 10.4 |
| 50 | 61.7 | 0.8 | 1.5 | 41.6 | 0.9 | 2.0 | 31.7 | 1.0 | 2.5 | 24.1 | 1.0 | 3.0 | 18.8 | 1.1 | 3.5 | 14.7 | 1.2 | 4.1 | 11.7 |
| 55 | 67.8 | 0.8 | 1.5 | 45.7 | 0.9 | 2.0 | 34.8 | 1.0 | 2.5 | 26.5 | 1.0 | 3.0 | 20.7 | 1.1 | 3.5 | 16.2 | 1.2 | 4.1 | 12.9 |
| 60 | 74.0 | 0.8 | 1.5 | 49.9 | 0.9 | 2.0 | 38.0 | 1.0 | 2.5 | 28.9 | 1.0 | 3.0 | 22.6 | 1.1 | 3.5 | 17.7 | 1.2 | 4.1 | 14.1 |
| 65 | 80.2 | 0.8 | 1.5 | 54.0 | 0.9 | 2.0 | 41.1 | 1.0 | 2.5 | 31.4 | 1.0 | 3.0 | 24.5 | 1.1 | 3.5 | 19.5 | 1.2 | 4.1 | 15.4 |
| 70 | 86.3 | 0.8 | 1.5 | 58.2 | 0.9 | 2.0 | 44.3 | 1.0 | 2.5 | 33.8 | 1.0 | 3.0 | 26.3 | 1.1 | 3.5 | 21.0 | 1.2 | 4.1 | 16.6 |
| 75 | 92.5 | 0.8 | 1.5 | 62.3 | 0.9 | 2.0 | 47.5 | 1.0 | 2.5 | 36.2 | 1.0 | 3.0 | 28.2 | 1.1 | 3.5 | 22.4 | 1.2 | 4.1 | 17.8 |
| 80 | 98.7 | 0.8 | 1.5 | 66.5 | 0.9 | 2.0 | 50.6 | 1.0 | 2.5 | 38.6 | 1.0 | 3.0 | 30.1 | 1.1 | 3.5 | 23.9 | 1.2 | 4.1 | 19.0 |
| 85 | 104.8 | 0.8 | 1.5 | 70.6 | 0.9 | 2.0 | 53.8 | 1.0 | 2.5 | 41.0 | 1.0 | 3.0 | 32.0 | 1.1 | 3.5 | 25.4 | 1.2 | 4.1 | 20.3 |
| 90 | 111.0 | 0.8 | 1.5 | 74.8 | 0.9 | 2.0 | 57.0 | 1.0 | 2.5 | 43.4 | 1.0 | 3.0 | 33.8 | 1.1 | 3.5 | 26.9 | 1.2 | 4.1 | 21.8 |
| 95 | 117.2 | 0.8 | 1.5 | 78.9 | 0.9 | 2.0 | 60.1 | 1.0 | 2.5 | 45.8 | 1.0 | 3.0 | 35.7 | 1.1 | 3.5 | 28.4 | 1.2 | 4.1 | 23.0 |
| 100 | 123.3 | 0.8 | 1.5 | 83.1 | 0.9 | 2.0 | 63.3 | 1.0 | 2.5 | 48.2 | 1.0 | 3.0 | 37.6 | 1.1 | 3.5 | 29.9 | 1.2 | 4.1 | 24.2 |
| 105 | 129.5 | 0.8 | 1.5 | 87.3 | 0.9 | 2.0 | 66.4 | 1.0 | 2.5 | 50.6 | 1.0 | 3.0 | 39.5 | 1.1 | 3.5 | 31.4 | 1.2 | 4.1 | 25.4 |
| 110 | 135.7 | 0.8 | 1.5 | 91.4 | 0.9 | 2.0 | 69.6 | 1.0 | 2.5 | 53.0 | 1.0 | 3.0 | 41.3 | 1.1 | 3.5 | 32.9 | 1.2 | 4.1 | 26.6 |
| 115 | 141.8 | 0.8 | 1.5 | 95.6 | 0.9 | 2.0 | 72.8 | 1.0 | 2.5 | 55.4 | 1.0 | 3.0 | 43.2 | 1.1 | 3.5 | 34.4 | 1.2 | 4.1 | 27.9 |
| 120 | 148.0 | 0.8 | 1.5 | 99.7 | 0.9 | 2.0 | 75.9 | 1.0 | 2.5 | 57.9 | 1.0 | 3.0 | 45.1 | 1.1 | 3.5 | 35.9 | 1.2 | 4.1 | 29.1 |
| 125 | 154.1 | 0.8 | 1.5 | 103.9 | 0.9 | 2.0 | 79.1 | 1.0 | 2.5 | 60.3 | 1.0 | 3.0 | 47.0 | 1.1 | 3.5 | 37.4 | 1.2 | 4.1 | 30.3 |
| 130 | 160.3 | 0.8 | 1.5 | 108.0 | 0.9 | 2.0 | 82.3 | 1.0 | 2.5 | 62.7 | 1.0 | 3.0 | 48.8 | 1.1 | 3.5 | 38.9 | 1.2 | 4.1 | 31.5 |
| 135 | 166.5 | 0.8 | 1.5 | 112.2 | 0.9 | 2.0 | 85.4 | 1.0 | 2.5 | 65.1 | 1.0 | 3.0 | 50.7 | 1.1 | 3.5 | 40.3 | 1.2 | 4.1 | 32.7 |
| 140 | 172.6 | 0.8 | 1.5 | 116.3 | 0.9 | 2.0 | 88.6 | 1.0 | 2.5 | 67.5 | 1.0 | 3.0 | 52.6 | 1.1 | 3.5 | 41.8 | 1.2 | 4.1 | 33.9 |
| 145 | 178.8 | 0.8 | 1.5 | 120.5 | 0.9 | 2.0 | 91.8 | 1.0 | 2.5 | 69.9 | 1.0 | 3.0 | 54.5 | 1.1 | 3.5 | 43.3 | 1.2 | 4.1 | 35.1 |
| 150 | 185.0 | 0.8 | 1.5 | 124.6 | 0.9 | 2.0 | 94.9 | 1.0 | 2.5 | 72.3 | 1.0 | 3.0 | 56.4 | 1.1 | 3.5 | 44.8 | 1.2 | 4.1 | 36.3 |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet. Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-13 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 4.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"
Grade 4.00 Percent

| Q CFS | V1=2.0 | | | V1=2.5 | | | V1=3.0 | | | V1=3.5 | | | V1=4.0 | | | V1=4.5 | | | V1=5.0 | | | V1=5.5 | | | V1=6.0 | | | |
|----------|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--------|-----|-----|--|
| | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | |
| 5 | 8.5 | 0.6 | 1.4 | 5.9 | 0.7 | 1.8 | 4.1 | 0.8 | 2.3 | | | | | | | | | | | | | | | | | | | |
| 10 | 17.2 | 0.6 | 1.4 | 12.1 | 0.7 | 1.8 | 8.8 | 0.7 | 2.3 | 6.7 | 0.8 | 2.8 | 5.2 | 0.9 | 3.3 | 3.8 | 1.0 | 3.9 | | | | | | | | | | |
| 15 | 25.8 | 0.6 | 1.4 | 18.1 | 0.7 | 1.8 | 13.4 | 0.7 | 2.3 | 10.3 | 0.8 | 2.8 | 8.1 | 0.8 | 3.4 | 6.4 | 0.9 | 3.9 | 4.9 | 1.0 | 4.5 | | | | | | | |
| 20 | 34.4 | 0.6 | 1.4 | 24.2 | 0.7 | 1.8 | 17.8 | 0.7 | 2.3 | 13.9 | 0.8 | 2.8 | 10.9 | 0.8 | 3.4 | 8.7 | 0.9 | 3.9 | 6.9 | 1.0 | 4.5 | 5.5 | 1.1 | 5.0 | | | | |
| 25 | 43.0 | 0.6 | 1.4 | 30.2 | 0.7 | 1.9 | 22.3 | 0.7 | 2.3 | 17.4 | 0.8 | 2.8 | 13.8 | 0.8 | 3.3 | 10.9 | 0.9 | 3.9 | 8.8 | 1.0 | 4.5 | 7.1 | 1.0 | 5.1 | 5.7 | 1.2 | 5.6 | |
| 30 | 51.6 | 0.6 | 1.4 | 36.3 | 0.7 | 1.9 | 26.7 | 0.7 | 2.3 | 20.8 | 0.8 | 2.8 | 16.5 | 0.8 | 3.3 | 13.2 | 0.9 | 3.9 | 10.7 | 0.9 | 4.5 | 8.7 | 1.0 | 5.1 | 7.1 | 1.1 | 5.6 | |
| 35 | 60.2 | 0.6 | 1.4 | 42.3 | 0.7 | 1.9 | 31.1 | 0.7 | 2.3 | 24.3 | 0.8 | 2.8 | 19.3 | 0.8 | 3.4 | 15.6 | 0.9 | 3.9 | 12.5 | 0.9 | 4.5 | 10.3 | 1.0 | 5.0 | 8.4 | 1.1 | 5.6 | |
| 40 | 68.8 | 0.6 | 1.4 | 48.3 | 0.7 | 1.9 | 35.6 | 0.7 | 2.3 | 27.8 | 0.8 | 2.8 | 22.0 | 0.8 | 3.4 | 17.8 | 0.9 | 3.9 | 14.4 | 0.9 | 4.5 | 11.8 | 1.0 | 5.0 | 9.8 | 1.1 | 5.7 | |
| 45 | 77.4 | 0.6 | 1.4 | 54.4 | 0.7 | 1.9 | 40.0 | 0.7 | 2.4 | 31.2 | 0.8 | 2.8 | 24.8 | 0.8 | 3.4 | 20.0 | 0.9 | 3.9 | 16.2 | 0.9 | 4.4 | 13.3 | 1.0 | 5.0 | 11.1 | 1.1 | 5.7 | |
| 50 | 86.0 | 0.6 | 1.4 | 60.4 | 0.7 | 1.9 | 44.5 | 0.7 | 2.4 | 34.7 | 0.8 | 2.8 | 27.5 | 0.8 | 3.4 | 22.2 | 0.9 | 3.9 | 18.2 | 0.9 | 4.4 | 14.9 | 1.0 | 5.0 | 12.3 | 1.1 | 5.7 | |
| 55 | 94.6 | 0.6 | 1.4 | 66.5 | 0.7 | 1.9 | 48.9 | 0.7 | 2.4 | 38.2 | 0.8 | 2.8 | 30.3 | 0.8 | 3.4 | 24.4 | 0.9 | 3.9 | 20.0 | 0.9 | 4.4 | 16.6 | 1.0 | 5.0 | 13.6 | 1.1 | 5.7 | |
| 60 | 103.2 | 0.6 | 1.4 | 72.5 | 0.7 | 1.9 | 53.4 | 0.7 | 2.4 | 41.7 | 0.8 | 2.8 | 33.0 | 0.8 | 3.4 | 26.6 | 0.9 | 3.9 | 21.8 | 0.9 | 4.5 | 18.1 | 1.0 | 5.0 | 14.9 | 1.1 | 5.7 | |
| 65 | 111.8 | 0.6 | 1.4 | 78.5 | 0.7 | 1.9 | 57.8 | 0.7 | 2.4 | 45.1 | 0.8 | 2.8 | 35.8 | 0.8 | 3.4 | 28.9 | 0.9 | 3.9 | 23.6 | 0.9 | 4.5 | 19.6 | 1.0 | 5.0 | 16.2 | 1.1 | 5.7 | |
| 70 | 120.4 | 0.6 | 1.4 | 84.6 | 0.7 | 1.9 | 62.3 | 0.7 | 2.4 | 48.6 | 0.8 | 2.8 | 38.6 | 0.8 | 3.4 | 31.1 | 0.9 | 3.9 | 25.4 | 0.9 | 4.5 | 21.1 | 1.0 | 5.0 | 17.7 | 1.1 | 5.6 | |
| 75 | 129.0 | 0.6 | 1.4 | 90.6 | 0.7 | 1.9 | 66.7 | 0.7 | 2.4 | 52.1 | 0.8 | 2.8 | 41.3 | 0.8 | 3.4 | 33.3 | 0.9 | 3.9 | 27.2 | 0.9 | 4.5 | 22.6 | 1.0 | 5.0 | 19.0 | 1.1 | 5.6 | |
| 80 | 137.6 | 0.6 | 1.4 | 96.7 | 0.7 | 1.9 | 71.2 | 0.7 | 2.4 | 55.5 | 0.8 | 2.8 | 44.1 | 0.8 | 3.4 | 35.5 | 0.9 | 3.9 | 29.1 | 0.9 | 4.5 | 24.1 | 1.0 | 5.0 | 20.2 | 1.1 | 5.6 | |
| 85 | 146.2 | 0.6 | 1.4 | 102.7 | 0.7 | 1.9 | 75.6 | 0.7 | 2.4 | 59.0 | 0.8 | 2.8 | 46.8 | 0.8 | 3.4 | 37.7 | 0.9 | 3.9 | 30.9 | 0.9 | 4.5 | 25.6 | 1.0 | 5.0 | 21.5 | 1.1 | 5.6 | |
| 90 | 154.8 | 0.6 | 1.4 | 108.7 | 0.7 | 1.9 | 80.0 | 0.7 | 2.4 | 62.5 | 0.8 | 2.8 | 49.6 | 0.8 | 3.4 | 39.9 | 0.9 | 3.9 | 32.7 | 0.9 | 4.5 | 27.1 | 1.0 | 5.0 | 22.8 | 1.1 | 5.6 | |
| 95 | 163.4 | 0.6 | 1.4 | 114.8 | 0.7 | 1.9 | 84.5 | 0.7 | 2.4 | 65.9 | 0.8 | 2.8 | 52.3 | 0.8 | 3.4 | 42.2 | 0.9 | 3.9 | 34.5 | 0.9 | 4.5 | 28.6 | 1.0 | 5.0 | 24.0 | 1.1 | 5.6 | |
| 100 | 172.0 | 0.6 | 1.4 | 120.8 | 0.7 | 1.9 | 88.9 | 0.7 | 2.4 | 69.4 | 0.8 | 2.8 | 55.1 | 0.8 | 3.4 | 44.4 | 0.9 | 3.9 | 36.3 | 0.9 | 4.5 | 30.1 | 1.0 | 5.0 | 25.3 | 1.1 | 5.6 | |
| 105 | 180.6 | 0.6 | 1.4 | 126.9 | 0.7 | 1.9 | 93.4 | 0.7 | 2.4 | 72.9 | 0.8 | 2.8 | 57.8 | 0.8 | 3.4 | 46.6 | 0.9 | 3.9 | 38.1 | 0.9 | 4.5 | 31.6 | 1.0 | 5.0 | 26.5 | 1.1 | 5.6 | |
| 110 | 189.2 | 0.6 | 1.4 | 132.9 | 0.7 | 1.9 | 97.8 | 0.7 | 2.4 | 76.3 | 0.8 | 2.8 | 60.6 | 0.8 | 3.4 | 48.8 | 0.9 | 3.9 | 39.9 | 0.9 | 4.5 | 33.1 | 1.0 | 5.0 | 27.8 | 1.1 | 5.6 | |
| 115 | 197.8 | 0.6 | 1.4 | 138.9 | 0.7 | 1.9 | 102.3 | 0.7 | 2.4 | 79.8 | 0.8 | 2.8 | 63.3 | 0.8 | 3.4 | 51.0 | 0.9 | 3.9 | 41.7 | 0.9 | 4.5 | 34.6 | 1.0 | 5.0 | 29.0 | 1.1 | 5.6 | |
| 120 | 206.4 | 0.6 | 1.4 | 145.0 | 0.7 | 1.9 | 106.7 | 0.7 | 2.4 | 83.3 | 0.8 | 2.8 | 66.1 | 0.8 | 3.4 | 53.3 | 0.9 | 3.9 | 43.6 | 0.9 | 4.5 | 36.1 | 1.0 | 5.0 | 30.2 | 1.1 | 5.7 | |
| 125 | 215.0 | 0.6 | 1.4 | 151.0 | 0.7 | 1.9 | 111.2 | 0.7 | 2.4 | 86.8 | 0.8 | 2.8 | 68.8 | 0.8 | 3.4 | 55.5 | 0.9 | 3.9 | 45.4 | 0.9 | 4.5 | 37.6 | 1.0 | 5.0 | 31.5 | 1.1 | 5.7 | |
| 130 | 223.7 | 0.6 | 1.4 | 157.1 | 0.7 | 1.9 | 115.6 | 0.7 | 2.4 | 90.2 | 0.8 | 2.8 | 71.6 | 0.8 | 3.4 | 57.7 | 0.9 | 3.9 | 47.2 | 0.9 | 4.5 | 39.1 | 1.0 | 5.0 | 32.7 | 1.1 | 5.7 | |
| 135 | 232.3 | 0.6 | 1.4 | 163.1 | 0.7 | 1.9 | 120.1 | 0.7 | 2.4 | 93.7 | 0.8 | 2.8 | 74.3 | 0.8 | 3.4 | 59.9 | 0.9 | 3.9 | 49.0 | 0.9 | 4.5 | 40.6 | 1.0 | 5.0 | 34.0 | 1.1 | 5.7 | |
| 140 | 240.9 | 0.6 | 1.4 | 169.1 | 0.7 | 1.9 | 124.5 | 0.7 | 2.4 | 97.2 | 0.8 | 2.8 | 77.1 | 0.8 | 3.4 | 62.1 | 0.9 | 3.9 | 50.8 | 0.9 | 4.5 | 42.1 | 1.0 | 5.0 | 35.2 | 1.1 | 5.7 | |
| 145 | 249.5 | 0.6 | 1.4 | 175.2 | 0.7 | 1.9 | 129.0 | 0.7 | 2.4 | 100.6 | 0.8 | 2.8 | 79.8 | 0.8 | 3.4 | 64.3 | 0.9 | 3.9 | 52.6 | 0.9 | 4.5 | 43.6 | 1.0 | 5.0 | 36.5 | 1.1 | 5.7 | |
| 150 | 258.1 | 0.6 | 1.4 | 181.2 | 0.7 | 1.9 | 133.4 | 0.7 | 2.4 | 104.1 | 0.8 | 2.8 | 82.6 | 0.8 | 3.4 | 66.6 | 0.9 | 3.9 | 54.4 | 0.9 | 4.5 | 45.1 | 1.0 | 5.0 | 37.8 | 1.1 | 5.7 | |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second;
Depth "D" does not include allowance for freeboard or settlement.

Table DV-14 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 6.00%)

| Q CFS | | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | | | | |
|----------|-------|--------|-----|--------|-----|--------|-------|--------|-----|--------|-----|--------|------|--------|-----|--------|-----|--------|------|-----|-----|------|
| | | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 | T | D | V2 |
| 5 | 10.6 | 0.5 | 1.3 | 7.3 | 0.6 | 2.3 | 4.0 | 0.7 | 2.8 | 2.9 | 0.8 | 3.2 | 5.3 | 0.8 | 3.8 | 4.2 | 0.8 | 4.3 | | | | |
| 10 | 21.1 | 0.5 | 1.3 | 14.7 | 0.6 | 2.3 | 8.4 | 0.7 | 2.8 | 6.6 | 0.7 | 3.2 | 5.3 | 0.8 | 3.8 | 4.2 | 0.8 | 4.3 | | | | |
| 15 | 31.6 | 0.5 | 1.3 | 22.1 | 0.6 | 2.3 | 12.7 | 0.6 | 2.7 | 10.1 | 0.7 | 3.3 | 8.2 | 0.7 | 3.8 | 6.6 | 0.8 | 4.3 | 5.4 | 0.9 | 4.9 | 4.3 |
| 20 | 42.1 | 0.5 | 1.3 | 29.5 | 0.6 | 2.3 | 17.0 | 0.6 | 2.7 | 13.6 | 0.7 | 3.2 | 11.1 | 0.7 | 3.7 | 9.0 | 0.8 | 4.3 | 7.4 | 0.8 | 4.9 | 6.1 |
| 25 | 52.7 | 0.5 | 1.3 | 36.8 | 0.6 | 2.3 | 21.2 | 0.6 | 2.8 | 17.0 | 0.7 | 3.2 | 13.9 | 0.7 | 3.8 | 11.3 | 0.8 | 4.3 | 9.3 | 0.8 | 4.9 | 7.8 |
| 30 | 63.2 | 0.5 | 1.3 | 44.2 | 0.6 | 2.3 | 25.4 | 0.6 | 2.8 | 20.4 | 0.7 | 3.2 | 16.6 | 0.7 | 3.8 | 13.7 | 0.8 | 4.3 | 11.3 | 0.8 | 4.9 | 9.4 |
| 35 | 73.7 | 0.5 | 1.3 | 51.6 | 0.6 | 2.3 | 29.7 | 0.6 | 2.8 | 23.8 | 0.7 | 3.2 | 19.4 | 0.7 | 3.8 | 16.0 | 0.8 | 4.3 | 13.4 | 0.8 | 4.9 | 11.1 |
| 40 | 84.2 | 0.5 | 1.3 | 58.9 | 0.6 | 2.3 | 33.9 | 0.6 | 2.8 | 27.2 | 0.7 | 3.3 | 22.2 | 0.7 | 3.8 | 18.3 | 0.8 | 4.3 | 15.3 | 0.8 | 4.9 | 12.7 |
| 45 | 94.8 | 0.5 | 1.3 | 66.3 | 0.6 | 2.3 | 38.2 | 0.6 | 2.8 | 30.7 | 0.7 | 3.3 | 24.9 | 0.7 | 3.8 | 20.6 | 0.8 | 4.3 | 17.2 | 0.8 | 4.9 | 14.5 |
| 50 | 105.3 | 0.5 | 1.3 | 73.6 | 0.6 | 2.3 | 42.4 | 0.6 | 2.8 | 34.1 | 0.7 | 3.3 | 27.7 | 0.7 | 3.8 | 22.8 | 0.8 | 4.3 | 19.1 | 0.8 | 4.9 | 16.1 |
| 55 | 115.8 | 0.5 | 1.3 | 81.0 | 0.6 | 2.3 | 46.6 | 0.6 | 2.8 | 37.5 | 0.7 | 3.3 | 30.5 | 0.7 | 3.8 | 25.1 | 0.8 | 4.3 | 22.9 | 0.8 | 4.9 | 19.3 |
| 60 | 126.4 | 0.5 | 1.3 | 88.4 | 0.6 | 2.3 | 50.9 | 0.6 | 2.8 | 40.9 | 0.7 | 3.3 | 33.3 | 0.7 | 3.8 | 27.4 | 0.8 | 4.3 | 25.9 | 0.8 | 4.9 | 20.9 |
| 65 | 136.9 | 0.5 | 1.3 | 95.7 | 0.6 | 2.3 | 55.1 | 0.6 | 2.8 | 44.3 | 0.7 | 3.3 | 36.0 | 0.7 | 3.8 | 29.7 | 0.8 | 4.3 | 28.6 | 0.8 | 4.9 | 22.5 |
| 70 | 147.4 | 0.5 | 1.3 | 103.1 | 0.6 | 2.3 | 59.3 | 0.6 | 2.8 | 47.7 | 0.7 | 3.3 | 38.8 | 0.7 | 3.8 | 32.0 | 0.8 | 4.3 | 31.3 | 0.8 | 4.9 | 24.1 |
| 75 | 158.0 | 0.5 | 1.3 | 110.5 | 0.6 | 2.3 | 63.6 | 0.6 | 2.8 | 51.1 | 0.7 | 3.3 | 41.6 | 0.7 | 3.8 | 34.3 | 0.8 | 4.3 | 34.0 | 0.8 | 4.9 | 25.7 |
| 80 | 168.5 | 0.5 | 1.3 | 117.8 | 0.6 | 2.3 | 67.8 | 0.6 | 2.8 | 54.5 | 0.7 | 3.3 | 44.3 | 0.7 | 3.8 | 36.5 | 0.8 | 4.3 | 36.7 | 0.8 | 4.9 | 27.3 |
| 85 | 179.0 | 0.5 | 1.3 | 125.2 | 0.6 | 2.3 | 72.0 | 0.6 | 2.8 | 57.9 | 0.7 | 3.3 | 47.1 | 0.7 | 3.8 | 38.8 | 0.8 | 4.3 | 39.4 | 0.8 | 4.9 | 28.9 |
| 90 | 189.6 | 0.5 | 1.3 | 132.6 | 0.6 | 2.3 | 76.3 | 0.6 | 2.8 | 61.3 | 0.7 | 3.3 | 49.9 | 0.7 | 3.8 | 41.1 | 0.8 | 4.3 | 42.1 | 0.8 | 4.9 | 30.5 |
| 95 | 200.1 | 0.5 | 1.3 | 139.9 | 0.6 | 2.3 | 80.5 | 0.6 | 2.8 | 64.7 | 0.7 | 3.3 | 52.6 | 0.7 | 3.8 | 43.4 | 0.8 | 4.3 | 44.8 | 0.8 | 4.9 | 32.1 |
| 100 | 210.6 | 0.5 | 1.3 | 147.3 | 0.6 | 2.3 | 84.8 | 0.6 | 2.8 | 68.1 | 0.7 | 3.3 | 55.4 | 0.7 | 3.8 | 45.7 | 0.8 | 4.3 | 47.5 | 0.8 | 4.9 | 33.7 |
| 105 | 221.1 | 0.5 | 1.3 | 154.6 | 0.6 | 2.3 | 89.0 | 0.6 | 2.8 | 71.5 | 0.7 | 3.3 | 58.2 | 0.7 | 3.8 | 47.9 | 0.8 | 4.3 | 50.2 | 0.8 | 4.9 | 35.3 |
| 110 | 231.7 | 0.5 | 1.3 | 162.0 | 0.6 | 2.3 | 93.2 | 0.6 | 2.8 | 74.9 | 0.7 | 3.3 | 60.9 | 0.7 | 3.8 | 50.2 | 0.8 | 4.3 | 52.9 | 0.8 | 4.9 | 36.9 |
| 115 | 242.2 | 0.5 | 1.3 | 169.4 | 0.6 | 2.3 | 97.4 | 0.6 | 2.8 | 78.3 | 0.7 | 3.3 | 63.7 | 0.7 | 3.8 | 52.5 | 0.8 | 4.3 | 55.6 | 0.8 | 4.9 | 38.5 |
| 120 | 252.7 | 0.5 | 1.3 | 176.7 | 0.6 | 2.3 | 101.7 | 0.6 | 2.8 | 81.7 | 0.7 | 3.3 | 66.5 | 0.7 | 3.8 | 54.8 | 0.8 | 4.3 | 58.3 | 0.8 | 4.9 | 40.1 |
| 125 | 263.3 | 0.5 | 1.3 | 184.1 | 0.6 | 2.3 | 106.0 | 0.6 | 2.8 | 85.1 | 0.7 | 3.3 | 69.3 | 0.7 | 3.8 | 57.1 | 0.8 | 4.3 | 61.0 | 0.8 | 4.9 | 41.7 |
| 130 | 273.8 | 0.5 | 1.3 | 191.5 | 0.6 | 2.3 | 110.2 | 0.6 | 2.8 | 88.5 | 0.7 | 3.3 | 72.0 | 0.7 | 3.8 | 59.4 | 0.8 | 4.3 | 63.7 | 0.8 | 4.9 | 43.3 |
| 135 | 284.3 | 0.5 | 1.3 | 198.8 | 0.6 | 2.3 | 114.4 | 0.6 | 2.8 | 91.9 | 0.7 | 3.3 | 74.8 | 0.7 | 3.8 | 61.6 | 0.8 | 4.3 | 66.4 | 0.8 | 4.9 | 44.9 |
| 140 | 294.9 | 0.5 | 1.3 | 206.2 | 0.6 | 2.3 | 118.7 | 0.6 | 2.8 | 95.3 | 0.7 | 3.3 | 77.6 | 0.7 | 3.8 | 63.9 | 0.8 | 4.3 | 69.1 | 0.8 | 4.9 | 46.5 |
| 145 | 305.4 | 0.5 | 1.3 | 213.6 | 0.6 | 2.3 | 122.9 | 0.6 | 2.8 | 98.7 | 0.7 | 3.3 | 80.3 | 0.7 | 3.8 | 66.2 | 0.8 | 4.3 | 71.8 | 0.8 | 4.9 | 48.1 |
| 150 | 315.9 | 0.5 | 1.3 | 220.9 | 0.6 | 2.3 | 127.1 | 0.6 | 2.8 | 102.1 | 0.7 | 3.3 | 83.1 | 0.7 | 3.8 | 68.5 | 0.8 | 4.3 | 74.5 | 0.8 | 4.9 | 49.7 |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second; Depth "D" does not include allowance for freeboard or settlement.

Table DV-15 Parabolic Diversion Design Chart (Retardance "D" and "C", Grade 8.00%)

V1 FOR RETARDANCE "D", TOP WIDTH (T), DEPTH (D), AND V2 FOR RETARDANCE "C"
Grade 8.00 Percent

| Q CFS | V1=2.0 | | V1=2.5 | | V1=3.0 | | V1=3.5 | | V1=4.0 | | V1=4.5 | | V1=5.0 | | V1=5.5 | | V1=6.0 | | | | | | | | | | |
|----------|--------|-----|--------|-------|--------|-----|--------|-----|--------|-------|--------|-----|--------|-----|--------|------|--------|-----|------|-----|-----|------|-----|-----|------|-----|-----|
| | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | T | D | | | | | | | | | |
| 5 | 12.0 | 0.5 | 1.3 | 8.5 | 0.5 | 1.7 | 6.2 | 0.5 | 2.2 | 4.6 | 0.6 | 2.7 | 3.7 | 0.6 | 3.2 | 2.9 | 0.7 | 3.6 | 3.2 | 0.8 | 4.2 | 4.2 | 0.8 | 4.8 | 3.2 | 0.9 | 5.3 |
| 10 | 24.1 | 0.5 | 1.3 | 16.9 | 0.5 | 1.7 | 12.6 | 0.5 | 2.2 | 9.6 | 0.6 | 2.7 | 7.8 | 0.6 | 3.2 | 6.3 | 0.6 | 3.7 | 5.1 | 0.7 | 4.2 | 5.1 | 0.7 | 4.2 | 4.2 | 0.8 | 4.8 |
| 15 | 36.1 | 0.5 | 1.3 | 25.3 | 0.5 | 1.7 | 18.9 | 0.5 | 2.2 | 14.4 | 0.6 | 2.7 | 11.8 | 0.6 | 3.2 | 9.7 | 0.6 | 3.7 | 7.9 | 0.7 | 4.2 | 6.5 | 0.7 | 4.2 | 6.5 | 0.7 | 4.8 |
| 20 | 48.1 | 0.5 | 1.3 | 33.8 | 0.5 | 1.7 | 25.2 | 0.5 | 2.2 | 19.2 | 0.6 | 2.7 | 15.8 | 0.6 | 3.2 | 12.9 | 0.6 | 3.7 | 10.7 | 0.7 | 4.2 | 8.8 | 0.7 | 4.2 | 8.8 | 0.7 | 4.8 |
| 25 | 60.1 | 0.5 | 1.3 | 42.2 | 0.5 | 1.7 | 31.5 | 0.5 | 2.2 | 24.0 | 0.6 | 2.7 | 19.7 | 0.6 | 3.2 | 16.2 | 0.6 | 3.7 | 13.4 | 0.7 | 4.2 | 11.2 | 0.7 | 4.2 | 11.2 | 0.7 | 4.7 |
| 30 | 72.1 | 0.5 | 1.3 | 50.6 | 0.5 | 1.7 | 37.8 | 0.5 | 2.2 | 28.8 | 0.6 | 2.7 | 23.6 | 0.6 | 3.2 | 19.4 | 0.6 | 3.7 | 16.1 | 0.7 | 4.2 | 13.5 | 0.7 | 4.2 | 13.5 | 0.7 | 4.8 |
| 35 | 84.1 | 0.5 | 1.3 | 59.1 | 0.5 | 1.7 | 44.1 | 0.5 | 2.2 | 33.6 | 0.6 | 2.7 | 27.6 | 0.6 | 3.2 | 22.6 | 0.6 | 3.7 | 18.7 | 0.7 | 4.2 | 15.7 | 0.7 | 4.2 | 15.7 | 0.7 | 4.8 |
| 40 | 96.2 | 0.5 | 1.3 | 67.5 | 0.5 | 1.7 | 50.4 | 0.5 | 2.2 | 38.4 | 0.6 | 2.7 | 31.5 | 0.6 | 3.2 | 25.8 | 0.6 | 3.7 | 21.4 | 0.7 | 4.2 | 17.9 | 0.7 | 4.2 | 17.9 | 0.7 | 4.8 |
| 45 | 108.2 | 0.5 | 1.3 | 76.0 | 0.5 | 1.7 | 56.7 | 0.5 | 2.2 | 43.2 | 0.6 | 2.7 | 35.4 | 0.6 | 3.2 | 29.0 | 0.6 | 3.7 | 24.1 | 0.7 | 4.2 | 20.2 | 0.7 | 4.2 | 20.2 | 0.7 | 4.8 |
| 50 | 120.2 | 0.5 | 1.3 | 84.4 | 0.5 | 1.7 | 63.0 | 0.5 | 2.2 | 48.0 | 0.6 | 2.7 | 39.4 | 0.6 | 3.2 | 32.3 | 0.6 | 3.7 | 26.8 | 0.7 | 4.2 | 22.4 | 0.7 | 4.2 | 22.4 | 0.7 | 4.8 |
| 55 | 132.2 | 0.5 | 1.3 | 92.8 | 0.5 | 1.7 | 69.3 | 0.5 | 2.2 | 52.8 | 0.6 | 2.7 | 43.3 | 0.6 | 3.2 | 35.5 | 0.6 | 3.7 | 29.4 | 0.7 | 4.2 | 24.7 | 0.7 | 4.2 | 24.7 | 0.7 | 4.8 |
| 60 | 144.2 | 0.5 | 1.3 | 101.3 | 0.5 | 1.7 | 75.6 | 0.5 | 2.2 | 57.6 | 0.6 | 2.7 | 47.2 | 0.6 | 3.2 | 38.7 | 0.6 | 3.7 | 32.1 | 0.7 | 4.2 | 26.9 | 0.7 | 4.2 | 26.9 | 0.7 | 4.8 |
| 65 | 156.3 | 0.5 | 1.3 | 109.7 | 0.5 | 1.7 | 81.8 | 0.5 | 2.2 | 62.4 | 0.6 | 2.7 | 51.2 | 0.6 | 3.2 | 41.9 | 0.6 | 3.7 | 34.8 | 0.7 | 4.2 | 29.1 | 0.7 | 4.2 | 29.1 | 0.7 | 4.8 |
| 70 | 168.3 | 0.5 | 1.3 | 118.2 | 0.5 | 1.7 | 88.1 | 0.5 | 2.2 | 67.2 | 0.6 | 2.7 | 55.1 | 0.6 | 3.2 | 45.2 | 0.6 | 3.7 | 37.5 | 0.7 | 4.2 | 31.4 | 0.7 | 4.2 | 31.4 | 0.7 | 4.8 |
| 75 | 180.3 | 0.5 | 1.3 | 126.6 | 0.5 | 1.7 | 94.4 | 0.5 | 2.2 | 72.0 | 0.6 | 2.7 | 59.0 | 0.6 | 3.2 | 48.4 | 0.6 | 3.7 | 40.1 | 0.7 | 4.2 | 33.6 | 0.7 | 4.2 | 33.6 | 0.7 | 4.8 |
| 80 | 192.3 | 0.5 | 1.3 | 135.0 | 0.5 | 1.7 | 100.7 | 0.5 | 2.2 | 76.8 | 0.6 | 2.7 | 63.0 | 0.6 | 3.2 | 51.6 | 0.6 | 3.7 | 42.8 | 0.7 | 4.2 | 35.9 | 0.7 | 4.2 | 35.9 | 0.7 | 4.8 |
| 85 | 204.3 | 0.5 | 1.3 | 143.5 | 0.5 | 1.7 | 107.0 | 0.5 | 2.2 | 81.6 | 0.6 | 2.7 | 66.9 | 0.6 | 3.2 | 54.9 | 0.6 | 3.7 | 45.5 | 0.7 | 4.2 | 38.1 | 0.7 | 4.2 | 38.1 | 0.7 | 4.8 |
| 90 | 216.4 | 0.5 | 1.3 | 151.9 | 0.5 | 1.7 | 113.3 | 0.5 | 2.2 | 86.4 | 0.6 | 2.7 | 70.8 | 0.6 | 3.2 | 58.1 | 0.6 | 3.7 | 48.1 | 0.7 | 4.2 | 40.3 | 0.7 | 4.2 | 40.3 | 0.7 | 4.8 |
| 95 | 228.4 | 0.5 | 1.3 | 160.3 | 0.5 | 1.7 | 119.6 | 0.5 | 2.2 | 91.2 | 0.6 | 2.7 | 74.8 | 0.6 | 3.2 | 61.3 | 0.6 | 3.7 | 50.8 | 0.7 | 4.2 | 42.6 | 0.7 | 4.2 | 42.6 | 0.7 | 4.8 |
| 100 | 240.4 | 0.5 | 1.3 | 168.8 | 0.5 | 1.7 | 125.9 | 0.5 | 2.2 | 96.0 | 0.6 | 2.7 | 78.7 | 0.6 | 3.2 | 64.5 | 0.6 | 3.7 | 53.5 | 0.7 | 4.2 | 44.8 | 0.7 | 4.2 | 44.8 | 0.7 | 4.8 |
| 105 | 252.4 | 0.5 | 1.3 | 177.2 | 0.5 | 1.7 | 132.2 | 0.5 | 2.2 | 100.8 | 0.6 | 2.7 | 82.6 | 0.6 | 3.2 | 67.8 | 0.6 | 3.7 | 56.2 | 0.7 | 4.2 | 47.1 | 0.7 | 4.2 | 47.1 | 0.7 | 4.8 |
| 110 | 264.4 | 0.5 | 1.3 | 185.7 | 0.5 | 1.7 | 138.5 | 0.5 | 2.2 | 105.6 | 0.6 | 2.7 | 86.6 | 0.6 | 3.2 | 71.0 | 0.6 | 3.7 | 58.8 | 0.7 | 4.2 | 49.3 | 0.7 | 4.2 | 49.3 | 0.7 | 4.8 |
| 115 | 276.5 | 0.5 | 1.3 | 194.1 | 0.5 | 1.7 | 144.8 | 0.5 | 2.2 | 110.4 | 0.6 | 2.7 | 90.5 | 0.6 | 3.2 | 74.2 | 0.6 | 3.7 | 61.5 | 0.7 | 4.2 | 51.5 | 0.7 | 4.2 | 51.5 | 0.7 | 4.8 |
| 120 | 288.5 | 0.5 | 1.3 | 202.5 | 0.5 | 1.7 | 151.1 | 0.5 | 2.2 | 115.2 | 0.6 | 2.7 | 94.4 | 0.6 | 3.2 | 77.4 | 0.6 | 3.7 | 64.2 | 0.7 | 4.2 | 53.8 | 0.7 | 4.2 | 53.8 | 0.7 | 4.8 |
| 125 | 300.5 | 0.5 | 1.3 | 211.0 | 0.5 | 1.7 | 157.4 | 0.5 | 2.2 | 120.0 | 0.6 | 2.7 | 98.4 | 0.6 | 3.2 | 80.7 | 0.6 | 3.7 | 66.9 | 0.7 | 4.2 | 56.0 | 0.7 | 4.2 | 56.0 | 0.7 | 4.8 |
| 130 | 312.5 | 0.5 | 1.3 | 219.4 | 0.5 | 1.7 | 163.7 | 0.5 | 2.2 | 124.8 | 0.6 | 2.7 | 102.3 | 0.6 | 3.2 | 83.9 | 0.6 | 3.7 | 69.5 | 0.7 | 4.2 | 58.3 | 0.7 | 4.2 | 58.3 | 0.7 | 4.8 |
| 135 | 324.5 | 0.5 | 1.3 | 227.9 | 0.5 | 1.7 | 170.0 | 0.5 | 2.2 | 129.6 | 0.6 | 2.7 | 106.2 | 0.6 | 3.2 | 87.1 | 0.6 | 3.7 | 72.2 | 0.7 | 4.2 | 60.5 | 0.7 | 4.2 | 60.5 | 0.7 | 4.8 |
| 140 | 336.6 | 0.5 | 1.3 | 236.3 | 0.5 | 1.7 | 176.3 | 0.5 | 2.2 | 134.4 | 0.6 | 2.7 | 110.2 | 0.6 | 3.2 | 90.3 | 0.6 | 3.7 | 74.9 | 0.7 | 4.2 | 62.7 | 0.7 | 4.2 | 62.7 | 0.7 | 4.8 |
| 145 | 348.6 | 0.5 | 1.3 | 244.7 | 0.5 | 1.7 | 182.6 | 0.5 | 2.2 | 139.2 | 0.6 | 2.7 | 114.1 | 0.6 | 3.2 | 93.6 | 0.6 | 3.7 | 77.6 | 0.7 | 4.2 | 65.0 | 0.7 | 4.2 | 65.0 | 0.7 | 4.8 |
| 150 | 360.6 | 0.5 | 1.3 | 253.2 | 0.5 | 1.7 | 188.9 | 0.5 | 2.2 | 144.0 | 0.6 | 2.7 | 118.0 | 0.6 | 3.2 | 96.8 | 0.6 | 3.7 | 80.2 | 0.7 | 4.2 | 67.2 | 0.7 | 4.2 | 67.2 | 0.7 | 4.8 |

RETARDANCE "D" AND "C"

NOTE: Width and Depth dimensions are in feet; Velocity measurements are in feet per second
Depth "D" does not include allowance for freeboard or settlement

H. Sediment Barrier (SB)

Sediment Barrier (SB)



Practice Description

A sediment barrier is a temporary structure used across a landscape mostly on the contour to reduce the quantity of sediment that is moving downslope. The most commonly used barrier is a silt fence (a geotextile fabric that is trenched into the ground and attached to supporting posts and possibly reinforced with a wire fence or polypropylene netting). Other barrier materials could include sand bags, wattles, and various man-made materials and devices that can be used in a similar manner as a silt fence.

This practice applies where sheet and rill erosion occurs on small disturbed areas. Barriers intercept runoff from upslope to form ponds that temporarily store runoff and allow sediment to settle out of the water and remain on the construction site.

Planning Considerations

Sediment barriers may be used on developing sites. It is important that they be installed on the contour so that flow will not concentrate and cause overtopping due to lack of storage capacity. It is also important that the ends of sediment barriers are turned upslope to prevent runoff from bypass around the ends of the barrier. Prevention of scouring, erosion, and undermining at and under sediment barriers is also of utmost importance to ensure maximum impoundment capabilities.

The most commonly used sediment barriers are silt fences and manufactured sediment logs (often referred to as wattles or sediment retention fiber rolls). Manufactured sediment logs should be installed according to manufacturer's recommendations.