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December 11, 2006

Docket Nos.: 50-321 50-348 50-424  
50-366 50-364 50-425

NL-06-2611

U. S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Washington, D. C. 20555-0001

Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant

Request For Use Of Radium Hurricane Hood™ Category-2 and Category-3

Ladies and Gentlemen:

Southern Nuclear Operating Company (SNC) has identified the Hurricane Hoods™ manufactured by Radium Inc. as having benefits from contamination control and heat stress reduction. The Hurricane Hood™ is a Non-National Institute for Occupational Safety and Health (NIOSH) certified device, however; it is a successful alternative to devices that create safety issues with heat stress, mental and physical stress, and limited vision.

Pursuant to Title 10 of the Code of Federal Regulations (10 CFR), Section 20.1703 (b), SNC is submitting the following topical report/application for NRC review and approval for SNC use of the Hurricane Hoods™ without an assigned protection factor.

This topical report will demonstrate that the material quality and performance characteristics of the Hurricane Hood™ (Category-2 and Category-3) are capable of providing the desired skin contamination protection and enhanced comfort to the wearer under anticipated conditions of use while not subjecting the wearer to undue physical or psychological stress, or to undue hazard. Such anticipated conditions of use include contamination control and reduction of heat stress.

Hurricane Hood™ (Category-2 and Category-3) PortaCount test results are enclosed.

SNC requests approval by February 1, 2007, to provide sufficient acquisition of Hurricane Hoods™ prior to Refueling Outage for Hatch Unit-2 scheduled to begin February 2007. Approval of this request would improve worker safety in areas of high heat and high potential for facial/skin contamination from hot particles.

This topical report contains no proprietary information.

A001 |

This letter contains no NRC commitments. If you have any questions, please advise.

Sincerely,



Don E. Grissette

DEG/JDG/daj

- Enclosures:
1. Topical Report
  2. The Hurricane Hood™ Solution
  3. Hurricane Hood™ Category (Cat-3) Brochure
  4. Radium Hurricane Hood™ Category-3 (Cat-3) Owners Manual
  5. Radium Hurricane Hood™ Category-2 (Cat-2) Brochure
  6. Radium Hurricane Hood™ Category -2 (Cat-2) Owners Manual
  7. Results of Hurricane Hood™ PortaCount Testing at Indian Point

cc: Southern Nuclear Operating Company  
Mr. H. L. Sumner, Jr., Vice President – Plant Farley  
Mr. L. M. Stinson, Vice President – Plant Hatch  
Mr. J. R. Johnson, General Manager – Plant Farley  
Mr. D. R. Madison, General Manager – Plant Hatch  
Mr. T. E. Tynan, General Manager – Plant Vogtle  
Mr. J. M. Godfrey, Environmental Affairs Manager  
Mr. D. A. Hostetter, Radiological Services Supervisor  
RType: CFA04.054; CHA02.004; CVC7000; LC# 14511

U. S. Nuclear Regulatory Commission  
Dr. W. D. Travers, Regional Administrator  
Ms. K. R. Cotton, NRR Project Manager – Farley  
Mr. R. E. Martin, NRR Project Manager – Hatch  
Mr. R. E. Martin, NRR Project Manager – Vogtle  
Mr. C. A. Patterson, Senior Resident Inspector – Farley  
Mr. D. S. Simpkins, Senior Resident Inspector – Hatch  
Mr. G. J. McCoy, Senior Resident Inspector – Vogtle

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Enclosure 1

Topical Report

Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
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Enclosure 1

Description

The enclosed topical report will demonstrate that the material quality and performance characteristics of the Hurricane Hood™ (Category-2 and Category-3) are capable of providing the desired skin contamination protection and enhanced comfort to the wearer under anticipated conditions of use. Such anticipated conditions of use include contamination control and reduction of heat stress during tasks such as Steam Generator Nozzle Dam Work and Reactor Cavity Decontamination Activities.

Request

Southern Nuclear Operating Company (SNC) requests approval for use of Radium Hurricane Hoods™ (Category-2 and Category-3) to enhance worker comfort, to reduce physiological stress in areas of high ambient temperatures, and to reduce facial and skin contamination events in areas with high surface contamination in close proximity to the face. No respiratory protection factor for airborne radioactive materials is requested for these hoods.

Background

Radium Incorporated (Radium Inc.), located in Lexington, South Carolina, developed the Hurricane Hood™ (patent pending) line of products for use in the nuclear power industry, as a solution to the limitations of other similar anti-contamination devices and other respiratory equipment used as anti-contamination devices. These respirators can be obstructive in close quarters and they can create safety issues with heat stress, limited vision, mental stress, physical stress, etc. In turn, these issues contribute to higher man-rem exposure due to poor worker productivity. The use of Radium Hurricane Hoods™, specifically will reduce man-rem, increase worker efficiency, increase worker mobility, provide an unobstructed field of vision, reduce heat stress, and reduce facial contamination.

Radium Hurricane Hoods™ are one-of-a kind devices that do not claim a protection factor and are used as a personal cooling system. They increase a person's work performance and efficiency by providing a high volume of filtered air for cooling, anti-fogging, and ease of breathing in a very mobile package. By increasing worker performance and efficiency, Radium Hurricane Hood™ usage will cut down on the time it takes to do jobs in radiological areas thereby decreasing worker dose and possibly affect critical path milestones.

The design of the Hurricane Hood™ consists of a clear vinyl hood that completely covers the head of the wearer providing an unobstructed field of vision. It is used in conjunction with a suit that is equipped with exhaust valves, can be modified for exhausting, or is sufficiently porous as to be self venting. The Category-3 model is configured with a thin power belt that supplies power to a blower positioned on the head of the wearer by a head harness assembly. The blower assembly has a filter adaptor that protrudes through the filter opening hole on top of the clear vinyl hood. A filter securing ring is placed on top of the filter adaptor and a National Institute for Occupational Safety and Health (NIOSH) approved HEPA filter is screwed onto the filter adaptor



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Joseph M. Farley Nuclear Plant  
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Enclosure 1

securing the filter and hood in place. The hood provides a high volume of filtered air for ample breathing, antifogging, and full body cooling without any hoses or breathing air system.

SNC intends to use Hurricane Hoods™ in highly contaminated areas, such as placement and removal of steam generator nozzle dams.

In general, use of these devices in highly contaminated areas will involve total effective dose equivalent (TEDE) as low as reasonably achievable (ALARA) evaluations to confirm that respiratory protection is not required. Engineering controls to control airborne contamination (e.g., HEPA filters, etc.) will be employed as appropriate along with Health Physics oversight and sampling to ensure proper oxygen content, as appropriate.

Technical Analyses

Section 20.1703 (b) permits licensees to apply to the Commission for authorization to use respiratory equipment that has not been tested and certified by National Institute for Occupational Safety and Health (NIOSH).

*10 CFR 20.1703 Use of individual respiratory protection equipment. If the licensee assigns or permits the use of respiratory protection equipment to limit the intake of radioactive material, (a) The licensee shall use only respiratory protection equipment that is tested and certified by the National Institute for Occupational Safety and Health (NIOSH) except as otherwise noted in this part.*

*(b) If the licensee wishes to use equipment that has not been tested or certified by NIOSH, or for which there is no schedule for testing or certification, the licensee shall submit an application to the NRC for authorized use of this equipment except as provided in this part. The application must include evidence that the material and performance characteristics of the equipment are capable of providing the proposed degree of protection under anticipated conditions of use. This must be demonstrated either by licensee testing or on the basis of reliable test information.*

According to 10CFR 20.1703 (f), standby rescue persons must be provided when workers wear supplied air hoods or suits, possibly in conjunction with other protective equipment, that are difficult to remove without assistance. Such standby rescue persons must be equipped with respiratory protection devices that are appropriate for the potential hazards, must observe or otherwise be in direct communication with such workers, and must be immediately available to assist them in case of a failure of the air supply or any other reason that necessitates relief from distress. A sufficient number of standby rescue persons (not necessarily one-for-one) must be available to effectively assist all users of this type of equipment. Standby rescue persons must be sufficiently trained or experienced to render effective assistance if needed.

Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Request For Use Of Radium Hurricane Hood™ Category-2 and Category-3

Enclosure 1

On approval, the following precautions and limitations for the use of Hurricane Hoods™ will be incorporated into site specific procedures:

- Hurricane Hoods™ are issued and used for contamination control and worker comfort only. There is no Protection Factor assigned to these devices, and as such, are not respiratory devices
- Hurricane Hoods™ are not to be worn/used in known Airborne Radioactivity Areas. Only NIOSH approved respiratory protection devices approved by the NRC and with assigned protection factors may be used in Airborne Radioactivity Areas.
- Hurricane Hoods™ are normally used for work evolutions with constant HP coverage, either directly or through video surveillance.
- Hurricane Hoods™ will be issued to workers after an ALARA evaluation of the work area is performed and it is determined that, due to the environment, no respiratory protection apparatus is needed, however due to the potential for personnel contamination, additional controls are needed.

Ease of removal of the Hurricane Hood™ provides more desirable self-rescue features, avoiding asphyxiation if the air supply is interrupted or lost (i.e. hose crimped). It also provides a means to undress that minimizes the potential for personnel contamination events. Hurricane Hood™ users are provided with continuous radiological protection (RP) coverage, communication devices and video camera surveillance.

Condensation Particle Counting (CPC) testing of the Hurricane Hood™ was conducted on November 16, 2006 at Entergy's Indian Point Site. Testing consisted of using a variety of people with different physical characteristics. Each test subject passed each exercise and passed the overall test. The average performance factor was 12, 732.

#### Regulatory Evaluation

Part 20 to 10 CFR, Standards for Protection Against Radiation,” Subpart H, “Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas,” concerns the use of respiratory protection equipment for protection against airborne radioactive materials.

Section 20.1703, “Use of individual respiratory protection equipment,” paragraph (a), requires that respiratory protection equipment used by a licensee to limit the intake of radioactive material be tested and certified by NIOSH. Section 20.1703(b) states that a licensee can submit an application to the NRC for authorized use of respiratory protection equipment that has not been tested and certified by NIOSH.

NRC guidance provided in NUREG/CR-0041 encourages the use of suits, noting that in certain work environments, if used properly, heat stress is mitigated, skin contamination minimized and worker doses are maintained as low as reasonable achievable (ALARA).

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Enclosure 2

The Hurricane Hood™ Solution

October 9, 2006

Southern Nuclear Operating Company, Inc  
P.O. Box 1295  
Birmingham, AL 35201

Attention: Judith Grant

**Subject: Radium Incorporated's Hurricane Hoods**

Radium Incorporated is pleased to provide information about our Hurricane Hood line of products for referencing in your licensing submittal to the NRC for approval fleet wide.

Enclosed is the following information:

1. The Hurricane Hood Solution - An overview paper that discusses the Hurricane Hood systems and overall industry experience with the systems.
2. Hurricane Hood Category-3 (CAT-3) Brochure – Details features for the Category-3 system.
3. Hurricane Hood Category-3 Owners Manual – Details how to use the equipment and the safety guidelines of the Category-3 system.
4. Hurricane Hood Category-2 (CAT-2) Brochure - Details features for the Category-2 system.
5. Hurricane Hood Category-2 Owners Manual - Details how to use the equipment and the safety guidelines of the Category-2 system.

If you have any questions or require additional information, don't hesitate to contact me at (803) 414-4445.

Sincerely,



Cam Abernethy

## **The Hurricane Hood Solution**

Today's nuclear workers face more and more challenges everyday in this industry. They are expected to perform at peak mental and physical states, to work efficiently, save dose, and prevent mental errors. The best way to ensure that your workers or contractors are performing at peak levels is to ensure that they work in a "personal" environment that promotes this high level of productivity while increasing their safety.

Radium Incorporated (Radium) developed the Hurricane Hood (patent pending) line of products as a solution to the limitations of current anti-contamination devices such as Trend AirShield and 3Ms Power Visor and respiratory equipment used as anti-contamination devices in the nuclear power industry. Radium's personnel have many years of work experience providing Steam Generator Nozzle Dam Services and other services in the nuclear power industry. For decades, Radium personnel and other nuclear workers had no choice but to use respiratory protection and anti-contamination devices that made it difficult to breathe, were obstructive to use, and created an extremely hot and stressful environment to work. It has been well documented that this older equipment creates safety issues with heat stress, limited vision, mental stress, physical stress, etc. Any one of these issues can create a serious safety problem and will also contribute to poor worker productivity and higher man-rem exposure. Combine these issues and you multiply your risks and man-rem exposure.

Hurricane Hoods are an anti-contamination and personal cooling system. A high volume of filtered air (HEPA Filter 99.97% efficiency; 0.3 micron) is blown into a clear vinyl hood and suit at 33 CFM to provide the user with ample air for ease of breathing, anti-fogging, and full body cooling without any hoses or breathing air system.

It is called a "system" because it provides much more functionality than just providing a high volume of filtered air. It also is a platform for the nuclear worker to add Radium's in-suit hydration unit called HydroPack, wireless cameras, LED lighting, wireless communication systems, and other accessories. Everything is powered through our very thin high capacity power belt.

Hurricane Hoods can be used as an anti-contamination and personal cooling system in any non-IDLH (Immediately Dangerous to Life or Health) environments where the objective is to keep nuclear worker's dose ALARA and/or the individual cooler.

## **Hurricane Hood Models**

### Category-3 (CAT-3)

The Category-3 model is configured with a thin power belt that supplies power to a blower positioned on the head of the wearer by the head harness assembly. (Refer to the enclosed brochure operation manuals for pictures) The blower assembly has a filter adaptor that protrudes through the filter opening hole on top of the clear vinyl hood. A filter securing ring is placed on top of the filter adaptor and a NIOSH approved HEPA filter is screwed onto the filter adaptor securing the filter and sealing the hood in place.

Because of the very compact design, the Category-3 model can be used for any potential high heat stress areas that have limited access such as accessing through a 16" primary manway to enter inside a steam generator to install nozzle dams. This design has a more direct air flow path from above the head to the user for cooling, ease of breathing, and great defogging capabilities.

You can use the CAT-3 with different types of suits that are equipped with exhaust valves (or modified for exhausting) or are porous enough, such as the Orex protective clothing, to easily allow the flow of air entering

into the suit to exit. Radium also offer's PVC suits that are designed specifically for the Hurricane Hoods that have reinforced knee areas and additional exhaust vents in the arms.

Refer to enclosed brochure and operations manual for more information about the Category-3.

### Category-2 (CAT-2)

Category-2 model uses the same blower and filter assembly used in the Category-3 but, relocates it to the upper back for a lightweight backpack design that provides filtered air from the upper back to the clear vinyl hood. The Cat-2 utilizes a Radium designed 2-piece PVC protective suit that consists of a jacket with integrated clear vinyl hood and a pair of PVC pants. The jacket has the filter adaptor opening on the back panel to allow attachment of the filter. (Refer to the enclosed brochure operation manuals for pictures)

The CAT-2 model is a multipurpose system that can be used for steam generator support work, cavity decontamination, control rod drive maintenance, fuel transfer canal work, and several other applications.

Refer to enclosed brochure and operations manual for more information about the Category-2.

Both models can be used with various accessories.

### Hydro-Pack

Radium's Hydropack is an in-suit or under protective clothing, hands-free worker hydration system. The system can be used with the Hurricane Hood blower/filter module or as a stand alone system.

#### Features:

- Very compact size
- Every Hydropack has features to mount a Hurricane Hood CAT-2 blower at any time.
- If hydration is not needed, it can be used without the reservoir and only as a Hurricane Hood CAT-2 backpack
- Hydropack is laundrable
- Holds 1.5 liters of water
- Reservoir is guaranteed not to leak
- No spill bite valve - Users can drink water by simply biting down on the bite valve. Valve closes when released.
- Economical bite valves can be changed easily for different users.

For workers to perform at their peak ability, proper hydration is the utmost importance. During physical work, your heart increases the blood flow to your muscles and your skin to cool them down. Through perspiration, your body loses about 1 liter of water per hour based on moderate activity. If you do not replace the water you lose, your body starts to become dehydrated. At a higher heart rate and core temperature, your body can't produce more energy, leaving you weak and much more vulnerable to heat stress illnesses.

Besides the obvious personal safety issues that dehydration can cause, you also have a less productive worker in the field that takes longer to complete tasks which also results in high accumulated dose.

The best defense against dehydration is a good offense - - drink often - - at least 1 liter per hour for moderate activity in moderate conditions. It is also better to drink continuously. 6-8 ounces every 15-20 minutes is recommended by the American College of Sports Medicine. Thirst is a delayed response, and by the time you are thirsty, your body is dehydrated.

Radium's Hydropack is a one-of-a-kind device (patent pending) that not only provides in-suit hands-free hydration; it also has an integrated Hurricane Hood blower to quickly cool your body by pumping a continuous large volume of filtered air over your body which quickly evaporates your perspiration and pushing it out of the suit, keeping the nuclear worker cooler, safer, and more productive.

A Hydropack reservoir can be frozen like an ice vest to keep you cool. But when the Hydropack melts, you are not carrying around dead weight as you would with an ice vest. When a Hydropack melts, you have a ready source of water for hydration.

There were times in the Nuclear Power Industry when having water in the containment building, in a radioactive contaminated zone, or any other contaminated area was not allowed due to the possibility of internal intake of radioactive contaminants. Times have changed and we are now seeing water fountains and "cool rooms" for workers to cool off and hydrate themselves. Better worker anti-contamination methods and procedures have proven that workers can hydrate themselves and NOT become internally contaminated.

Water fountains and cool rooms take a lot of time and dose to setup, maintain, monitor, or replenish. They also contribute to generating a high level of radwaste with constant glove changes, etc. An ideal solution would be a hydration system that did not have these disadvantages and would increase a worker's productivity, safety, and quality of work.

The Hydropack is the ideal solution that can provide today's nuclear workers a ready source of cold water for hydration and keep the user cooler when used with the Hurricane Hood systems at his/her work area.

### **Operational Experience:**

Hurricane Hoods have been used successfully as anti-contamination devices in the following applications:

#### **Plant Vogtle 2R11; Fall 2005 Outage**

Installed and removed steam generator nozzle dams in record low dose for Unit 2 and with no personal contamination events, heat stress issues, or injuries using Hurricane Hoods CAT-3 model.

Installing and removing steam generator nozzle dams is one of the most physically and mentally demanding jobs that a nuclear worker performs. The nozzle dam technician needs to be in top performance condition to quickly move heavy nozzle dam sections and accurately assemble the dam inside this Locked High Radiation Area within a couple of minutes. Typical issues such as heat stress, fogging visor, obstructive equipment, crimped breathing air supply hose, and the psychological stress that these conditions create, can be minimized, if not eliminated, by using the Hurricane Hood.

Steam generator primary platform workers during nozzle dam removal used WetPro Suits with exhaust vents cut into the suit calves vs. the PVC suit with installed vents for the generator jumpers. This helped with additional cooling and freedom of movement that also resulted in no personal contamination events and contributed to the record low dose received for this project.

#### **Diablo Canyon Fall 2005 Outage**

Installed and removed steam generator nozzle dams in near record low dose for that unit and with no personal contamination events, heat stress issues, or injuries using Hurricane Hoods CAT-3 model.

The Category-3 model was also successfully used for cavity decontamination activities during this outage.

### Diablo Canyon Spring 2006 Outage

Installed and removed steam generator nozzle dams in near record low dose for that unit and with no personal contamination events, heat stress issues, or injuries using Hurricane Hoods CAT-3 model.

The Category-2 model was successfully used for seal table work, cavity decontamination, and other activities during this outage.

### Shearon Harris Spring 2006 Outage

The Category 2 model was used for sponge blasting operations on the upper internals lifting rig. Sponge blasting is an abrasive blasting process using grit-impregnated foam and non-abrasive blasting media using foam without grit. Sponge blasting systems incorporate various grades of water-based urethane-foam cleaning media used to clean and prepare surfaces. The non-abrasive media grades are used to clean delicate substrates. The abrasive media grades are used to remove surface contaminants, paints, protective coatings, and rust from a variety of surfaces.

The sponge blasting was performed in the lower cavity inside a tent with the workers wearing a Category 2 model. Fifteen minutes into the process, the blasting material started to escape the tent enclosure. Radiation Protection personnel stopped the job to evaluate the situation. Air samples taken during the process read 1.8 E-6 and the HEPA filter on the Hurricane Hood read 2.5 mrem/hr. Plant management stopped the job since it was determined the scope of the job was expanding due to the sponge process shortcomings. The worker wearing the Hurricane Hood CAT-2 exited the area clean and his body count was negative.

### Vogtle 1R13; Fall 2006 Outage

Successfully installed steam generator nozzle dams using the Category-3 model with no personal contamination, heat stress, or safety issues due to the Hurricane Hoods.

During platform work, an issue occurred when a Hurricane Hood power cable got entangled with a worker's knee inside his suit. The cable broke at the connector when it was pulled inside the suit and the blower lost power. As directed by the Health Physics and Job Supervisor monitoring the job, the individual left the primary platform immediately and was removed from the suit without incident. As a result from this experience, 1) the cable has been shortened on new models, 2) the operations manual has been revised to include wrapping the power cable around the belt to prevent this incident again, 3) other Licensees that use Hurricane Hoods will receive the new operations manual with this revision.

### Approvals and Awards

INPO oversaw the use of the Hurricane Hoods at Vogtle for steam generator nozzle dam operations in the fall of 2005 during 2R11. They gave plant Vogtle a rating of "Beneficial Practice" for the use of the Hurricane Hoods.

Diablo Canyon's Health Physics Department has labeled the Hurricane Hood as one of their "Golden Nuggets" at the PWR Conference due to the overall performance of the equipment and proven dose saving capabilities.

### Conclusion

Hurricane Hoods are a proven anti-contamination device that reduces health and safety issues and increases workers efficiency that can minimize overall accumulated dose.



## **Contact Information**

For questions and requests for additional information, contact Cam Abernethy at the contact information below.

540-942-5734 office  
803-753-0067 fax  
803-414-4445 mobile

Radium Incorporated  
435 Essex Ave. STE 7  
Waynesboro, VA 22980

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Enclosure 3

Radium Hurricane Hood™ Category-3 (Cat-3) Brochure





## Personal Cooling System

### **HURRICANE HOOD™** **Category-3 (CAT-3)**

# Got oxygen?

are you tired of

# SWEATING to death?



Provides OVER 33 CFM of filtered air flow. This is MORE THAN 5 TIMES the amount of air from any powered air visor on the market!



Shown with Radium's optional Hi-Resolution Color Wireless Video Camera. Hurricane Hoods are designed with lightweight materials.

(Hood not shown for clarity)



A very thin (3/4" Thick) power belt supplies power to the system for 3.5 - 7 Hours depending on options. Optional 3-hour extended pack available.

(Poly sleeving not shown)



## 500% More Air!

## 500% Cooler!

### The **HURRICANE HOOD**

### **BLOWS AWAY**

### the competition!

Radium Incorporated (Radium) set out on a mission to develop the ultimate personal breathing and cooling system for the nuclear power industry worker. For decades, nuclear workers had no choice but to use respiratory protection products that starved them for air, were obstructive to use, and created an extremely hot and stressful environment to work. The Hurricane Hood™ line of products is the industry solution for a problem that has lingered long enough.

Radium's experience in steam generator nozzle dam services played an important role in the development of the Hurricane Hood. One of the design goals was to develop a system that could be used by nozzle dam technicians to install or remove dams, one of the most physically and mentally demanding industry jobs. It had to be a compact system that would not obstruct the technician from entering or exiting the channel head through a 16" manway and provide ample air flow. The Hurricane Hood CAT-3 is the solution.





# HURRICANE HOOD™ CAT-3

Radium's patent pending design utilizes a bubble hood which is used in the industry and preferred by most nozzle dam installation technicians as the basis for the design. Next, Radium's engineers separated the components of a typical Powered Air Purifying Respirator (PAPR) because a standard PAPR would not allow a technician to enter the channel head due to the massive size of the battery pack/filter assembly. Separating these components offers several advantages.



## HURRICANE HOOD CAT-3 ADVANTAGES >>>>>

- > Eliminated all hoses! – removes a serious safety hazard of crimping and cutting hoses
- > High performance lightweight blower with optimized air flow path
- > Innovative Halo Band design provides the following features:
  - adjustable harness assembly to secure the Hurricane Hood to your head
  - integrated roller bearing mechanism that allows the user to rotate their head
  - a designated area to secure a Teledose dosimeter on the users' head
  - provides a mounting support for an optional lightweight wireless camera.
- > Powered by a very thin (only 3/4" thick!) adjustable power belt configured with 2 banks of 12 volt batteries to supply power to the hood for up to 7 hours.
- > Optional 3rd 12 volt battery bank for additional equipment or extended use
- > Electrical connectors have a locking mechanism to prevent accidental disconnection
- > The power belt buckle is made from heavy duty thermal plastic that requires a double action to disconnect
- > The power belt can be sleeved in poly sleeving and worn on the outside of your outer protective clothing (PCs) to allow for quick in the field swaps without removing the user's outer layer PCs
- > The batteries can be recharged in 15 minutes; minimizes the amount of batteries needed for operations and future potential hazardous radiological waste.

Contact Radium today for your Hurricane Hoods and start to reap the rewards of a nuclear workforce that is more efficient and less likely to make mistakes because they are in a less stressful and safer personal environment.

## Hurricane Hood CAT-3 vs. Trend® Airshield

Hurricane Hood™ CAT-3	Trend® Airshield
Designed for use in the Nuclear Power Industry in particular steam generator maintenance including nozzle dam installation and cavity decontamination operations.	Designed to protect individuals from dust in Woodworking, Pottery, Dental Laboratories and other non-industrial environments.
Provides over 33 CFM of filtered air which is more than 5 times the amount of air that the Airshield provides and over 5 times the amount of air NIOSH approves (6 CFM) for a Powered Air Purifying Respirator (PAPR) <ul style="list-style-type: none"><li>• More air to breathe</li><li>• More air to cool the user</li></ul>	Only provides 6.36 CFM with a clean filter and fully charged battery. The 3M Power Visor only provides 4.6 CFM.
Uses a Bubble Hood which allows for clear unobstructed view.	Airshield manual warns that "At very high work rates, the pressure in powered respirators may become negative at peak inhalation."
Very low profile battery belt is easily replaceable in a contaminated area if it is worn externally on your outer protective clothing.	Very limited visibility.
Battery replacement requires disassembly of the Airshield which means the individual will need to exit the RCA and undress to replace the battery.	Supplied batteries take 14 hours to recharge.
Supplied batteries take 15 minutes to recharge.	Can restrict head movement from side to side and rotation due to its' design.
Supplied with a roller bearing rotation ring to give the user the ability to rotate their head.	No optional equipment.
Can be provided with a wireless camera and communications.	Can use communication headsets.
Can use under the helmet communication headsets for added comfort.	Design only provides partial (front) containment of the head area.
Hood provides 100% coverage of the head to prevent the user from being contaminated.	

Trend® is a registered trademark of Trend Machinery & Cutting Tools Ltd.

010506

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Enclosure 4

Radium Hurricane Hood™ Category-3 (Cat-3) Owners Manual



***HURRICANE HOOD™***  
***CATEGORY-3 (CAT-3)***

**OWNERS MANUAL**

## Introduction to Radium's Hurricane Hood Cat-3 Model

Thank you for purchasing Radium's Hurricane Hood Cat-3. The Hurricane Hood Cat-3 was designed as a personal cooling and containment system that provides ample air without hoses or airlines for today's nuclear power workers. For decades, nuclear workers had no choice but to use personal protection products that starved them for air, were obstructive to use, and created an extremely hot and stressful environment to work. The Hurricane Hood Cat-3 gives you the mobility of a powered air visor with the air flow better than a bubble suit...the best of both worlds!

Radium's Hurricane Hood Cat-3 is more than just a personal containment system that provides ample air. The Hurricane Hood line of products provides options such as miniature wireless color cameras, wireless communications, and LED lights. When you purchased a Hurricane Hood, you have purchased a modular platform that can be configured for numerous jobs. A Cat-3 can be configured as a Cat-2 for back mounting with the addition of the Cat-2 conversion back pack. Typical uses include Steam Generator Nozzle Dam Installation, Steam Generator Platform Support Workers, and Reactor Cavity Decontamination Workers. Virtually any job that requires personal protection from radioactive contamination and added cooling will benefit from using a Hurricane Hood. Not recommend for very wet environments where liquids can enter into the filter openings such as Control Rod Drives maintenance.

Contact Radium at (803) 414-4445 for additional details on other models of the Hurricane Hood and the various options.



NOTE: ALL USERS SHOULD READ THESE INSTRUCTIONS PRIOR TO USING THIS EQUIPMENT.

## Table of Contents

SECTION	DESCRIPTION	PAGE
1.	Safety Guidelines	4
	- General Description and Limitations	4
2.	Equipment	5
	- Parts Identification	5
	- Additional Equipment Needed	5
3.	Equipment Inspection and Preparation	6
	- Preoperational Inspection and Checks	6
	- Charging Batteries	6
	- Install Batteries	7
4.	Assembly and Donning	8
	- Head Height Adjustment	8
	- Donning the System	9
5.	Operation	12
6.	Undressing or Equipment Removal	13
7.	Equipment Decontamination and Storage	14
8.	Troubleshooting	14
9.	Technical Support	15



## Safety Guidelines

### General Description and Limitations

The Radium Hurricane Hood Cat-3 is a personal cooling and containment system that offers protection from nuisance particulates\* while providing cool flowing air to the head and body. The Hurricane Hood Cat-3 includes the blower assembly, halo assembly with ratchet suspension, filter, filter cap, hood securing ring, hood sealing gasket, power belt, and hood.

A minimum of 10 Nickel-Metal Hydride (NiMH) Size AA batteries are required for operation. See Sections 3 and 5 for additional information on battery requirements. The proper batteries can be purchased from Radium.

A personal containment suit such as a one piece outer protection suit made from plastic or other substantial material is required for proper operation of the Hurricane Hood Cat-3. The outer protective suit provides an anchoring surface to secure the Hurricane Hood and the suit helps direct the air from the Hurricane Hood blower to parts of the body for cooling. Contact Radium for more information on their suits.

A blower located within the top of the hood assembly draws ambient air through the filter. The air is directed to the front surface of the hood and down into the protective suit where it then exits through a vent (or vents) in the suit.



### WARNING

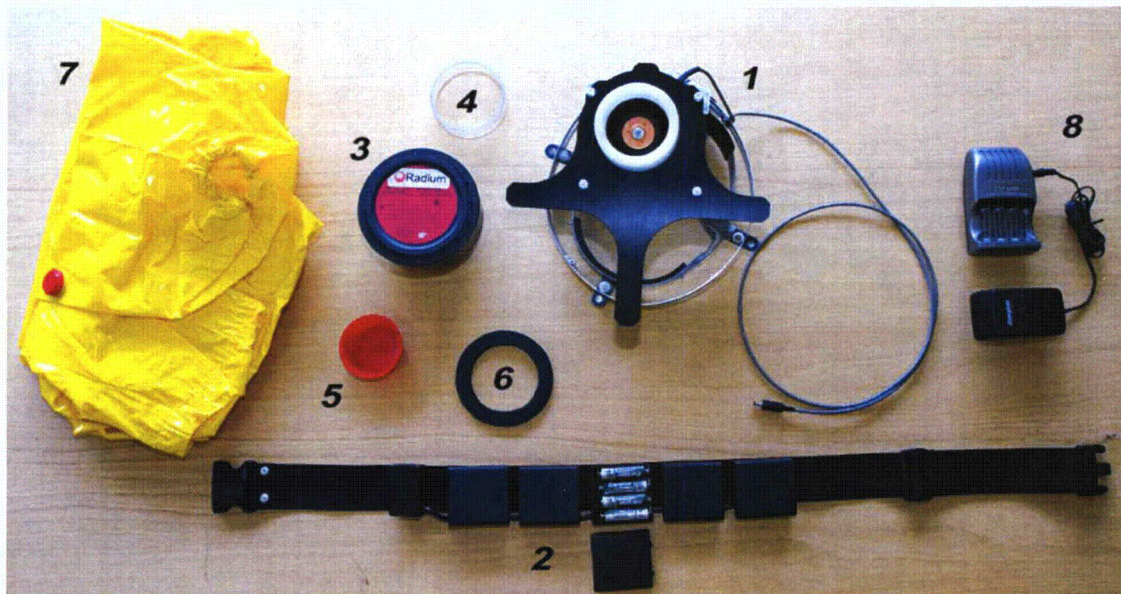
Radium's Hurricane Hood Cat-3 is to be used for worker comfort only and is NOT a government approved respiratory device. If harmful materials or substances are present in the work area, use a proper government certified respiratory device. This system has not been evaluated by NIOSH/MSHA as a potential ignition source in flammable or explosive atmospheres. This device does not protect your respiratory system such as your lungs. This system has not been tested or approved for intrinsic safety. Misuse of this product may result in sickness or death.

\*Nuisance particulates are those that do not adversely affect health.



# Equipment

## Parts Identification



## List of Components

1. Blower Assembly
2. Power Belt with NiMH AA Batteries (10 Minimum)
3. HEPA Filter
4. Hood Securing Ring
5. Filter Cap
6. Hood Sealing Gasket
7. Containment Suit (optional)
8. 15 Minute AA Battery Charger Shown (other chargers can be used; refer to battery manufacturer recommendations.)
9. Hurricane Hood Cat-3 Bubble Hood (Not shown for clarity)

## Additional Equipment Needed for Operation

1. Plastic or other substantial Containment Suit with vent(s). Radium recommends their CAT-3 suit which has vents in the calves and elbows. See Page 10 for more information on suits. (NOTE: Polyurethane material is not recommended due to the problems with duct tape sticking to it.)
2. Duct Tape
3. Small Phillips Head Screwdriver



# Equipment Inspection and Preparation

## Pre-Operation Inspection and Checks

Before each use, examine all components of the Hurricane Hood system for incorrectly fitting parts, damage, or missing fasteners or parts. If any components are missing or damaged, replace them prior to use.

Other checks:

- Test Hurricane Hood Operation by assembling the system with the same components that will be used in the actual operation without the hood and hood securing ring. (Refer to picture below. Power the system ON by connecting the blower power connector to the power belt power port. Ensure the flow is adequate for use.



**Testing Configuration**

- Examine the hood for any rips or other type of damage.
- Examine the hood sealing gasket and ensure it is not deformed or damaged.
- Examine the blue clevis blocks and ensure they are parallel with the rails. (They rotate)
- Ensure all hardware is tight and secured in place.
- Examine power belt for damage.
- Repair or replace any damaged components.

## Charging Batteries

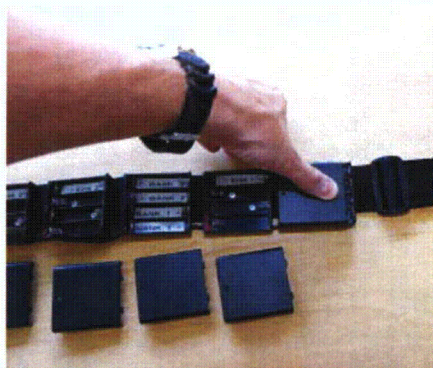
Radium provided NiMH batteries are not charged when shipped. Charging could take 15 minutes to 12 hours depending on the type of battery charger purchased. NiMH do not have a battery memory therefore, they can be charged prior to use in any capacity (drained to full) to ensure batteries are fully charged and ready for use.



## Equipment Inspection and Preparation

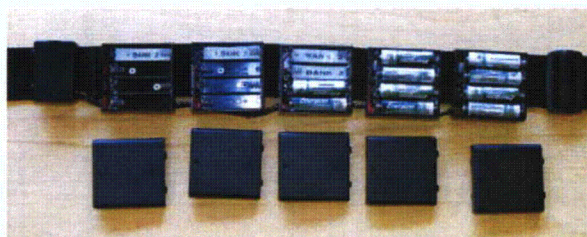
**Install Batteries** (See Section 5 for information on the type of batteries)

Place the power belt on a table with battery compartments facing up. If installed, remove cover locking screws and place them aside. Look for the thumb ridges on the battery compartment covers and push the cover to the left at the thumb ridges as shown below.



### Removing Battery Compartment Cover

Install the fully charged NiMH batteries in Bank 1 or Bank 2 or both depending on the desired operation duration. Ensure batteries are seated properly in each slot and that the electrical conductors make contact with the battery end. Each bank takes 10 batteries.



### Batteries Installed in Bank 1

The center battery compartment is used for BOTH Banks 1 and 2. Install batteries as indicated inside the battery compartment (picture shows typical configuration).



### Center Battery Compartment

Reinstall battery covers by sliding them into place. If desired, secure the covers in place but reinstalling the locking cover screws. Installing the locking cover screw is recommended to ensure the cover does not come off during rough operations.

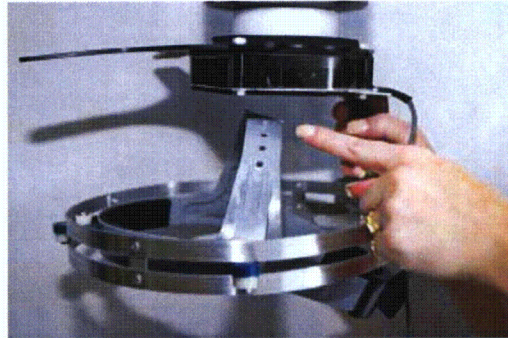


## Assembly And Donning

Note: Donning of equipment requires a minimum of 2 people, the user and the assistant.

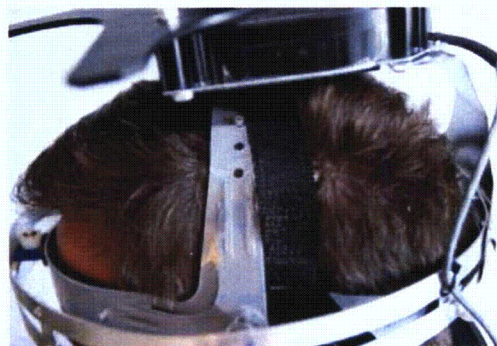
### Head Height Adjustment

The head height should be adjusted to the users head to ensure the Hurricane Hood properly sits on the user's head.



**Adjustment Strap**

NOTE: If the user is going to wear an under-the-hard-hat type intercom headset, then the user should first install the headset and adjust it so it does not interfere with the Hurricane Hood position. The Velcro strap on the headset can be actually be used to assist in securing the Hurricane Hood into position by installing it as shown in this picture.



**Headset Strap over the Adjustment Strap**

It is not recommended to use any other type of intercom headset than an under-the-hard-hat type headset, as it could interfere with the Hurricane Hood operation and placement on the head. As shown below, the Hurricane Hood Cat-2 can be used with any type of intercom headset since it is mounted to your back. Contact Radium for a CAT-2 conversion kit or for more information.



### For Information Only

Cat-2 Model



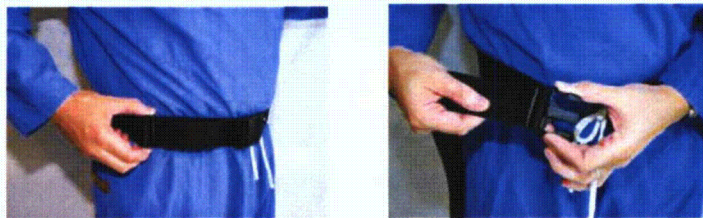


## Assembly And Donning

### Donning the System

With charged batteries installed, adjust the power belt to fit securely around the waist.

NOTE: If desired, the power belt can be sleeved in 4" poly to protect it from any contaminants and secured around the waist of the OUTER protective suit. This also provides an easy method of changing out power belts without undressing. If the power belt is installed around the outer protective suit, a **vent MUST be opened to allow air flow to exit the suit** above the power belt such as on the back or shoulder if you are not using Radium's CAT-3 suits.



**Power Belt Adjustment (Type 1 and 2 Belts)**

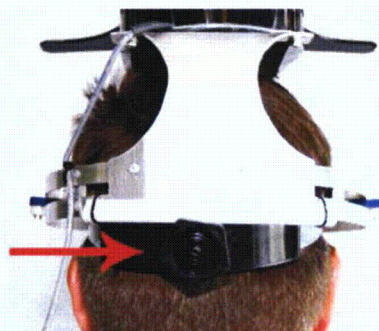
Don the outer protective suit up to the waist and put on any protective foot protection.

Place the blower and halo band assembly on the head and position it with the front halo band roller in the center front of the head as shown below.



**Center Roller Location**

Adjust the ratchet strap to ensure snug fit on the user's head.

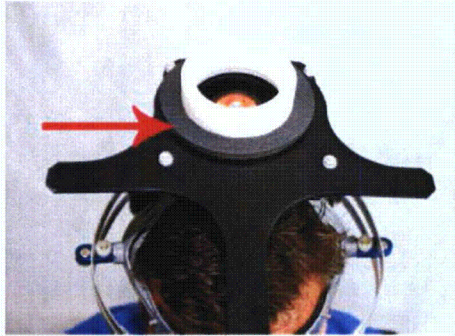


**Ratchet Adjustment**



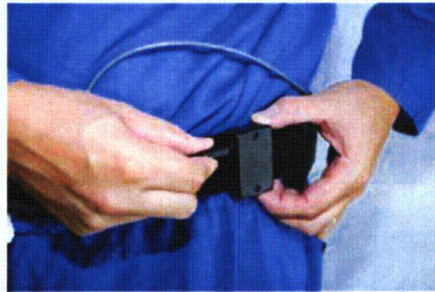
## Assembly And Donning

If not already installed, install the hood sealing gasket.



Installed Hood Sealing Gasket

Connect the blower power connector to the power belt by inserting the connector into the power jack and **align the two keys on the connector then turn the connector a quarter turn to lock** the connector in place. Take the slack cable and wrap it around the power belt. The blower should be running. If not, go to the Equipment Inspection and Preparation Section to troubleshoot problem.



Align Connector - Twist to Lock

## SUIT SELECTION

This is **VERY IMPORTANT!!** Hurricane Hoods are NOT a pressurized system. They rely on high air flow going into the suit and easily exiting the suit through vents. If not utilizing Radium's CAT-3 suits, ensure that your protective suits have at least 2 vents if it is a plastic protective suit or a suit that is made of material that is not easily permeable such as WetPros. It is recommended to have vents located in the calves and elbows to ensure that air exhausts through the suit during all working positions. The vents must be opened as far as possible to allow air to exit but not allow contamination in the suit. Orex does not require vents.

This is **VERY IMPORTANT!!** If vents are only located on the calves, **DO NOT PLACE A TIGHT BAND OF TAPE AROUND THE WAIST** when securing the hood. This could prevent the air from exiting the suit and could possibly result in sickness or death.



## Assembly And Donning

Unfold and open up the hood. Install the hood with the clear PVC seam facing the back of the head. Align hood cutout with the filter adaptor hole. Complete dress-out of the user by inserting the inner hood bib in the protective suit and apply tape to the areas shown here:



Securing the hood in place as shown above is **VERY IMPORTANT!** Besides acting as containment for the user, the hood also anchors the Hurricane Hood to the top of the users head by applying duct tape around the outer bib and from the outer bib to the protective suit. An alternate way to secure the hood to the suit, is to tape an "X" from the thighs, over the shoulders to the back of the opposite leg. Also, applying tape to the outer bib on the shoulders is helpful.

Complete the dress-out process.

Install the Hood Securing Ring around the filter adaptor. Screw the filter in place until it is fully seated on the filter adaptor. **DO NOT OVERTIGHTEN!** The Hood Securing Ring is clear to provide the inspection of the sealing surface.



**Screw Filter in place until it is snug and fully seated.**

The user is ready to go to work.



## Operation

The Hurricane Hood blower will operate at full operation until the battery bank(s) capacity drops to a low level (See chart below). If the blower is not providing enough air for the user, replace the battery belt that has newly recharged batteries.

NOTE: DO NOT leave a user in a hood without power. Make a quick swap of the power belts, NOT individual batteries in the belt!

If the user experiences a period where the blower will turn OFF and ON (quickly at first then longer OFF duration as time passes by) this is warning the user of the low battery capacity. This OFF and ON period could last up to 30 minutes but it is **HIGHLY RECOMMENDED** that the user's power belt be swapped out with a fully charged belt OR the user should be removed from the work area and undressed immediately. Warning: This ON and OFF period does not occur with every type of battery and can be affected by the vent size in the protective suit.

* Battery Type	1 Battery Bank	2 Battery Banks
Energizer NiMH 2500 mAh AA Batteries	3.5 Hours	7 Hours
Energizer NiMH 2300 mAh AA Batteries	3 Hours	6 Hours
Energizer NiMH 2000 mAh AA Batteries	2.75 Hours	5.5 Hours

\*Radium recommends the batteries listed above. Other batteries such as NiCads, alkaline, other NiMH batteries should be tested prior to use to know duration limitations. Our testing has determined that not all same capacity NiMH batteries will operate as well as the Energizer brand and some brands operate at LESS THAN 50% the duration of the Energizer brand.

Note: Added options such as wireless cameras and LED lights will reduce operation durations. Contact Radium for more information.

### WARNING

Wearing the Hurricane Hood with little or no blower operation could result in sickness or death. Ensure the user has a means of removing the hood such as using a safety razor knife staged in the work area to cut a large hole in the hood if the need should arise or personnel should have established continuous communication with the user where he or she could be assisted immediately if need should arrive to remove the hood quickly.

## Undressing and Equipment Removal

Undressing the Hurricane Hood user is very similar to undressing a bubble hood user.

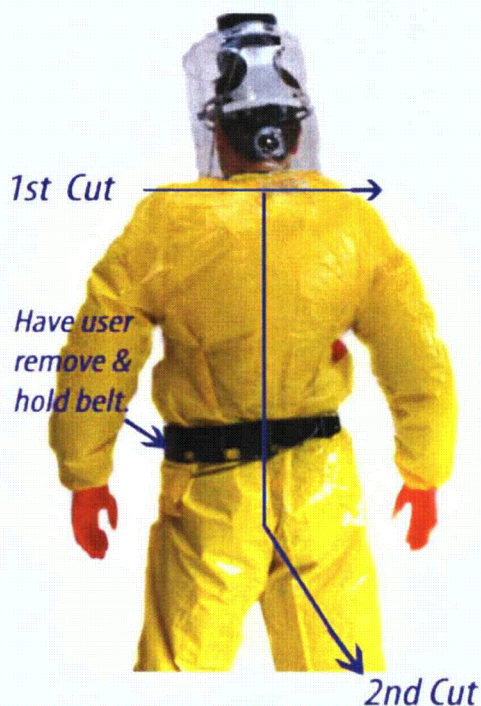
OPTION 1: With the power belt worn underneath the outer plastic protective suit, follow these steps:

1. The person who will be removing the suit should face the wearer's back.
2. Take a cutting utensil such as a safety razor knife and start a horizontal cut at the top of the back outer bib of the hood.
3. Make a second cut vertically starting at the middle of the horizontal cut down to one of the user's feet.
4. Preferably with clean gloves, open up the suit at the cut area and disconnect the power at the power belt and peel the suit off the user while also removing the Hurricane Hood assembly.
5. The user exits the area.
6. Radiation Protection can now go in the RCZ and unscrew filter from the blower unit and place the red filter cap on the threaded portion of the filter and set the filter aside for decontamination.
7. Remove the hood securing ring and set it aside with the filter for decontamination.
8. Preferably with clean gloves, open up the hood and remove the blower unit.

OPTION 2: With the power belt worn over the outer plastic protective suit, follow these steps:

Follow the same procedure above except have the wearer hold the power belt **with power still connected** until the suit is removed.

All equipment is reusable if in good working order except for the PVC hood. Equipment should be decontaminated as necessary.



## Equipment Decontamination and Storage

Equipment can be wiped down with a water and mild soap using a towel or rag. Do not spray any cleaning fluid directly on any electrical components or filters.

Store equipment in an environmentally controlled area for a long serviceable life.

## Troubleshooting

### Troubleshooting

Use the following guide to help to identify and remedy possible problems:

Problem	Probable Cause	Corrective Action
Reduced airflow	Discharged batteries	Replace batteries with fully charged batteries
	Filter clogged	Replace filter
	Blower motor failure	Contact Radium Technical Service
No Airflow	Batteries discharged	Replace batteries with fully charged batteries
	Missing batteries in power belt	Check battery compartments
	Batteries not installed properly or not seating properly with metal contacts in battery holder	Check battery compartments and battery seating
	Electrical connector is damaged	Inspect connector for damage
	Blower motor failure	Contact Radium Technical Service
Rotation of the suspension system is not smooth	Ensure the blue clevis blocks are NOT rotated out of position in the rail	Rotate the clevis blocks back into parallel position with the rail and tighten securing screw, if necessary.

## Technical Support

### Technical Support

For Technical Support, Spare and Replacement Parts, contact Radium:

Phone: 1-803-414-4445

Fax: 1-803-753-0067

Email: [TechnicalSupport@radiuminc.com](mailto:TechnicalSupport@radiuminc.com)

Radium Incorporated

Attn: HH Technical Support

435 Essex Ave. STE 7

Waynesboro, VA 22980

Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Request For Use Of Radium Hurricane Hood™ Category-2 and Category-3

Enclosure 5

Radium Hurricane Hood™ Category-2 (Cat-2) Brochure





## Personal Cooling System

### **HURRICANE HOOD™** **Category-2 (CAT-2)**

# Got oxygen?

are you tired of

# SWEATING to death?



Provides OVER 33 CFM of filtered air flow. This is MORE THAN 5 TIMES the amount of air from any powered air visor on the market!



CAT-2 is a very compact and lightweight (<2 lbs.) back pack unit. It is a modular design and can be configured as a CAT-3 for limited access areas with the purchase of the CAT-3 Halo Band.



A very thin (3/4" Thick) power belt supplies power to the system for 3.5 - 7 Hours depending on options. The power belt can be worn inside or outside protective clothing.

(Poly sleeving not shown)



## 500% More Air!

## 500% Cooler!

### The **HURRICANE HOOD**

### **BLOWS AWAY**

### the competition!

Radium Incorporated (Radium) set out on a mission to develop the ultimate personal breathing and cooling system for the nuclear power industry worker. For decades, nuclear workers had no choice but to use respiratory protection products that starved them for air, were obstructive to use, and created an extremely hot and stressful environment to work. The Hurricane Hood™ line of products is the industry solution for a problem that has lingered long enough.

Radium's experience in steam generator nozzle dam services played an important role in the development of the Hurricane Hood CAT-2. Our design goal was to develop a modular, lightweight, and comfortable system that provided ample air flow and could be used for extended period of times with no degradation of blower performance. The Hurricane Hood CAT-2 is the solution for applications ranging from steam generator support personnel to cavity decontamination crews.



# HURRICANE HOOD™ CAT-2

Radium's patent pending design utilizes a bubble hood which is preferred by most nuclear workers for comfort as the basis for the design. Next, Radium's engineers beefed-up and separated the components of a typical Powered Air Purifying Respirator (PAPR) because a standard PAPR was too heavy, bulky, and worn on the outside of protective clothing and could easily become contaminated. Separating these components offers several advantages.



## HURRICANE HOOD CAT-2 ADVANTAGES >>>>>

- > Eliminated all hoses! – removes a serious safety hazard of crimping and cutting hoses
- > High performance lightweight blower with optimized air flow path
- > Everything from headsets to hard hats can be worn under the hood
- > Modular design that can be easily configured as a CAT-3 with the purchase of the Halo Band for limited access areas such as steam generator manways
- > Powered by a very thin (only 3/4" thick!) adjustable power belt configured with 2 banks of 12 volt batteries to supply power to the hood for up to 7 hours.
- > Optional 3rd 12 volt battery bank for additional equipment or extended use
- > Electrical connectors have a locking mechanism to prevent accidental disconnection
- > The power belt buckle is made from heavy duty thermal plastic that requires a double action to disconnect
- > The power belt can be sleeved in poly sleeving and worn on the outside of your outer protective clothing (PCs) to allow for quick in the field swaps without removing the user's outer layer PCs
- > Very low cost of ownership. Does NOT require air compressors, air filter banks, air lines, air support and monitoring personnel, piping and plumbing, and all of the maintenance that comes with a breathing air system.

Contact Radium today for your Hurricane Hoods and start to reap the rewards of a nuclear workforce that is more efficient and less likely to make mistakes because they are in a less stressful and safer personal environment.

## Hurricane Hood CAT-2 vs. Trend® Airshield

Hurricane Hood™ CAT-2	Trend® Airshield
Designed for use in the Nuclear Power Industry for activities such as steam generator maintenance, cavity decontamination operations, and control rod drive maintenance.	Per their own documentation, it is designed to protect individuals from dust in Woodworking, Pottery, Dental Laboratories and other non-industrial environments.
Provides over 33 CFM of filtered air which is more than 5 times the amount of air that the Airshield provides and over 5 times the amount of air NIOSH approves (6 CFM) for a Powered Air Purifying Respirator (PAPR) <ul style="list-style-type: none"> <li>• More air to breathe</li> <li>• More air to cool the user</li> </ul>	Only provides 6.36 CFM with a clean filter and fully charged battery. The 3M Power Visor only provides 4.6 CFM.
Uses a Bubble Hood which allows for clear unobstructed view.	Airshield manual warns that "At very high work rates, the pressure in powered respirators may become negative at peak inhalation."
Very low profile battery belt is easily replaceable in a contaminated area if it is worn externally on your outer protective clothing.	Very limited visibility and restricted head movement.
Battery replacement requires disassembly of the Airshield which means the individual will need to exit the RCZ and undress to replace the battery.	Supplied batteries take 15 minutes to recharge.
Supplied batteries take 14 hours to recharge.	Can be configured as a CAT-3 model with Halo Band.
One trick pony!	Can be provided with optional wireless camera and communications.
No optional equipment.	Virtually anything can be worn on the user's head under the hood.
Airshield is worn on the head and limits other equipment to fit properly.	Hood provides 100% coverage of the head to prevent the user from being contaminated.
Design only provides partial (front) containment of the head area.	

Trend® is a registered trademark of Trend Machinery & Cutting Tools Ltd.

032806



Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Request For Use Of Radium Hurricane Hood™ Category-2 and Category-3

Enclosure 6

Radium Hurricane Hood™ Category -2 (Cat-2) Owners Manual





***HURRICANE HOOD™***  
***CATEGORY-2 (CAT-2)***

**OWNERS MANUAL**

Radium Incorporated, 435 Essex Ave., STE 7, Waynesboro, VA 22980; 803.414.4445

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## Introduction to Radium's Hurricane Hood Cat-2 Model

Thank you for purchasing Radium's Hurricane Hood Cat-2. The Hurricane Hood Cat-2 was designed as a personal cooling and containment system that provides ample air without hoses or airlines for today's nuclear power workers. For decades, nuclear workers had no choice but to use personal protection products that made it difficult to breath, were obstructive to use, and created an extremely hot and stressful environment to work. The Hurricane Hood Cat-2 gives you the mobility of a powered air visor with better air flow than a bubble suit...the best of both worlds!

Radium's Hurricane Hood Cat-2 is more than just a personal containment system that provides ample air. The Hurricane Hood line of products provides options such as miniature wireless color cameras, wireless communications, LED lights, and a new Hydration Pack. When you purchased a Hurricane Hood, you have purchased a modular platform that can be configured for numerous jobs. A Cat-2 can be configured as a Cat-3 for head mounting with the addition of the Cat-3 Halo Band. Typical uses include Control Rod Drive Maintenance, Steam Generator Platform Support Workers, and Reactor Cavity Decontamination Workers. Virtually any job that requires personal protection from radioactive contamination and added cooling and/or hydration will benefit from using a Hurricane Hood.

Contact Radium at (803) 414-4445 for additional details on other models of the Hurricane Hood and the various options.



NOTE: ALL USERS SHOULD READ THESE INSTRUCTIONS PRIOR TO USING THIS EQUIPMENT.

# Table of Contents

SECTION	DESCRIPTION	PAGE
1.	Safety Guidelines	4
	- General Description and Limitations	4
2.	Equipment	5
	- Parts Identification	5
	- List of Components	5
	- Additional Equipment Needed	5
3.	Equipment Inspection and Preparation	6
	- Preoperational Inspection and Checks	6
	- Charging Batteries	6
	- Install Batteries	7
4.	Assembly and Donning	8
	- Donning the System	8
	- Back Pack Adjustment	8
	- Donning the two piece Hurricane Hood suit	10
5.	Optional Equipment	12
	- Hydration Pack	12
6.	Operation	13
7.	Undressing or Equipment Removal	14
8.	Equipment Decontamination and Storage	15
9.	Troubleshooting	15
10.	Technical Support	16



# Safety Guidelines

## General Description and Limitations

The Radium Hurricane Hood Cat-2 is a personal cooling and containment system that offers protection from nuisance particulates\* while providing cool flowing air to the head and body. The Hurricane Hood Cat-2 includes the blower assembly, back pack, filter, filter cap, suit securing ring, suit sealing gasket, power belt, and Hurricane Hood Cat-2 suit with integrated bubble hood.

The Hurricane Hood Cat-2 suit is a two piece suit that has a top (or jacket) and bottom (or pants) sections. It can be fabricated from several materials but is most often provided in PVC. The vinyl hood is attached to the top section and has the filter access hole for the blower on the back. The pants are provided with each suit but are optional to wear.

A minimum of 10 Nickel-Metal Hydride (NiMH) Size AA batteries are required for operation. See Sections 3 and 5 for additional information on battery requirements. The proper batteries can be purchased from Radium.

A blower located on the wearer's back draws ambient air through the filter. The air is directed into the hood from the back and down into the suit where it exits through vents located on the sides of the top section of the suit.



### WARNING

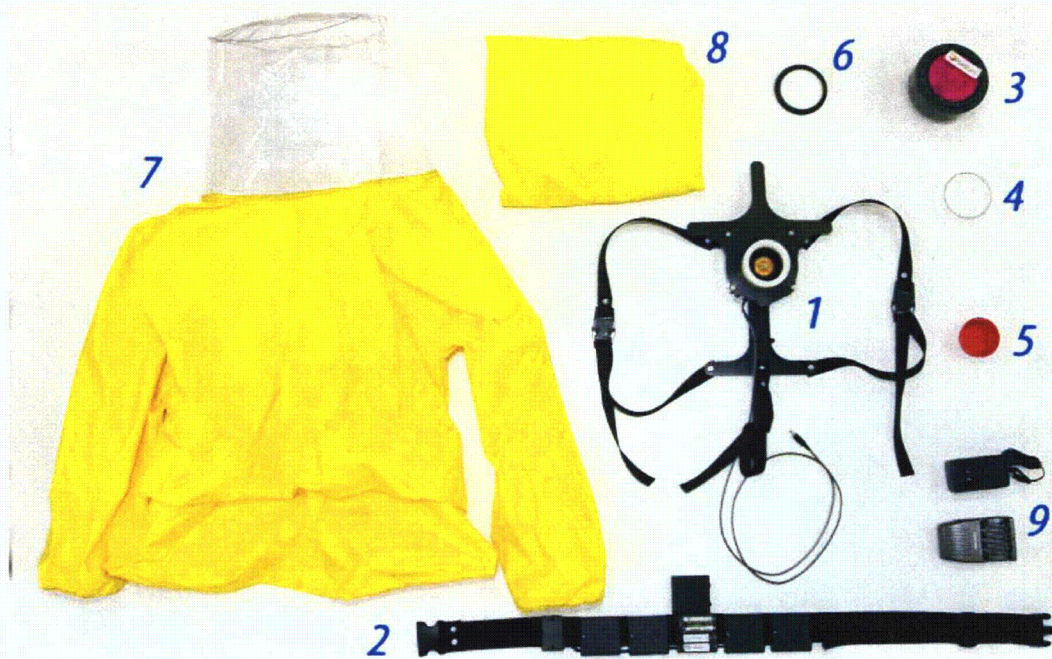
Radium's Hurricane Hood Cat-2 is to be used for worker comfort only and is NOT a government approved respiratory device. If harmful materials or substances are present in the work area, use a proper government certified respiratory device. This system has not been evaluated by NIOSH/MSHA as a potential ignition source in flammable or explosive atmospheres. This device does not protect your respiratory system such as your lungs. This system has not been tested or approved for intrinsic safety. Misuse of this product may result in sickness or death.

\*Nuisance particulates are those that do not adversely affect health.



# Equipment

## Parts Identification



## List of Components

1. Blower Assembly with Back Pack
2. Power Belt with NiMH AA Batteries (10 Minimum)
3. HEPA Filter
4. Suit Securing Ring
5. Filter Cap
6. Suit Sealing Gasket
7. Hurricane Hood CAT-2 Suit - Jacket
8. Hurricane Hood CAT-2 Suit - Pants
9. 15 Minute AA Battery Charger Shown (other chargers can be used; refer to battery manufacturer recommendations.)

## Additional Equipment Needed for Operation

1. Duct Tape
3. Small Phillips Head Screwdriver



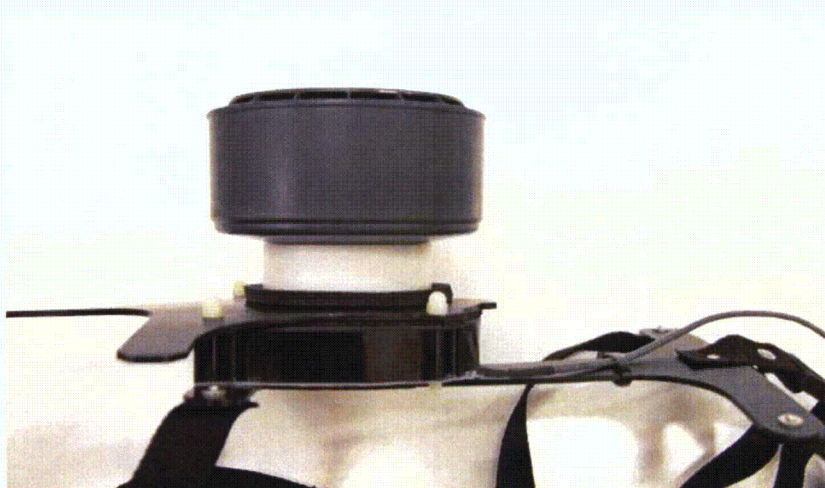
# Equipment Inspection and Preparation

## Pre-Operation Inspection and Checks

Before each use, examine all components of the Hurricane Hood system for incorrectly fitting parts, damage, or missing fasteners or parts. If any components are missing or damaged, replace them prior to use.

Other checks:

- Test Hurricane Hood Operation by assembling the system with the same components that will be used in the actual operation without the suit and suit securing ring. (Refer to picture below. Power the system ON by connecting the blower power connector to the power belt power port. Ensure the flow is adequate for use.



**Testing Configuration**

- Examine the suit for any rips or other type of damage.
- Examine the suit sealing gasket and ensure it is not deformed or damaged.
- Ensure all hardware is tight and secured in place.
- Examine power belt for damage.
- Repair or replace any damaged components.

## Charging Batteries

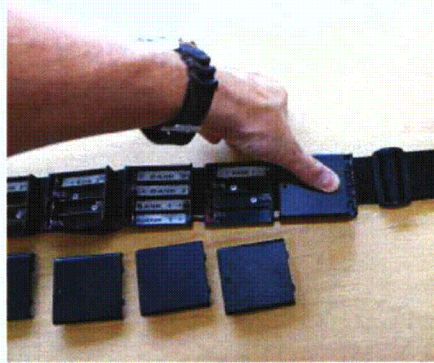
Radium provided NiMH batteries are not charged when shipped. Charging could take 15 minutes to 12 hours depending on the type of battery charger purchased. NiMH do not have a battery memory therefore, they can be charged prior to use in any capacity (drained to full) to ensure batteries are fully charged and ready for use.



# Equipment Inspection and Preparation

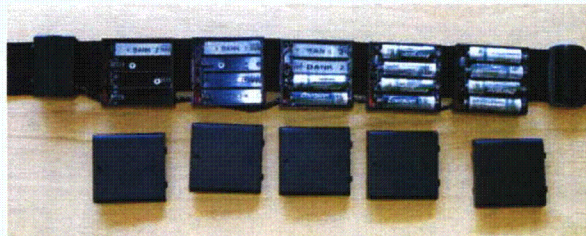
## **Install Batteries** (See Section 5 for information on the type of batteries)

Place the power belt on a table with battery compartments facing up. If installed, remove cover locking screws and place them aside. Look for the thumb ridges on the battery compartment covers and push the cover to the left at the thumb ridges as shown below.



### **Removing Battery Compartment Cover**

Install the fully charged NiMH batteries in Bank 1 or Bank 2 or both depending on the desired operation duration. Ensure batteries are seated properly in each slot and that the electrical conductors make contact with the battery end. Each bank takes 10 batteries.



### **Batteries Installed in Bank 1**

The center battery compartment is used for BOTH Banks 1 and 2. Install batteries as indicated inside the battery compartment (picture shows typical configuration).



### **Center Battery Compartment**

Reinstall battery covers by sliding them into place. If desired, secure the covers in place but reinstalling the locking cover screws. Installing the locking cover screw is recommended to ensure the cover does not come off during rough operations.

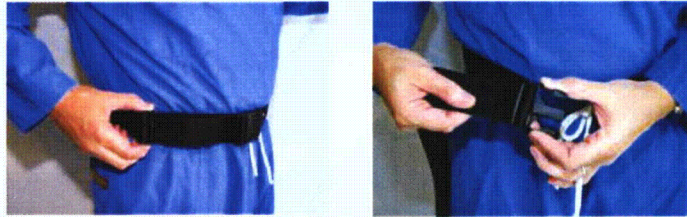


# Assembly And Donning

Note: Donning of equipment requires a minimum of 2 people, the user and the assistant.

## Donning the System

With charged batteries installed, adjust the power belt to fit securely around the waist.



## Power Belt Adjustment

## Back Pack Adjustment

The back pack blower unit is positioned on the upper back. Use the adjustable shoulder straps to position the unit as shown. Note the height of the blower guard. The top guard should be at the top of the shoulders as shown. The blower guard is used to protect the blower opening.



## Adjustable Shoulder Straps



## Assembly And Donning

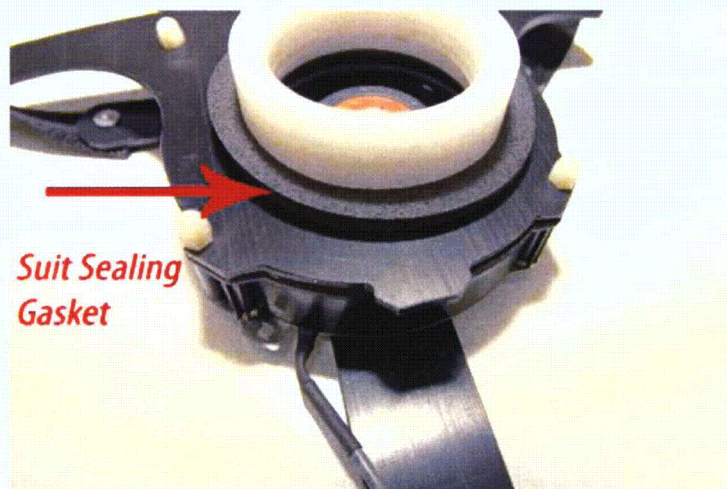
### Back Pack Adjustment (continued)

The lower back strap secures the back pack to the power belt. This will ensure that the blower does not move higher on the back when the wear bends over. The strap loops around the belt and clips in place as shown.



### Lower Strap Adjustment

If not already installed, install the suit sealing gasket.

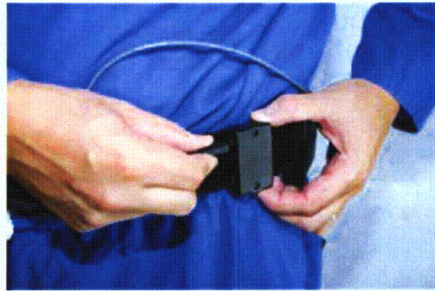


### Installed Suit Sealing Gasket



## Assembly And Donning

Wrap slack power cable around the power belt. Connect the blower power connector to the power belt by inserting the connector into the power jack and align the two keys on the connector then turn the connector a quarter turn to lock the connector in place. Pull straight back on the connector. The connector should be locked in place and the blower should be running. If not, go to the Equipment Inspection and Preparation Section to troubleshoot problem.



**Align Connector - Twist to Lock**

### **Donning the two piece Hurricane Hood suit**

If utilizing the pants, unfold them and put them on as shown below.

Unfold the Hurricane Hood and locate the side with the filter hole. The filter hole is on the back of the hood. With assistance, place your arms in the sleeves of the hood and lift the hood over your head. Have the assistant help with fitting the hood over the back pack and with locating the hole in the back of the suit to align it with the blower unit as shown.





## Assembly And Donning

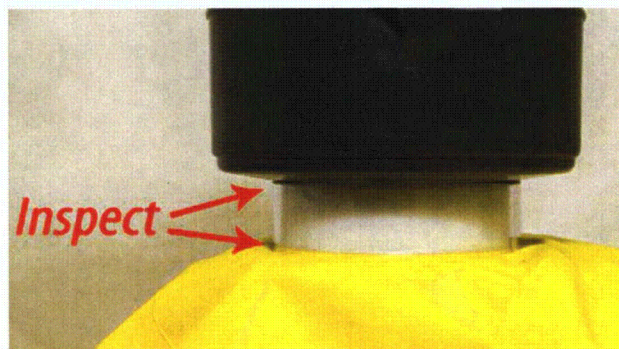
Tuck the inner bib of the hood into the pants and apply tape to the pants and inner bib as shown below. Do not tape the outer hood bib to the pants.



Ensure vents under both arms for the hood are completely open and are not obstructed.



Install the Suit Securing Ring around the filter adaptor. Screw the filter in place until it is fully seated on the filter adaptor. DO NOT OVERTIGHTEN! The Hood Securing Ring is clear to provide the inspection of the sealing surface.



The user is ready to go to work.



## Optional Equipment

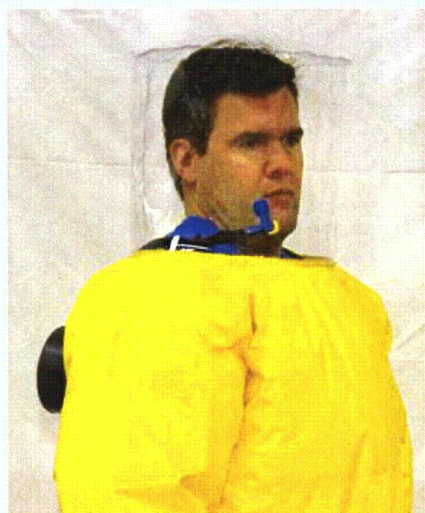
### Hydration Pack

Radium has teamed with Camelbak® to provide the Hydration Pack for the Hurricane Hood CAT-2 model. The Hurricane Hood CAT-2 blower mounts directly to the Hydration Pack. It holds 1.5 liters of water and allows for hands free operation.

The Hydration Pack has two adjustable straps for the shoulders and a adjustable strap that loops under the power belt to secure the unit on the wearer. Installation of the pack should be performed as shown.



The Hydration Pack has a special hose that can be formed into a convenient position for the user to drink inside the hood. There is a bite valve that allows the user to drink without using their hands and without spilling water by simply biting on the mouthpiece. Contact Radium for additional details and information on the Hydration Pack.





## Operation

The Hurricane Hood blower will operate at full operation until the battery bank(s) capacity drops to a low level (See chart below). If the blower is not providing enough air for the user, replace the battery belt that has newly recharged batteries.

NOTE: DO NOT leave a user in a hood without power. Make a quick swap of the power belts, NOT individual batteries in the belt!

If the user experiences a period where the blower will turn OFF and ON (quickly at first then longer OFF duration as time passes by) this is warning the user of the low battery capacity. This OFF and ON period could last up to 30 minutes but it is HIGHLY RECOMMENDED that the user's power belt be swapped out with a fully charged belt OR the user should be removed from the work area and undressed immediately. Warning: This ON and OFF period does not occur with every type of battery and can be affected by the vent size in the protective suit.

Operation duration has been tested using the following batteries:

* Battery Type	1 Battery Bank	2 Battery Banks
Energizer NiMH 2500 mAh AA Batteries	3.5 Hours	7 Hours
Energizer NiMH 2300 mAh AA Batteries	3 Hours	6 Hours
Energizer NiMH 2000 mAh AA Batteries	2.75 Hours	5.5 Hours

\*Radium recommends the batteries listed above. Other batteries such as NiCads, alkaline, other NiMH batteries should be tested prior to use to know duration limitations. Our testing has determined that not all same capacity NiMH batteries will operate as well as the Energizer brand and some brands operate at LESS THAN 50% the duration of the Energizer brand.

Note: Added options such as wireless cameras and LED lights will reduce operation durations. Contact Radium for more information.

### WARNING

Wearing the Hurricane Hood with little or no blower operation could result in sickness or death. Ensure the user has a means of removing the hood such as using a safety razor knife staged in the work area to cut a large hole in the hood if the need should arise or personnel should have established continuous communication with the user where he or she could be assisted immediately if need should arrive to remove the hood quickly.

## Undressing and Equipment Removal

Undressing the Hurricane Hood user is very similar to undressing a bubble hood user.

Recommended steps:

1. The person who will be removing the suit should face the wearer's back.
2. Loosen the filter one turn but do not remove it.
3. Take a cutting utensil such as a safety razor knife and start a vertical cut at the bottom of the filter down to one of the user's feet.
4. Preferably with clean gloves, open up the suit at the cut area and peel the suit off the user.
5. Remove the filter and suit securing ring.
6. The user exits the area.

All equipment is reusable if in good working order except for the hood/suit. Equipment should be decontaminated as necessary.



## Equipment Decontamination and Storage

Equipment can be wiped down with a water and mild soap using a towel or rag. Do not spray any cleaning fluid directly on any electrical components or filters.

Store equipment in an environmentally controlled area for a long serviceable life.

## Troubleshooting

### Troubleshooting

Use the following guide to help to identify and remedy possible problems:

Problem	Probable Cause	Corrective Action
Reduced airflow	Discharged batteries	Replace batteries with fully charged batteries
	Filter clogged	Replace filter
	Blower motor failure	Contact Radium Technical Service
No Airflow	Batteries discharged	Replace batteries with fully charged batteries
	Missing batteries in power belt	Check battery compartments
	Batteries not installed properly or not seating properly with metal contacts in battery holder	Check battery compartments and battery seating
	Electrical connector is damaged	Inspect connector for damage
	Blower motor failure	Contact Radium Technical Service

## Technical Support

### Technical Support

For Technical Support, Spare and Replacement Parts, contact Radium:

Phone: 1-803-414-4445

Fax: 1-803-753-0067

Email: [TechnicalSupport@radiuminc.com](mailto:TechnicalSupport@radiuminc.com)

Radium Incorporated

Attn: HH Technical Support

435 Essex Ave., STE 7

Waynesboro, VA 22980



Edwin I. Hatch Nuclear Plant  
Joseph M. Farley Nuclear Plant  
Vogtle Electric Generating Plant  
Request For Use Of Radium Hurricane Hood™ Category-2 and Category-3

Enclosure 7

Results of Hurricane Hood™ PortaCount Testing at Indian Point

November 21, 2006

Southern Nuclear Operating Company, Inc  
P.O. Box 1295  
Birmingham, AL 35201

Attention: Judith Grant

**Subject: Results of Hurricane Hood<sup>TM</sup> PortaCount Testing at Indian Point**

Enclosures: [5] PortaCount Test Results from (5) Indian Point/Entergy Employees

Dear Judy,

I am please to inform you that we have completed condensation particle counting (CPC) testing of the Hurricane Hood Systems (Category 2 & 3 Models). Testing was completed on November 16<sup>th</sup>, 2006 at Entergy's Indian Point Site.

Testing consisted of using a calibrated TSI Incorporated PortaCount<sup>TM</sup> Instrument to determine a performance factor of the Hurricane Hood Systems. The PortaCount instrument was setup for typical respirator fit testing. Loose-fitting powered air purifying respirators (PAPR) do not require a fit test per OSHA /NIOSH regulations therefore; the PortaCount software was configured for a MSA Ultra-Twin full face respirator. This is acceptable because we were looking for a "performance factor" and not a "fit factor" since the Hurricane Hood Systems do not require fit testing per OSHA/NIOSH regulations.

An air sample tube was secured to the inside surface of the hood at the mouth location by tape. The ambient air sample tube was attached to the outside of the hood in the HEPA filter location. Two TSI Particle Generators were used to increase the ambient particle environment. The ambient particle count in the test room averaged 26,000.

Five individuals were selected who had current respirator qualifications and who had different physical (height, weight, etc.) characteristics. The five test subjects consisted of (4) male and (1) female.

Equipment tested was the following:

1. Hurricane Hood Category 3 (CAT-3) System with a Hurricane Hood CAT-3 Hood and PVC Suit (4 Tests)
2. Hurricane Hood Category 2 (CAT-2) System with a Hurricane Hood CAT-2 PVC Suit (1 Test)

One at a time, the test subjects donned the Hurricane Hood equipment. Each test subject performed a series of test exercises. The exercises were:

- |                      |   |
|----------------------|---|
| 1. Normal breathing  | 5. Talking out load (rainbow passage)           |
| 2. Deep breathing    | 6. Moving arms up and down (replaced Grimacing) |
| 3. Head side to side | 7. Bend and touch toes                          |
| 4. Head up and down  | 8. Normal breathing                             |

Each exercise duration was 60 seconds except for Exercise 7, moving arms up and down, which was 35 seconds.

According to the PortaCount instrument, each test subject passed each exercise and passed the overall test. The test results were excellent with an average performance factor of 12,732. It was also noted on the attached test reports that when the Hurricane Hood CAT-3 users secured their wrists and ankles with tape, the performance factor was above average. Since donning gloves and booties and securing them with tape is the typical work practice when donning this type of equipment, it can be concluded that the actual performance factor will be well above 12,732.

This testing was documented via video tape.

If you have any questions or require additional information, please don't hesitate to contact me at (803) 414-4445.

Sincerely,



Cam Abernethy  
President



11/16/2006

LAST NAME TEST SUBJECT  
FIRST NAME R.T.

FIT TEST REPORT

Fit test information

ID NUMBER 000-00-0000  
LAST NAME TEST SUBJECT #3  
FIRST NAME R.T.  
COMPANY  
LOCATION  
NOTE ~~ADDITIONAL TAPE ON HOOD & SLEEVES, GLOVES~~  
*WITH BOOTIES - NO TAPE AT FEET, NO GLOVES.*  
TEST DATE 11/16/2006  
TEST TIME 10:07  
DUE DATE 11/16/2007  
CUSTOM1 HEIGHT 5'9"  
CUSTOM2 WGT. 165 LB.  
CUSTOM3  
CUSTOM4  
PORTACOUNT S/N 17104  
N95 COMPANION N

RESPIRATOR  
MANUFACTURER MSA  
MODEL ULTRA - TWIN  
MASK STYLE FF - MED  
MASK SIZE HURRICANE #3  
APPROVAL MSA2  
EFF. < 99% N  
PROTOCOL OSHA 29CFR1910.134  
PASS LEVEL 1000

<u>EXERCISE</u>	<u>DURATION (SEC)</u>	<u>FIT FACTOR</u>	<u>PASS</u>
NORMAL BREATHING	60	12900	Y
DEEP BREATHING	60	18000	Y
HEAD SIDE TO SIDE	60	5830	Y
HEAD UP AND DOWN	60	4820	Y
TALKING	60	10800	Y
GRIMACE	35	8810	Y
BEND AND TOUCH TOES	60	7880	Y
NORMAL BREATHING	60	10000	Y

OVERALL FF 8490 Y

FIT TEST OPERATOR \_\_\_\_\_ DATE \_\_\_\_\_  
TEST

NAME \_\_\_\_\_ DATE \_\_\_\_\_  
R.T. TEST SUBJECT

11/16/2006

LAST NAME TEST SUBJECT #4  
FIRST NAME P.Z.

FIT TEST REPORT

Fit test information

ID NUMBER 000-00-0000  
LAST NAME TEST SUBJECT #4  
FIRST NAME P.Z.  
COMPANY  
LOCATION  
CUSTOM1 HEIGHT 5'10"  
CUSTOM2 WGT. 179 LB.  
CUSTOM3  
CUSTOM4  
NOTE BOOTIES TAPED, NO GLOVES BUT WRISTS TAPED.

TEST DATE 11/16/2006  
TEST TIME 10:26  
DUE DATE 11/16/2007  
PORTACOUNT S/N 17104  
N95 COMPANION N

RESPIRATOR  
MANUFACTURER MSA  
MODEL ULTRA - TWIN  
MASK STYLE FF - MED  
MASK SIZE HURRICANE # 3  
APPROVAL MSA2  
EFF. < 99% N  
PROTOCOL OSHA 29CFR1910.134  
PASS LEVEL 1000

<u>EXERCISE</u>	<u>DURATION (SEC)</u>	<u>FIT FACTOR</u>	<u>PASS</u>
NORMAL BREATHING	60	19800	Y
DEEP BREATHING	60	19600	Y
HEAD SIDE TO SIDE	60	16700	Y
HEAD UP AND DOWN	60	15000	Y
TALKING	60	21200	Y
GRIMACE	35	14900	Y
BEND AND TOUCH TOES	60	8440	Y
NORMAL BREATHING	60	17700	Y

OVERALL FF 15400 Y

FIT TEST OPERATOR \_\_\_\_\_ DATE \_\_\_\_\_  
TEST

NAME \_\_\_\_\_ DATE \_\_\_\_\_  
P.Z. TEST SUBJECT #4



11/16/2006

LAST NAME TEST SUBJECT #5

FIRST NAME J.D.

FIT TEST REPORT

Fit test information

ID NUMBER 000-00-0000

LAST NAME TEST SUBJECT #5

CUSTOM1 HEIGHT 5'10"

FIRST NAME J.D.

CUSTOM2 WGT. 250 LB.

COMPANY

CUSTOM3

LOCATION

CUSTOM4

NOTE BOOTIES TAPED, NO GLOVES BUT WRISTS TAPED.

TEST DATE 11/16/2006

PORTACOUNT S/N 17104

TEST TIME 10:48

N95 COMPANION N

DUE DATE 11/16/2007

RESPIRATOR

PROTOCOL OSHA 29CFR1910.134

MANUFACTURER MSA

PASS LEVEL 1000

MODEL ULTRA - TWIN

MASK STYLE FF - MED

MASK SIZE HURRICANE #3

APPROVAL MSA2

EFF. < 99% N

<u>EXERCISE</u>	<u>DURATION (SEC)</u>	<u>FIT FACTOR</u>	<u>PASS</u>
NORMAL BREATHING	60	16100	Y
DEEP BREATHING	60	17300	Y
HEAD SIDE TO SIDE	60	14500	Y
HEAD UP AND DOWN	60	15200	Y
TALKING	60	18000	Y
GRIMACE	35	16200	Y
BEND AND TOUCH TOES	60	12200	Y
NORMAL BREATHING	60	14000	Y

OVERALL FF	15200	Y
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FIT TEST OPERATOR \_\_\_\_\_ DATE \_\_\_\_\_  
TEST

NAME \_\_\_\_\_ DATE \_\_\_\_\_  
J.D. TEST SUBJECT #5

11/16/2006

LAST NAME TEST SUBJECT #6

FIRST NAME J.S.

FIT TEST REPORT

Fit test information

ID NUMBER 000-00-0000  
LAST NAME TEST SUBJECT #6  
FIRST NAME J.S.  
COMPANY  
LOCATION  
CUSTOM1 HEIGHT 5'8"  
CUSTOM2 WGT. 175 LB.  
CUSTOM3  
CUSTOM4  
NOTE BOOTIES TAPED, NO GLOVES BUT WRISTS TAPED. BACK MOUNT BLOWER.

TEST DATE 11/16/2006

PORTACOUNT S/N 17104

TEST TIME 11:05

N95 COMPANION N

DUE DATE 11/16/2007

RESPIRATOR  
MANUFACTURER MSA  
MODEL ULTRA - TWIN  
MASK STYLE FF - MED  
MASK SIZE HURRICANE # 2  
APPROVAL MSA2  
EFF. < 99% N

PROTOCOL OSHA 29CFR1910.134  
PASS LEVEL 1000

<u>EXERCISE</u>	<u>DURATION (SEC)</u>	<u>FIT FACTOR</u>	<u>PASS</u>
NORMAL BREATHING	60	8810	Y
DEEP BREATHING	60	9820	Y
HEAD SIDE TO SIDE	60	8770	Y
HEAD UP AND DOWN	60	6940	Y
TALKING	60	10600	Y
GRIMACE	35	5400	Y
BEND AND TOUCH TOES	60	5980	Y
NORMAL BREATHING	60	10300	Y

OVERALL FF 7870 Y

FIT TEST OPERATOR \_\_\_\_\_ DATE \_\_\_\_\_  
TEST

NAME \_\_\_\_\_ DATE \_\_\_\_\_  
J.S. TEST SUBJECT #6



11/16/2006

LAST NAME TEST SUBJECT #7

FIRST NAME T.B.

**FIT TEST REPORT**

*Fit test information*

ID NUMBER 000-00-0000

LAST NAME TEST SUBJECT #7

CUSTOM1 HEIGHT 5'9"

FIRST NAME T.B.

CUSTOM2 WGT. 152 LB.

COMPANY

CUSTOM3

LOCATION

CUSTOM4

NOTE BOOTIES TAPED, RUBBER GLOVES TAPED.

TEST DATE 11/16/2006

PORTACOUNT S/N 17104

TEST TIME 11:22

N95 COMPANION N

DUE DATE 11/16/2007

RESPIRATOR

PROTOCOL OSHA 29CFR1910.134

MANUFACTURER MSA

PASS LEVEL 1000

MODEL ULTRA - TWIN

MASK STYLE FF - MED

MASK SIZE HURRICANE #3

APPROVAL MSA2

EFF. < 99% N

<u>EXERCISE</u>	<u>DURATION (SEC)</u>	<u>FIT FACTOR</u>	<u>PASS</u>
NORMAL BREATHING	60	21700	Y
DEEP BREATHING	60	16200	Y
HEAD SIDE TO SIDE	60	22000	Y
HEAD UP AND DOWN	60	16100	Y
TALKING	60	17900	Y
GRIMACE	35	17000	Y
BEND AND TOUCH TOES	60	10700	Y
NORMAL BREATHING	60	18100	Y

OVERALL FF	16700	Y
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FIT TEST OPERATOR \_\_\_\_\_ DATE \_\_\_\_\_  
TEST

NAME \_\_\_\_\_ DATE \_\_\_\_\_  
T.B. TEST SUBJECT #7

### **References:**

1. Regulatory Guide 8.15 Acceptable Programs For Respiratory Protection
2. FRN Vol 64, No. 194 10/07/99 Respiratory Protection and Controls to Restrict Internal Exposures (10 CFR 20 Final Rule)
3. Title 10, Code of Federal Regulations, Part 20
4. 10 CFR 20.1703
5. 10 CFR 170.11
6. 10 CFR 2.390
7. National Institute for Occupational Safety and Health (NIOSH) National Personal Protective Technology Laboratory (NPPTL) Respirator Branch Standard Application Procedure For The Certification Of Respirators Under 42 CFR 84 Revision 1, July 2005