Getting optimal performance from a powered air-purifying respirator (PAPR) depends on the condition of its battery!

NIOSH Fact Sheet

The guidance in this fact sheet will help respiratory protection program administrators, managers, and powered air-purifying respirator (PAPR) wearers understand the importance of a PAPR's battery in assuring effective respiratory protection. The respiratory protection program administrator should assure that PAPR manufacturer recommendations for battery storage, care, usage, and disposal are addressed. However, an understanding of these requirements by managers and PAPR wearers is also beneficial to ensure personal protection.

The National Institute for Occupational Safety and Health (NIOSH) approves a PAPR as an assembly of components, which are listed on the full NIOSH approval label packaged with the unit. The battery is a crucial component of an approved PAPR assembly and must operate the assembly for a minimum period of four hours. The PAPR must be used with its manufacture-specified battery and provide the NIOSH-required air flow rates.

A NIOSH-approved PAPR may include more than one battery type. However, for each alternate battery there is a specific assembly of components required to assure the PAPR performs to NIOSH standards. Use of components not listed on the NIOSH full approval label for the PAPR and air-purifying component constitutes an assembly not evaluated by NIOSH and may result in serious injury and/or death to the wearer.

If the battery is not in proper operating condition, it may not supply the PAPR with a sufficient charge to perform properly, which could place the PAPR wearer at risk of personal injury or death. Therefore, it is important to know the battery's storage, use, care, and disposal requirements to assure effective personal protection. The instructions supplied with a PAPR might not include all of this information, so it is also essential to reference the instructions provided with the battery and battery charger.

How does one assure a PAPR battery is ready for use?

Manufacturer recommended conditions for storage and use of batteries such as packaging, temperature, and humidity vary significantly among manufacturers even for the same battery type.

Before use, the battery should be inspected. Do not use a battery that has been damaged and shows evidence of leaking chemicals or bulging.

It is important to assure that the battery is stored in accordance with the temperature and humidity specifications provided by the manufacturer including being kept away from exposure to sunlight and heating sources such as

furnaces. In general, excessively high temperatures can reduce battery capacity during both storage and use. If the battery was not stored properly, and its capacity is reduced, the PAPR performance and wearer protection can be adversely affected. The PAPR air flow rate may drop to less than the required level and the PAPR may operate for a reduced period of time than if the battery were stored under manufacturer recommended conditions.

There are two types of batteries used by PAPRs; non-rechargeable batteries are single-use while rechargeable can be conditioned to restored capacity several hundred times. The packaging of non-rechargeable batteries contains an expiration date. These batteries should be kept in their sealed packaging until they are used. They should be disposed of properly when the expiration date is exceeded or when they can no longer provide a sufficient charge to properly operate the PAPR at the manufacturer's specified air flow rate.

Rechargeable batteries may need to be conditioned prior to first use depending on the length of time in storage. If a battery is new, or if it has not been used for an extended period (usually 2 months or longer, depending on the manufacturer's specifications), it will most likely be necessary to "condition" the battery for it to be fully charged. The conditioning process can require several charge and discharge cycles to restore the battery capacity. This activity is most likely performed by the person assigned to maintain the PAPR. Manufacturer's instructions must be followed when carrying out this procedure.

Prior to using a PAPR with either battery type, the PAPR must be tested to assure it is operating at its proper air flow rate. PAPR manufacturers have specific instructions on how to check that the PAPR with battery installed is operating properly. It is important to follow the manufacturer's instructions. In general, the procedure is common for both types of batteries. The battery, along with all components in the NIOSH-approved PAPR assembly, must be installed for this procedure.

With the PAPR turned on, the air flow level is measured with the flow meter provided by the manufacturer, or it will be displayed by the PAPR's battery status indicator. If the air flow level does not meet specifications in accordance with the manufacturer's instructions, or if the PAPR battery status indicator indicates low battery capacity, the non-rechargeable battery should be properly disposed of or the rechargeable battery should be recharged.

Carefully follow the manufacturer's storage and use recommendations supplied with the PAPR, battery, and battery charger. These instructions are located in their individual containers.

What is the correct way to charge and condition a rechargeable battery?

The battery and its charger are uniquely matched. Use only the battery and battery chargers specified in the manufacturer instructions. A single rechargeable battery may have more than one charger specified by the manufacturer.

Several different types of battery chargers and their performance must be considered in setting up a battery-conditioning program. Battery chargers include quick chargers, trickle chargers, conditioning chargers (chargers that automatically charge and discharge the battery), and gang chargers (chargers that charge multiple batteries). Selecting the most appropriate battery charger depends on many factors such as the frequency with which the PAPR is used, the number of available batteries, facility for maintaining and charging batteries, and cost. This activity is most likely be performed by the person assigned to maintain the PAPR.

Remember, an individual assigned to care for and maintain respiratory protective equipment must be knowledgeable of the performance capabilities of the PAPR, its batteries, and battery chargers. Understanding how the charger works is necessary to assure that the battery is maintained with a full charge and is ready for use when needed. A battery-charging program should be implemented that includes a trial to test the PAPR performance before actual use.

Never discharge the battery by short-circuiting its terminals. Follow the PAPR manufacturer's instructions to properly charge and discharge rechargeable batteries.

What is the PAPR in-use service time?

The length of time a PAPR will perform to specifications depends on several conditions including the battery capacity, air-purifying components used on the PAPR, and the environment. Due to the potential for variations in service time, it is important to carefully follow the manufacturer's instructions on how often to check the PAPR air flow or battery status. In general, the air flow level or battery status should be checked prior to use, after 4 hours, and every 2 hours thereafter. The frequency and duration of performing one of these checks is described in the PAPR manufacturer's user instructions.

Sometimes the PAPR air flow during use can drop or stop quickly without advance notice. The instructions for leaving the contaminated environment with the PAPR facepiece/headgear donned or doffed may vary, but should be described in the respiratory protection program for the worksite. If this occurs, the wearer should immediately leave the work area as trained in accordance with procedures in the required respiratory protection program. Replace the battery in a safe clean air location.

Do batteries have safety features?

Some batteries contain special safety features for protection against excessive high temperature, internal pressure, current charge, or current drain. These features protect the battery from damage or prevent it from exploding. Battery safety features can affect the operation of the PAPR. For example, a battery with a safety feature to protect it from over-drain can cause the PAPR to stop abruptly during use. Be aware of the safety features and devices that may be installed in the battery to protect it and

know how it will affect the PAPRs' performance.

Inspect the battery according to the manufacturer's instructions to make sure the features and devices have not been compromised in any way.

Do batteries have special disposal requirements?

Most batteries contain chemicals that are hazardous to the environment and may cause personal injury if mishandled. Most batteries also have special instructions to prepare them for disposal and the PAPR manufacturer may have a program for the return of spent batteries.

Disposal instructions could include properly discharging the battery then placing an insulating tape over the battery terminals, waiting a few days, and then disposing of it in accordance with federal, state, or local governmental regulations. The waiting period is required to assure that the battery is fully discharged before disposal. It is important to follow the PAPR manufacturer's disposal instructions and to check for federal, state, or local governmental regulations.

Where can one obtain more information on managing PAPR batteries?

PAPR manufacturers provide specifications and instructions with the PAPR, batteries, and battery chargers. The complete instructions for battery storage and care may not be in a single document or location. For example, complete information regarding the battery may be located in the PAPR instructions or supplemental battery instructions, and/or battery charger instructions. It may be beneficial to request assistance from the PAPR manufacturer to establish an effective battery management program.

Information on the NIOSH-approved PAPR assembly of components, protection levels, cautions, and limitations is located on the NIOSH paper approval label provided in the PAPR and air-purifying component containers. The NIOSH adhesive approval label affixed on the individual air-purifying canister, cartridge, or filter component will not contain all of this important information.

For more detail on how to read a NIOSH approval label, refer to the NIOSH Fast Fact sheet on *NIOSH Approval Labels—Key Information to Protect Yourself at* http://www.cdc.gov/niosh/docs/2011-179/

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