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SAFETY POLICY & PROCEDURE

Diving Operations

SPP# 1910.401

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1.0 Purpose

The purpose of this Safety Policy and Procedure (SPP) is to establish guidelines for the protection and safety of North Carolina Department of Transportation (NCDOT) employees who perform diving operations.

2.0 Scope and Applicability

Underwater diving operations can present substantial risks to employees who perform diving if safe practices and procedures are not followed. Underwater obstructions and improper diving techniques can present hazards to NCDOT employees who perform diving operations.

This SPP will aid NCDOT employees who perform diving operations. It includes provisions for training and a listing of general dive team requirements. Procedures are presented for pre-dive activities, dive activities, and post-dive activities. Additionally, information is presented on Self-Contained Underwater Breathing Apparatus (SCUBA) diving, surface-supplied air diving, and liveboating. Equipment and recordkeeping requirements are also detailed.

This document also details the areas of responsibility for managers/unit heads, dive team leads, employees, dive team members, designated person-in-charge, **Structure Management Unit** and Safety and Risk Management (SRM) within NCDOT.

This SPP affects any bridge employee who because of job duties are involved in diving operations.

This SPP affects any NCDOT employee who may serve in a support roll for diving operations.

3.0 Reference

This SPP is established in accordance with Occupational Safety and Health Standards for General Industry (CFR 1910.401-440) and for Construction (1926.1071-1091). As a minimum, Division/Work Units OSH Systems shall be developed and maintained based upon these documents and other specific Division/Work Unit standards and regulations, where applicable. (E.g., Reference materials are not limited to and may include but not limited too statutory requirements, federal standards, general statutes, local standards, manufacture instructions, conscious standards, and best industry practices. All employees must review specific standards/requirements related to the job performing.

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29 CFR 1910 Subpart T	29 CFR 1926 Subpart O	29 CFR 1926 Subpart Y
29 CFR 1915.6	29 CFR 1917.1(a)(2)(iii)	29 CFR 1918.1(b)(2)
29 CFR 1910.147	29 CFR 1910	29 CFR 1910
46 CFR 197.204 Subpart B - CDO	CPL 02-00-151 - CDO (NCDOL)	Consensus Standards for Underwater and CDO (Association of Diving Contractors International)
NCDOT Underwater Inspection General Operation Procedures and Safe Practices Manual (required manual)	U.S. Navy Diving Manual	IG 047-Public Safety Diving (NCDOL)
NCDOL Field Operations Manual (FOM) Chapter IV - Violations	NCDOL FOM Chapter V - Citations	NCDOL FOM Chapter VI – Penalties

4.0 Policy

It is the policy of NCDOT to provide a place of employment that is free from recognized hazards that cause or are likely to cause death or serious physical harm to employees or the public. Therefore, diving operations will not be performed until all hazards are eliminated or minimized. When diving hazards exist that cannot be eliminated, engineering practices, administrative practices, safe work practices, Personal Protective Equipment (PPE), and proper training regarding Diving will be implemented. These measures will be implemented to minimize those hazards to ensure the safety of employees and the public.

5.0 General Responsibilities

It is the responsibility of each manager/unit head, dive team leads, dive team members, and employees to ensure implementation of NCDOT's SPP on Diving. It is also the responsibility of each NCDOT employee to report immediately any unsafe act or condition to the supervisor. Specific responsibilities are found in Section 6.3.

6.0 Procedure

This section provides applicable definitions, establishes general provisions, and identifies responsibilities required by NCDOT's SPP on Diving.

6.1 Definitions

ACFM

Actual Cubic feet per minute. A unit of volumetric flow.

Bottom Time

The total elapsed time measured in minutes from the time the diver leaves the surface in descent to the time the diver begins ascent.

Bursting Pressure

The pressure at which a pressure containment device would fail structurally.

Cylinder

A pressure vessel for the storage of gases.

Decompression Sickness

A condition with a variety of symptoms which may result from gas or bubbles in the tissue of divers after pressure reduction.

Decompression Table

A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

Dive Location

A surface or vessel from which a diving operation is conducted.

Dive Team

Divers and support employees involved in a diving operation, including the designated person-in-charge.

Diver

An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Diver-Carried Reserve Breathing Gas

A supply of air or gas sufficient under standard operating conditions to allow the diver to reach the surface or another source of breathable air.

Diving Mode

A type of diving requiring specific equipment, procedures, and techniques.

FSW

Feet of sea water (or equivalent static pressure head).

Liveboating

The practice of supporting a surface-supplied air or mixed gas diver from a vessel which is underway.

SCUBA Diving

A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

Standby Diver

A diver at the dive location available to assist other divers.

Umbilical

The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power or heat.

Working Pressure

The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

6.2 General Provisions

This section details the provisions of this **SPP** with each provision discussed in a separate subsection. These provisions are:

Training	General Requirements	Pre-Dive Procedures
Procedures During Dive	Post-Dive Procedures	SCUBA Diving
Liveboating	Equipment	Surface-Supplied Air Diving
Recordkeeping		

6.2.1 Training

NCDOT employees will have the experience or training necessary to perform assigned tasks in a safe manner. All training shall be recorded in the Learning Management System however, hard copy rosters and training syllabuses shall be maintained locally. Dive supervisors are responsible for ensuring all dive team members receive the following training in:

The proper use of equipment and tools	The techniques of the assigned diving mode
Dive operations and emergency procedures	Cardiopulmonary Resuscitation (CPR)
First Aid – utilizing the approved divers first aid	Physics or physiology for those exposed to or who control the exposure of others to hyperbaric conditions

6.2.2 General Dive Team Requirements

Dive Team Leads will assign tasks to dive team members in accordance with training and experience. All training will be supervised to ensure competency and accuracy in the given assignments.

All training shall be recorded in the Learning Management System however, hard copy rosters and training syllabuses shall be maintained locally.

No employee will be asked to perform dives that are inconsistent with their level of training. NCDOT will provide at each dive location a Safe Practice Manual.

The Safe Practice Manual shall be reviewed at least annually for completeness or when change notices are published. This review shall record by date completed, by whom (Printed Name and Signature), changes noted/no changes required.

The Safe Practice Manual will be available to each dive team member and contain the following information.

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A copy of this SPP	Safety procedures and checklist for diving operations	Assignments and responsibilities of the dive team members
Equipment procedures and checklists	Emergency procedures for fire, equipment failure, adverse environmental conditions, and illness and injury	

6.2.3 Pre-Dive Procedures

The following equipment and information will be provided at each dive location for all employees to review prior to the dive. Dive team leads are responsible for ensuring this information is available and accurate.

All tool and equipment shall be inspected for condition and serviceability prior use and entry into water. Unserviceable equipment shall not be used and tagged out of service	A list of emergency aid facilities, hospitals, available physicians, and transportation available at the location (with contact information)
A physician-approved first aid kit consistent with the dangers posed by diving	The nearest U.S. Coast Guard Rescue Coordination Center
An American Red Cross standard first aid handbook or its equivalent	A bag-type manual resuscitator with transparent mask and tubing Planning a diving operation will include an assessment of the safety and health <u>aspects of:</u>
Diving mode	Surface and underwater conditions and hazards
Thermal protection	Breathing gas supply (including reserves)
Dive team assignments and physical fitness of dive team members including any known impairments	Diving equipment and systems
Decompression and treatment procedures (including altitude corrections)	Repetitive dive designation or residual inert gas status of dive team members
Emergency procedures	

6.2.4 Procedures During Dive

The following dive procedures will be outlined prior to the dive and all dive members will be trained in the proper methods and use of equipment.

A ladder or platform capable of supporting the diver will be provided for safely entering and exiting the water. The ladder or platform will extend below the water surface to ensure a proper foot and handhold	A means will be provided to assist injured divers onto the vessel and out of the water.
An operational two-way communication system will be available at each dive location to obtain emergency assistance. In addition, a communication system will be used between each surface-supplied air or mixed gas diver and a dive team member at the dive location.	Dive profiles for each diver will be maintained including depth-time, gas change schedules, and decompression tables, if necessary.
Decompression, repetitive, and no decompression tables (as appropriate) shall be at each dive location.	Power tools will be de-energized prior to entry or removal from the water.
Welding and burning current will be supplied with a switch to interrupt the current flow. The switch shall be tended by a dive team member in voice communication with the diver performing the welding or burning.	Welding equipment will be properly grounded to prevent shock hazards.
Welding cables and equipment will be maintained in excellent condition.	Welders will be provided with insulating gloves.
Explosives will be handled only by qualified employees and according to NCDOT's SPP on Explosives.	<i>All dives will be terminated when any of the following situations occur:</i>
<i>A diver requests termination</i>	<i>A diver fails to answer or respond correctly to communications or signals from a dive team member</i>
<i>Communication is lost and cannot be quickly re-established</i>	<i>A diver begins to use diver-carried reserve breathing gas or the dive location reserve breathing gas</i>

6.2.5 Post-Dive Procedures

After any dive, the dive team leads at the dive location will complete the following post-dive procedures.

Explosives will be handled only by qualified employees and according to NCDOT's SPP on Explosives.	<i>All dives will be terminated when any of the following situations occur:</i>
<i>A diver requests termination</i>	<i>A diver fails to answer or respond correctly to communications or signals from a dive team member</i>
<i>Communication is lost and cannot be quickly re-established</i>	<i>A diver begins to use diver-carried reserve breathing gas or the dive location reserve breathing gas</i>

For each dive performed, a record will be maintained which includes the following.

Date, time, and location of dive	Names of dive team members and the supervisor in charge	Diving modes used
General nature of work performed	Approximate underwater time and water conditions	Maximum depth and bottom time for each diver

6.2.6 SCUBA Diving

When SCUBA diving, the following rules will be observed.

Diving will not be conducted at depths greater than 130 FSW	Diving will not be conducted at depths greater than 100 FSW unless a decompression chamber is available	Diving will not be conducted against currents exceeding one knot unless line-tended or enclosed
A standby diver will be on location while a diver is in the water	A diver will be line-tended or accompanied by another diver in continuous visual contact in water depths greater than 6 feet, unless there is increased risk of entanglement	A diver will be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces
<i>A diver-carried reserve breathing gas supply will be provided for each diver consisting of:</i>	<i>A manual reserve (J valve)</i>	<i>An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus except physical space does not permit</i>
<i>The valve of the reserve breathing apparatus being in the closed position prior to the dive</i>		

6.2.7 Surface-Supplied Air Diving

The following rules will be observed when using surface-supplied air.

Surface-supplied air diving will be limited to a depth of 190 FSM	A decompression chamber will be provided for dives exceeding 100 FSW	Each diver will be continually tended while diving
A diver will be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces	Each operation will have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression, if applicable	A diver-carried reserve breathing gas supply will be provided except when heavy gear is worn or where physical space does not permit
A standby diver will be on location while a diver is line-tended in the water		

6.2.8 Liveboating

The following rules will be observed when performing liveboating operations.

Liveboating will not be allowed in rough seas which significantly impede diver operation	Liveboating will only be conducted in daylight hours	The propeller will be stopped prior to divers entering/ exiting the water
A device will be used to minimize the possibility of hose entanglement in the prop	Two-way voice communication will be used between the vessel's operator and the designated person-in-charge	A standby diver will be available while a diver is in the water
A diver-carried reserve breathing gas supply will be used by each diver		

6.2.9 Equipment

Each piece of equipment will be maintained in excellent working condition and inspected and tested prior to each dive. Unserviceable shall be tagged out of service and not used. Typical dive equipment includes.

Air compressor	Hoses	Umbilical/s	SCUBA tanks
Gauges	Masks and helmets	Weight belts	Safety harnesses
Flotation devices	Wet/Dry Suits	Gloves	Fins

Any **approved** modifications or repairs will be logged indicating the type of repair performed, the date of the repair, and the initials of the person performing the repairs.

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Air compressors will be fitted with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve. Each compressor will also comply with the following requirements.

Each inlet will be located away from areas containing exhaust gas or other contaminants	<i>Respirable air from the air compressor that is supplied to a diver will contain:</i>	<i>A level of carbon monoxide no greater than 20 ppm, to be lab tested annually</i>
<i>A level of carbon dioxide no greater than 1,000 ppm</i>	<i>A level of oil mist not greater than 5 milligrams per cubic meter</i>	<i>No noxious or pronounced odor</i>
The outlet of the air compressor system will be tested for air purity every 6 months	Hoses will have a rated bursting pressure at least equal to 4 times the working pressure.	Hoses will be tested at least annually to 1.5 times their working pressure.
All hoses will have the ends taped, capped, or plugged when not in use.	Hose connectors will be made of corrosion-resistant material and be designed in such a way as to prevent accidental disengagement.	

SCUBA tanks will be stored in a secure manner to prevent falling or being knocked over. These tanks are not provided with valve caps.

Umbilical/s will be marked in 10-foot increments to 100 feet beginning at the diver's end, and in 50-foot increments thereafter.

Gauges indicating diver depth will be used for all dives except SCUBA dives. Each gauge will be deadweight tested or calibrated against a master reference gauge every 6 months. Also, these gauges will be tested when there is a discrepancy greater than two (2) percent of full scale between any two (2) equivalent gauges.

Each SCUBA diver will wear a cylinder pressure gauge capable of being monitored by the diver during the dive.

Masks and helmets for surface supplied air and mixed gas will be equipped with an exhaust valve and a non-return valve. These valves will be located at the attachment point between the helmet or mask and hose and will close readily and positively. Masks and helmets will have a minimum ventilation rate of 4.5 ACFM at any depth at which they are operated.

Weight belts and safety harnesses will be provided to each diver. The weight belt or assembly will be capable of quick release.

A safety harness with a positive buckling device and with an attachment point will be worn, except when heavy gear or SCUBA equipment is used. Except when heavy gear is worn or when SCUBA diving, a safety harness will be worn with a positive buckling device and an attachment point.

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Flotation devices capable of being inflated and maintaining the diver at the surface in a face-up position will be used in SCUBA diving. This inflatable flotation device will have a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve. A buoyancy compensator will have an inflation source separate from the breathing gas supply.

6.2.10 Recordkeeping

If an employee/s that are on the job suffer a fatality/serious injury resulting in emergency medical treatment care, hospital transport, hospitalization, Loss of one eye, or amputation a report outlining the incident and the extent of any injuries suffered in the accident is required (Phone call to the unit management, Director, SRM is required, and local safety staff with completion a 7-line yellow card forwarded to Director, SRM)

Additionally, all recordkeeping requirements outlined in NCDOT's safety program are also applicable. These records will be maintained at the division office for review by NCDOT accident investigators, at the request of employees' designated representative, or any state agency authorized to view such documents.

All records will be maintained on file for a period of 5 years, except for the Safe Practice Manual which will be replaced as changes in equipment or procedures are implemented.

6.2.11 Bloodborne Pathogens (Reference: Bloodborne Pathogens SPP#1910.1030)

The Dive Team Unit shall develop, publish, and train to the exposure control plan.

Bridge Inspector Divers, DOH, NCDOT have been identified as Category II task employees. These divers are required to work in water bodies where the level of contamination varies. While they are not categorized as a classification that would be required to perform Category I tasks, they do have an elevated risk of acquiring the Hepatitis B Virus from possible exposure to contaminated water bodies.

Category I: Tasks that involve exposure to blood, body fluids, or tissues. All procedures or other job-related tasks that involve an inherent potential for mucous membrane or skin contact with blood, body fluids, or tissues, or a potential for spills or splashes of them are Category I tasks. Category I tasks are those normally associated with frequent and repetitive handling and working directly with blood products such as those performed by physicians, nurses, Emergency Medical Technicians (EMTs), etc. These jobs by design require an almost constant exposure to the potential for infection

Category II: Tasks that involve no exposure to blood, body fluids, or tissues, but employment may require performing unplanned Category I tasks. The normal work routine involves no exposure to blood, body fluids or tissues, but exposure may be required as a condition of employment.

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Category II tasks are those normally associated with employees whose primary job function does not require them normally to be exposed to blood or body fluids but who are trained to respond to emergency medical situations and are distinctly identified as emergency responders by the organization. This does not include all employees who have received employer provided first aid and Cardiopulmonary Resuscitation (CPR) training, but only those specifically designated as emergency responders.

Others who are trained and respond to emergencies do so as a “good Samaritan” and should also follow all universal precautions. Category II tasks also include employees that may be exposed to biological hazards while performing tasks such as Bridge Inspection Divers and Rest Area Custodians. Those employees identified in Category II tasks are offered vaccinations free of charge prior to exposure for Hepatitis B Virus should they desire. If the employee declines the vaccination, he or she is required to signify this in writing using Appendix A.

All NCDOT dive team employees shall receive training in Bloodborne Pathogens at the time of initial assignment to tasks where occupational exposures are “reasonably anticipated” to occur and at least annually thereafter. Training shall be documented and recorded in current Electronic Training Recordkeeping System which is LMS, 2022:

- A copy of the regulatory text of this standard is available for review by any employee.
- NCDOT Exposure Control Plan for Bloodborne Pathogens shall be reviewed.
- Location and proper use of PPE, proper work practices, and the concept of
- Universal Precautions as it applies to their work practices.
- The meaning of color coding or other methods used to designate and dispose of contaminated articles or infectious waste.
- The actions to take if there is personal exposure to fluids or tissues, appropriate reporting procedures, and the medical monitoring recommended in cases of needle-stick injuries or other exposure to blood or body fluids.
- Information on the Hepatitis B vaccine, including information on its safety, method of administration, the benefits of being vaccinated, and that a preexposure vaccine is offered free of charge for Category I and II employees, and post-exposure vaccines free of charge for all employees who encounter an occupational exposure.
- Information on the post-exposure evaluation and follow-up that NCDOT provides for the employee following an exposure incident.

Pre-exposure vaccinations. Employees identified as having Category I or II work tasks will be provided at no cost the Hepatitis B vaccination. If the employee refuses the HBV vaccination, must sign a Hepatitis B vaccination declination form (See Appendix A). When completed, this form must be retained indefinitely in the employee’s file. If an employee has received an HBV vaccination from a previous employer, evidence of that vaccination must be obtained by the employee and placed in the employee’s file

Tighter testing and revaccination. Currently, the HBV vaccination is expected to last 10 years. It is recommended that employees be provided a to determine if the HBV Vaccination is still active or is a revaccination (sometimes called a booster) is required,

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this determination must be made by a licensed medical professional provided and documented and placed in the employee's file an additional refusal declination is required to be completed.

Post-Exposure Vaccinations. Employees who report work-related exposure will be provided at no cost a Hepatitis B vaccination. If the employee refuses the HBV vaccination, they must sign a Hepatitis B vaccination declination form (See Appendix A). When completed, this form must be retained indefinitely in the employee's file. If an employee has received an HBV vaccination from a previous employer, evidence of that vaccination must be obtained by the employee and placed in the employee's file.

Post-exposure medical evaluation will be provided at no cost through Safety & Risk Management Worker's Compensation third party administrator. A Workers Compensation claim must be filed for exposure to Bloodborne Pathogens. Medical counseling for any employee found, because of the monitoring described above, to be seropositive for HBV or HIV, will be provided at no cost. Counseling guidelines have been published by the Public Health Service. For detailed information, reference the Occupational Safety & Health Bloodborne Pathogen Standard 29 CFR 1910.1030.

Following a report of an exposure incident, a confidential medical evaluation and follow-up shall be made available to the exposed employee. The medical evaluation and follow-up provided by the physician shall include the following as a minimum:

- Documentation of routes of exposure and circumstances under which the exposure occurred
- Identification and documentation of source individual unless prohibited by law. Results of source individual testing shall be made available to the exposed employee. (If the source denies permission for testing, the local or state health director may order testing of the source if that director determines that the exposure poses a significant risk of transmission of HIV and that the source is at high risk for HIV infection.)
- Testing of the exposed employee's blood by consent.
- Post-exposure vaccination and treatment, when medically indicated, as recommended by the United States Public Health Service.
- Counseling and evaluation of reported illnesses.

NCDOT Safety and Risk Management Workers Compensation unit shall ensure that the physician or healthcare professional responsible for medical evaluation is provided with a copy of 29 CFR 1910.1030 (Bloodborne Pathogen Standard).

NCDOT shall maintain records at the Division/Unit level for each employee involved in a Category I task or for Category II and III employees who have been exposed to bloodborne pathogens for a minimum period of their employment duration plus 30 years.

All employee medical records shall remain confidential. No information regarding employee medical information is to be disclosed or reported to any person outside the workplace except as may be required by law.

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Employee medical and training records shall be provided upon request for examination and copying to the subject employee and to anyone having the express and written consent of the employee.

Copies of medical records shall be transferred to successor employer if employees leave NCDOT employment

OSHA Recordkeeping. Required OSHA Records shall be maintained in accordance with (OSHA Recordkeeping – SPP# 1904) please review document and noting paragraph 6.

6.3 Specific Responsibilities

6.3.1 Managers & Unit Heads

Managers/Unit Heads are responsible for ensuring that adequate funds are available and budgeted for the purchase of diving equipment and related supplies in their areas. Managers/Unit Heads will obtain and coordinate the required training for the affected employees. Managers/Unit Heads will also ensure compliance with this safety policy and procedure through their auditing process. The management/unit head staff shall prepare and submit budgetary requirements to ensure adequate financial resources for implementation of this inspection program to include programmed/projected equipment life cycle replacement, equipment failures/malfunctions replacement, equipment repair, breathing air testing requirements, and other out-year program projections with appropriate justifications.

6.3.2 Dive Team Leads & Supervisors

Dive team leads are responsible for ensuring that employees do not perform diving activities unless they have been trained. Dive team leads will also assign tasks to dive team members in accordance with training and experience. Dive team leads on the dive team will be designated as the person-in-charge. Dive team leads will be responsible for all aspects of the dive operation and will be present at each dive location to ensure dive team members' safety. They are also responsible for ensuring that all the pre-dive and post-dive procedures are performed. **Dive team leads** will also ensure that all diving equipment is properly inspected and maintained. Any defective diving equipment will be identified and removed from service for repair.

The NCDOT supervisory work unit staff shall submit budgetary requirements to shall prepare and submit budgetary requirements to ensure adequate financial resources are requested for implementation of this inspection program to include programmed/projected equipment life cycle replacement, equipment failures/malfunctions replacement, equipment repair, breathing air testing requirements, and other out-year program projections with appropriate justifications.

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Dive team leads shall create pre-dive accident plan and brief this plan to dive team members. Dive team pre-accident plans must be provided to on-site/location support staff. This plan must include external and internal emergency response support information, phone numbers, and other actions that maybe required.

6.3.3 Employees

Employees (to include dive support staff) shall comply with all applicable guidelines contained in this SPP. Employees shall inform Supervisor/s and lead diver of safety concerns prior to diving.

6.3.4 Dive Team Members

Dive team members are responsible for complying with all the applicable provisions of this SPP. They will report any unsafe condition immediately to their dive team lead at any point in a dive operation. Dive team members are responsible for inspecting their dive equipment prior to use and following good maintenance practices for the care of their diving equipment to include first aid kits and manual respirators.

6.3.5 Structures Management Unit

6.3.6 Division/Work Unit Safety Consultants/ Engineers/ Officers/ Coordinators/Collateral Duty Safety Officers

Division/Work Unit Safety Consultants/Engineers/Officers/Collateral Duty Safety Officers will provide consultative and audit assistance to ensure effective implementation of this SPP. External work unit support report request must be in writing.

6.3.7 Safety & Risk Management

Safety and Risk Management will provide prompt assistance to managers/unit heads, supervisors, or others as necessary on any matter concerning this SPP. Additionally, Safety Engineers, Consultants, or Officers will provide consultative and audit assistance to ensure effective implementation of this SPP.

7.0 Reporting Safety Concerns

ANYRISK is a safety reporting tool for NCDOT personnel. NCDOT Employees may report safety concerns anonymously, if desired (24/7/365) using the following.

1. <https://connect.ncdot.gov/anyrisk>
2. 1-866-361-1818