Guideline Name:		Department:
Powered Air Purifying Respirators		Orange County Emergency Services EMS Division

Effective Date:	Issued:	Approval(s):
July 24, 2023 **Revised Date:**	July 19, 2023	Kim Woodward, EMS Division Chief Chris Pope, EMS Deputy Division Chief/ Infection Control Officer

Scope

This procedure applies to all Orange County Emergency Services EMS Division personnel whose work assignment requires the use of a powered air-purifying respirator (PAPR).

Purpose

This policy is intended to describe how the Orange County Emergency Services EMS Division safely and effectively utilizes PAPRs to protect against exposure to airborne and respiratory hazards in accordance with 29 CFR 1910.134 OSHA Respiratory Protection Standard.

Permissible Practice

Indications

- As directed by Orange County Emergency Services SOG GEN-029 Respiratory Protection Policy or other departmental directives and/or applicable policies.
- Any instance where an employee should utilize respiratory protection against airborne and respiratory hazards.
- Most commonly in the EMS setting the use of a respirator is indicated for patients who require airborne precautions based on guidelines from the CDC or who exhibit signs and symptoms consistent with the potential for airborne transmission.
- Airborne precautions apply, but are not limited to, the following airborne-transmitted diseases when either suspected or confirmed:
    - Pulmonary or laryngeal tuberculosis/*Mycobacterium tuberculosis*
    - Primary varicella/chickenpox
    - Disseminated herpes zoster/varicella/shingles involving more than two dermatomes and/or in an immune suppressed patient
    - Measles (rubella)
    - Aerosolizable spore-containing powders such as Anthrax/*Bacillus anthracis*

- Aspergillosis (if massive soft tissue infection with copious drainage and repeated irrigation required)
- Monkeypox/Monkeypox virus
- Smallpox (variola)/Variola virus
- Severe acute respiratory syndrome/SARS-associated coronavirus (SARS-CoV)
- Novel or emerging pathogens and any other disease for which public health guidelines recommend airborne infection isolation

Limitations of Use

- Do not wear this respirator system to enter areas where:
  - Atmospheres that are oxygen deficient.
  - Contaminant concentrations are unknown.
  - Contaminant concentrations are Immediately Dangerous to Life or Health.
  - Contaminant concentrations exceed the maximum use concentration determined by the Assigned Protection Factor (APF) for the specific respirator system.
- Atmospheres that are flammable or explosive.
- Immediately exit the contaminated area if any of the PAPR assembly alarms activate.
- Do not use in environments subject to high magnetic fields (ex. MRI).

Specifications

Air flow	Greater than 6 cfm (170 lpm)
Respirator System Operating Temperature Operating Altitude Range	23ºF to 129ºF (-5 to 54ºC). Motor blower battery alarm will activate when battery pack internal temperature exceeds 130ºF (55ºF). Motor blower will shut down if the battery pack temperature reaches 140ºF (60ºC). Approximately sea level to 2600 feet (800 meters).
Storage Temperature (RH < 90%) TR-300 motor blower, HE filter, Battery pack	-22ºF to 122ºF (-30 to 50ºC) NOTE: 40ºF to 95ºF (4 to 35ºC) suggested storage temperature range if product will be stored for an extended period of time before first use. Optimal storage temperature for the battery pack is 59ºF (15ºC).
Shelf Life-Prior to use, when stored in original 3M packaging: 1. Motor/blower 2. Battery pack 3. HE filter	 1. 5 years 2. 9 months 3. 5 years

Battery Pack Chemistry Run Time: Standard – TR-330 High capacity – TR-332 Time to recharge: Standard – TR-330 High capacity – TR-332 Internal charging temperature	Lithium-ion Approximately 4-6 hours Approximately 8-12 hours < 3.0 hours < 3.5 hours Optimal: 60ºF (20ºC) to 95ºF (35ºC) Range: 32ºF (0ºC) to 104ºF (40ºC)
Motor/blower Alarms: Low air flow Low battery pack voltage	 Activates when airflow falls below 6 CFM (170 lpm) for greater than approximately 30 seconds. If alarm condition continues (airflow remains below 6 CFM) for approximately 15 minutes, the TR-300 system will automatically shut down. Activate when approximately 10-15 minutes of power remains. Power down the motor/blower and replace the battery pack and replace the battery pack to reset alarm. This alarm will also activate if the battery pack temperature reaches 130ºF (55ºC).
System Alarm	Audible alarms – 85 dBA at 4 inches (10 cm).
Intrinsic Safety	The TR-300 assembly is not an intrinsically safe system.
Latex	The TR-300 assembly does not contain dry or natural rubber latex.

Definitions & Acronyms

Aerosol generating procedure (AGP): procedures that stimulate coughing and promote the generation of aerosols include such procedures as intubation, manual ventilation, suctioning of the respiratory tract and noninvasive ventilation (CPAP).

Assign protection factor (APF): the workplace level of respiratory protection that a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program.

CDC: Centers for Disease Control and Prevention.

Cleaning: removal of all soil (organic and inorganic) and foreign material from objects and surfaces which is typically accomplished with water and mechanical action and sometimes with assistance from detergents.

Disinfection: a process of inhibiting or destroying disease-producing microorganisms (but may not kill bacterial spores) usually involving the use of chemicals, heat, and/or ultraviolet light.

EMS: Emergency Medical Services.

Fit test: the use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual.

High efficiency particulate air (HE or HEPA) filter: a filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

NEMO: New Employee Orientation.

NIOSH: National Institute for Occupational Safety & Health.

OCES: Orange County Emergency Services.

Operative IQ: A web-app utilized by OCES personnel to document daily equipment inspections and check offs.

OSHA: Occupational Safety and Health Administration.

PHLCP: Licensed Health Care Professional.

Positive pressure respirator: a respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR): an air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Service life: the period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Shared use respirator: A PAPR assembly that is used by more than a single individual.

Respiratory Protection Program

- This policy is intended to supplement the Orange County Emergency Services SOG GEN-029 Respiratory Protection Policy which is located on the private departmental internet website.
- The designated Respiratory Protection Officer is responsible for addressing any discrepancies noted between this policy and GEN-029 Respiratory Protection Policy.

Selection of Respirators

- The 3M TR-300 PAPR assembly, as described in this policy, is the primary respiratory protection provided to employees of the EMS Division.
- If used following all manufacturer recommendations, this PAPR assembly provides an APF of at least 25 and when utilized with alternative headcovers, may provide an APF of up to 1,000.
- This PAPR assembly requires the use of a HEPA filter which is selected based on the most common respiratory hazards found in the healthcare setting. Applications such as decontamination, or environments with fumes, vapors or gases are not suitable for this filter and are not considered in the scope of this policy.
- This PAPR assembly is NIOSH-certified and the respirator shall be used in compliance with the conditions of its certification.

Medical Evaluation

- In accordance with 1910.134(e), OCES shall provide a medical evaluation to determine the employee's ability to use a respirator. All employees are required to complete a medical evaluation, performed by a physician or PLHCP, before using a PAPR.
- New employees hired into the EMS Division will complete a medical evaluation during NEMO or before beginning Field Training and Evaluation.
- Employees must receive approval for use from the designated Respiratory Protection Officer after completing a medical evaluation.

Fit Testing

- The selected PAPR is a positive pressure assembly that does not utilize a tight-fitting facepiece.
- There are no fit testing requirements associated with the use of the department-issued PAPR assembly.

Use of Respirators

Daily & Before Use Inspections

- Employees are required to arrive to work each shift prepared with their issued headcover in its protective case. This is a job performance expectation as defined in EMS SOG Safety and Personal Protective Equipment Policy. Failure to have an issued headcover readily available for each patient encounter is considered a disregard of departmental safety precautions, can result in a delay to the provision of patient care and place the employee, patient and organization at risk and is considered unacceptable job performance.
- Employees are required to inspect each PAPR assembly during daily equipment checkoffs and to document findings in Operative IQ.
- It is recommended that employees repeat some parts of the inspection before and after each entry into a contaminated area.

PAPR Inspection

1. PAPR system: Visually inspect the entire PAPR system including the motor blower, cover, filter, breathing tube, battery pack, belt, issued headgear. If parts are missing or damaged, contact an EMS Supervisor.
2. Battery pack: Confirm that the battery pack is fully charged and charge is sufficient for duration of the work period. The battery pack must be securely latched to the motor/blower.
3. Breathing tube: Examine the entire breathing tube for tears, holes or cracks. Bend the tube to verify that it is flexible. Ensure the o-rings, located at both ends of the breathing tube (i.e. headgear and air source connections) are present and not damaged. The breathing tube should fit firmly into the air source connection.
4. HE filter (employee must wear gloves when handling; filter should be treated as contaminated):
    a. Inspect filter and seal for dirt, tears, cuts, distortion or indentations. Replace HE filter if any damage is noted or suspected.
    b. Ensure the HE filter is properly installed in the PAPR unit and that the cover latch is secure.
5. Airflow check:
    a. Ensure ball in the air flow indicator moves freely in its tube and the seal at the bottom end of the tube is in place.
    b. Insert the air flow indicator into the outlet on the motor/blower unit. If the breathing tube is in place, it must be removed to allow the air flow indicator to be inserted.
    c. Turn the motor/blower unit on by pushing and holding the power button. Run the TR-300 for 1 minute to allow the air flow to stabilize.
    d. With the airflow indicator in a vertical position, ensure that the bottom of the floating ball rests at, or above, the minimum flow mark. Airflow indicator must be in the vertical position for an accurate reading.
    e. If the airflow indicator ball fails to rise at or above the minimum flow level, do not use the unit. Notify an EMS Supervisor.
6. Check the low airflow alarm by simulating a low airflow condition. With the motor/blower on:
    a. Remove the air flow indicator and tightly cover the outlet of the motor/blower with the palm of your hand. The motor should automatically speed up, attempting to compensate for the low airflow condition.
    b. Continue to press your palm tightly against the end of the outlet, making a tight seal. After approximately 30 seconds, the unit will sound an audible alarm and the red fan shape LED on the top of the motor/blower unit will flash.
    c. Remove your hand from the end of the breathing tube; the audible alarm and the flashing red LED should both stop when the motor returns to a slower speed.

Donning & Doffing: Entering and Exiting the Contaminated Area

1. Turn the motor/blower on.
2. Perform donning procedures based on CDC guidelines.
3. Check airflow and alarms.
4. Don the PAPR assembly and headgear. Enter the work area.
5. Leave the contaminated area immediately if any of the following conditions occur:
    a. Any part of the system becomes damaged.
    b. Airflow into the respirator decreases or stops.
    c. The low airflow or low battery alarms trigger. In the event only an audible or only a visual alarm triggers, the user should immediately leave the contaminated area.
    d. Breathing becomes difficult.
    e. You feel dizzy or your vision is impaired.
    f. You taste or smell contaminants.
    g. Your face, eyes, nose or mouth become(s) irritated.
    h. You suspect that the concentration of contaminants may have reached levels at which this respirator may no longer provide adequate protection.
6. Do not remove the respirator or reach your hand into the headgear in areas where the air is contaminated.
7. Follow specific exiting, doffing and decontamination procedures for turning off the motor/blower and removing the PAPR assembly based on CDC guidelines.

Considerations During Patient Care

- Noise generated by motor blower
- Difficulty communicating
- Battery life
- Kinking or compression of breathing tube
- Maintaining sufficient inlet airflow
- Air inlet position while wearing seatbelt in patient compartment

Maintenance and Care of Respirators (Cleaning and Storage)

Cleaning & Decontamination

- At a minimum, employees must wear gloves when cleaning respirators and should perform hand hygiene upon completion.
- Shared use respirators, which are respirators issued to more than one individual, shall be cleaned and disinfected before and after being worn by different individuals.
- Respirators, and all components, shall be cleaned and disinfected after each use.
- Issued PAPR headcovers should be cleaned after each use.

- All cleaned or disinfected assembly components should be thoroughly dried before being stored.
- Headcovers should not be soaked, placed in a washing machine, sterilized with steam or disinfected with unapproved chemicals.
- Motor/blower: Clean the outer surfaces of the PAPR assembly and battery pack with a soft cloth dampened in a solution of water and mild, pH neutral detergent. Do not immerse the motor/blower or battery pack in water. Do not use solvents or abrasive cleaners. Do not attempt to clean the interior of the motor/blower with compressed air or vacuum. Ensure the electrical contracts of the motor/blower and battery pack are dry.
- Breathing tube: Clean the connection sites on the breathing tube with the water and detergent solution. The breathing tube can be immersed in water for cleaning. The inside of the tube must be completely dried prior to use or storage. Air dry, or dry by connecting the motor/blower and use it to force air through the tube until dry.
- HE filter: Open the filter cover and inspect the HE filter. Replace if excessively dirty, wet or damaged. The filter cannot be cleaned and should be considered dirty and contaminated.
- Battery pack: Solvents should not be used to clean the battery pack or charger. Wipe the housing of the battery pack with a soft cloth dipped in a mild cleaning solution or a pre-wetting cleaning wipe.
- If cleaning to remove gross soil before disinfection, clean all parts of the PAPR assembly with a clean soft cloth dampened with warm water containing a mild pH neutral (pH 6-8) detergent. While the breathing tube is still attached to the blower, begin cleaning with the exterior of the breathing tube, then the exterior of the blower/battery. Avoid allowing liquid to enter the breathing tube. Remove the battery, and wipe the top of the battery and the battery cavity of the blower. Avoid wiping the blower pins and battery pads. Wipe the belt and headcover/hood.
- Disinfect the PAPR assembly with the disinfectant cleaner. Surfaces must be visibly wet with disinfectant for the full specified contact time. With breathing tube attached, start by wiping the exterior of the breathing tube and the top of the blower outlet. Remove the breathing tube. Then, taking care not to allow liquid to drip into the blower, disinfect the rest of the blower body, battery, belt, and headcover/hood, avoiding the blower pins and battery pads.
- Acceptable disinfectants
    - 70% isopropyl alcohol
    - 1:10 ratio of bleach to water
    - Hydrogen peroxide 30%
    - Sanicloth Bleach Germicidal Disposable Wipe - Orange Top
    - Stryker Medical SideKick Disinfecting Wipes
- Rinse and remove disinfection solution from the PAPR assembly by wiping with a clean cloth dampened with clean water. Rise the cloth often to help ensure

effective removal of the disinfectant solution. Do not allow liquid to enter the air outlet port. Do not submerge components.

- Dry all components by air completely prior to reuse or storage. Air dry in an uncontaminated atmosphere, temperature not to exceed 120ºF. Breathing tube drying can be accelerated by connecting it to the motor/blower unit and using it to force air through the tube until dry. If using this method, orient the blower and breathing tube in such a way that prevents liquid from entering the blower.

Storage

- All respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they shall be packed or stored to prevent deformation of the facepiece and exhalation valve.
- Respirators should be kept accessible to the work area.
- Respirators should be stored in compartments that are clearly marked as containing emergency respirators.
- Respirators should be stored in accordance with manufacturer instructions.
- Respirators should be stored in temperatures between 40ºF and 95ºF and settings with less than 90% humidity. Batteries perform optimally in temperatures between 68ºF and 77ºF.
- If motor blower will not be used on a regular basis, the motor must be run for 5 minutes annually to ensure proper lubrication and operation. On a monthly basis, the motor blower should be run.
- HE filters should be stored inside the motor blower under conditions that are suitable for the motor blower.
- Belts and air hoses should be stored in provided containers and carefully packaged to avoid compression or kinking.
- Battery packs should be charged before storage including fully recharged after each use and at least monthly. Optimal storage conditions for battery packs include a temperature of 59ºF and dry conditions with relative humidity < 85%. Battery packs may be stored indefinitely on the charger. Battery packs should be disconnected from the motor/blower during storage.
- PAPR headcovers should be labeled with the employee’s name and stored individually in an issued rigid container that is also labeled with the employee’s name. Headcovers should be carefully rolled horizontally across the face shield to prevent unnecessary wear or damage to the face shield. Headcovers should not be folded or crushed in storage. Do not store headcovers near sources of heat.

Repairs

- If a PAPR assembly is found to be in a state of disrepair, the employee should notify an on-duty EMS Supervisor and create a work order in WebEOC

documenting the problem. The PAPR assembly should be removed from service and returned to EMS Logistics for repair.

- The employer shall ensure that respirators that fail an inspection or are otherwise found to be defective are removed from service, and are discarded or repaired by persons appropriately trained to perform such operations and shall use only the respirator manufacturer's NIOSH-approved parts designed for the respirator.
- Repairs shall be made according to the manufacturer's recommendations and specifications for the type and extent of repairs to be performed.

Service Life

- The HE filter must be changed if the low airflow alarm is activated, the air flow as shown by the air flow indicator falls below 6 CFM or the HE filter becomes damaged or wet. Additionally, the HE filter should be replaced as a first step to troubleshooting reduced battery pack run time. HE filters have a shelf life of 5 years.
- Factors that reduce filter/cartridge service life include:
    - Exertion level (work rate)
    - Cartridge variability
    - Temperature
    - Humidity
    - Multiple contaminants
- Battery service life is dependent upon use and storage conditions. If a battery after receiving a full charge only indicates 80% capacity, it should be considered for replacement. A battery pack, under ideal storage conditions, provides 250 charge cycles.
- Headcovers have a shelf life of 3 years when stored in original packaging under recommended storage conditions.

Breathing Air Quality and Use

- The selected PAPR assembly is not an atmosphere-supplying respirator.

Identification of Cartridges, Filters and Canisters

- Orange County Emergency Services utilizes a 3M Versaflo TR-300 PAPR assembly.
- Each PAPR assembly is typically configured using the following components:

Item Description	Part #
HE Filter	TR-3712N
Headcover	S-133
Battery	TR-332
Battery Charger	TR-340
Belt	TR-327
Motor Blower	TR-301N+

Air Flow Indicator	TR-971

- There are alternative 3M Versaflo TR-300 configurations that may be utilized without changes to this policy.
- Any alternative PAPR assembly configuration utilized must provide an equivalent or an enhanced level of respiratory protection.

Training and Information

- Prior to use: Employees must participate in a Medical Evaluation and receive approval for use from the Respiratory Protection Officer.
- Initial education: Employees during NEMO must receive demonstration and hands-on practice, as well as successfully complete LMS assignment consisting of video demonstration, receipt of policy, and quiz. Initial education must be completed before being released to field training.
- Ongoing education: On an annual basis, employees must successfully complete a LMS assignment consisting of video demonstration, receipt of policy and quiz.
- Additional information about the PAPR assembly is readily available on the manufacturer's website. There are general use PAPR resources available on the CDC, NIOSH and OSHA websites.

Program Evaluation

- This policy should be reviewed in conjunction with review of GEN-029 Respiratory Protection Policy.
- This policy may be reviewed on a more frequent basis through a request from the OCES Safety Committee or the Respiratory Protection Officer.

Recordkeeping

- The Respiratory Protection Officer, or designee, will maintain initial and on-going records documenting each employee's approval for use and continued compliance with PAPR training.
- Employees are responsible for completing daily checkoffs of each assigned PAPR assembly in Operative IQ. EMS Supervisors are responsible for ensuring that employees have completed daily checkoffs of each assigned PAPR assembly.
- Employees should document any issue preventing a PAPR assembly from operating normally by competing a work order in WebEOC and notifying an on-duty EMS Supervisor.
- Employees should document each use of a PAPR assembly during patient encounters by selecting the appropriate PPE in ESO.
- If a PAPR is used in a setting that is not documented in ESO, the user should notify the designated Respiratory Protection Officer by email of the PAPR # used, the circumstances of use, the date of use and the duration of use.

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