

Use and Control HEPA Filtration and Vacuum Equipment

RP02.08

Approved Rev: 11/27/2017



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STE SCOPE:

The scope of this lesson is to ensure that the knowledge objectives are understood by the student, such that they will be able perform and document radiological surveys which are necessary in order to determine and communicate radiation dose rates and contamination levels.

REFERENCES:

- NISP-RP-08, Use and Control HEPA Filtration and Vacuum Equipment

SUPPORTING MATERIALS:

- NISP-RP-04, Radiological Posting and Labeling
- NISP-RP-13, Radiological Protection Glossary

ESTIMATED TIME:

Duration to complete this training is estimated to be 2 to 3 hours.

EVALUATION STANDARDS:

The STE Knowledge Examination required a scoring grade of 80% to pass the examination. Remedial training must be provided after two unsuccessful attempts and a third attempt is allowed. Once complete, the Performance Evaluation must be passed to gain credit for the completion of the STE in the EPRI completion registry.

NOTE:

This presentation has been developed primarily for use as a Computer-Based Training (CBT) lesson. Consequently, all performance objectives for this Common Industry RP (CIRP) Task are located in the associated Performance Evaluation. If this presentation is used in an Instructor-Led Training (ILT) course, then the performance objectives from the Performance Evaluation should be utilized to create demonstration scenarios for the students. Additionally, the Performance Evaluation performance objectives can be used as part of on-the-job training (OJT) for students to gain proficiency in the objectives prior the conducting the Performance Evaluation for credit.

Standardized Task Evaluation Program

The Standardized Task Evaluation (STE) program promotes a work-ready workforce through the standardization of common tasks by defining the knowledge and skills required to perform a given task. Subject Matter Experts (SMEs) analyze the task and generate lesson plans, knowledge examination, and performance evaluation elements. These elements are combined to create an STE package.

The Electric Power Research Institute (EPRI) facilitates the development, oversees the quality, and programmatically implements each STE. EPRI STE members have access to these materials and permission to implement these STEs in accordance with their site training and qualification procedures.

EPRI STE program disclaimer. For more information contact Chuck Lease:
clease@epri.com.

Guidance for Completing this Module

- Duration of this Computer-Based Training course is approximately 2 to 3 hours.
- Material for this presentation is primarily derived from the NISPs; and in particular, NISP-RP-08, Use and Control HEPA Filtration and Vacuum Equipment. Various industry references have also been used in the development of this presentation. Note that HEPA is an acronym for High Efficiency Particulate Air.
- This training is objective-based. **Brown-colored text** at the top of a slide designates an objective with related material on the given slide.
- Feedback on this presentation should be provided to EPRI and STPNOC. Send email to: tmstroschein@stpegs.com.
- After viewing this presentation, be sure to complete the associated 25-question, multiple choice exam. Passing score is 80% or better.

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- Duration of this Computer-Based Training course is approximately 2 to 3 hours.
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10CFR20, Subpart B, Radiation Protection Program

Important Point

- §20.1101(b) - The licensee shall use, to the extent practical, procedures **and engineering controls** based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA).

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Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to radiation and contamination surveys.

If material is presented as instructor-led training, instructor should review appropriate events from INPO 12-004.

Use and Control HEPA Filtration and Vacuum Equipment Overview

- Efficiency Bulletin (EB) 17-01, Portable Supplemental Radiation Protection Technician Training and Qualification directed:
 - Development and implementation of Nuclear Industry Standard Processes (NISPs) to standardize RP procedures for supplemental workforce.
 - Creation of standardized, portable RP qualifications for the supplemental workforce.
- Overall goals of EB 17-01 are to:
 - Eliminate site-specific qualifications of supplemental radiation protection technicians through development of a standard vendor training program.
 - Significantly reduce or eliminate the time each site historically spends to qualify the supplemental RP technicians (SRPTs) prior to the start of an outage or project.
 - Additionally, this will result in improved SRPT performance due to standardization of key radiation protection processes and procedures.
- “Use and Control HEPA Filtration and Vacuum Equipment” is one of these standardized processes and uses NISP-RP-08, titled Use and Control HEPA Filtration and Vacuum Equipment as the primary reference.

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Efficiency Bulletin (EB) 17-01, Portable Supplemental Radiation Protection Technician Training and Qualification directed:

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- Additionally, this will result in improved SRPT performance due to standardization of key radiation protection processes and procedures.

“Use and Control HEPA Filtration and Vacuum Equipment” is one of these standardized processes and uses NISP-RP-08, titled Use and Control HEPA Filtration and Vacuum Equipment as the primary reference.

Use and Control HEPA Filtration and Vacuum Equipment Overview

- In addition to reviewing this presentation, you should also read the associated procedure, NISP-RP-08, in its entirety. This presentation largely follows the procedure as it is written.
- Clarifying notes are provided in Section 4 of the procedure and are numerically referenced – as a superscript – at the end of certain sentences within the procedure.
- You should note in the procedure, the process diagram which provides overall direction.

- In addition to reviewing this presentation, you should also read the associated procedure, NISP-RP-08, in its entirety. This presentation largely follows the procedure as it is written.
- Clarifying notes are provided in Section 4 of the procedure and are numerically referenced – as a superscript – at the end of certain sentences within the procedure.
- You should note in the procedure, the process diagram which provides overall direction.

Terminal Objective

- When working as an RP technician at a U.S. nuclear utility, the individual will be able to properly select, setup, periodically monitor and store HEPA-outfitted equipment in order to support worker activities in a radiological control area in accordance with the standards of NISP-RP-08, Use and Control HEPA Filtration and Vacuum Equipment.

Terminal Objective:

When working as an RP technician at a U.S. nuclear utility, the individual will be able to properly select, setup, periodically monitor and store HEPA-outfitted equipment in order to support worker activities in a radiological control area in accordance with the standards of NISP-RP-08, Use and Control HEPA Filtration and Vacuum Equipment.

Enabling Objectives

1. Describe the general requirements for set-up, use and control of HEPA and vacuum units.
2. Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.
3. Describe conditions that would require the need for:
 - HEPA Filter
 - Charcoal Filter
 - Spark Arrestor
 - Wet Vacuum
4. Describe how to verify efficiency testing of the HEPA equipment is current.
5. State the types of vacuum or ventilation units that are approved for use in the RCA.
6. Describe the steps and precautions in the set-up of HEPA equipment.
7. Describe the correct assembly of HEPA ventilation or vacuum equipment.

Review the Enabling Objectives

Enabling Objectives

8. Describe the proper location for a charcoal filter.
9. Explain the actions to be taken if the operation of HEPA ventilation or vacuum equipment is not as expected.
10. Describe the purpose of HEPA/Vacuum Issue and Return Log (NISP-RP-08, Attachment 3).
11. Describe actions and considerations for monitoring the operation of HEPA vacuums and ventilation, including potential for changing conditions such as dose rates of accumulated filtered material.
12. Describe the purpose of HEPA Shift/Daily Inspection Log (NISP-RP-08, Attachment 4).
13. Describe the use of continuous air monitors for high risk activities (i.e. steam generators ventilation) to provide a quick indication of HEPA equipment failure.
14. Describe storage requirements for HEPA equipment, including proper storage of charcoal filters to prevent damage from moisture.

Review the Enabling Objectives

Use and Control HEPA Filtration and Vacuum Equipment

- **General Requirements**
- Selection of HEPA Equipment
- HEPA Setup
- Monitoring of HEPA Operation
- Storage of HEPA Equipment

NOTE:

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Describe the general requirements for set-up, use and control of HEPA and vacuum units.

- In the procedure, note the general requirements which include:
 - Only HEPA and vacuum units with a current DOP/PAO test can be used to control airborne radioactivity.
 - HEPA and vacuum units shall be DOP/PAO tested based on the manufacturer recommendations but as a minimum will be tested once every 24 months or when HEPA filter media is changed. Date for retesting will be displayed on the unit.
 - Only HEPA certified vacuum units can be used inside the RCA.
 - Physical inspection is required for all HEPA and vacuum units prior to being placed in service. Specific attention is to be made to electrical connects and power cords, hoses and connections, and equipment guards. Do not operate any equipment with potential safety defects.
 - All HEPA and vacuum units used inside the RCA must be tagged as internally contaminated and cannot be opened without Radiation Protection oversight. If the unit has been used in an alpha Level 3 area it must be indicated on the tag as possibly containing alpha contamination.
 - Contact Industrial Safety prior to using a HEPA ventilation unit any time that volatile substances, vapors or fumes are expected to be generated during the work activity.¹
 - Portable HEPA ventilation does NOT eliminate the requirements for air quality or confined space monitoring.
 - Only those vacuums labeled as wet vacuums, or wet/dry vacuums or systems designed for this purpose, shall be used to remove liquids.

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Describe the general requirements for set-up, use and control of HEPA and vacuum units.

- In the procedure, note the general requirements which include:
 - HEPAs that require an operating voltage greater than 120V AC will require maintenance support for electrical connections. HEPA's requiring multi-phase wiring (e.g., 480V, 3-phase) should have proper rotation checked prior to placing the unit into service
 - All HEPA units and vacuums used in the RCA, while not in use, will be controlled in a manner to prevent unauthorized removal and use.
 - When not in the use, the openings of the HEPA ventilation unit and hoses will be covered to prevent access to any potentially contaminated surface or component.
 - An Out of Service tag will be attached to any HEPA ventilation or vacuum unit removed from service due to equipment failure or retesting due date.
 - Radiation levels should be monitored on the HEPA units and vacuums while they are in service. Where available, and based on the potential for increase in radiation levels, telemetry units should be placed on the filter housing to provide a continuous method of monitoring.
 - Fire zone loading should be considered when installing HEPA equipment.
 - Spark arrestors shall be used on all HEPA units for work activities that generate sparks such as grinding on metal. ²
 - Do **NOT** operate HEPA units with the end of the suction hose covered as this will damage components, over heat the unit, and may result in fire.
 - Site guidance should be utilized for the removal and replacement of HEPA filters based on unit type and model available.

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Use and Control HEPA Filtration and Vacuum Equipment

- General Requirements
- **Selection of HEPA Equipment**
- HEPA Setup
- Monitoring of HEPA Operation
- Storage of HEPA Equipment

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Portable HEPA Ventilation Units Purpose

- HEPA ventilation units are used frequently as an engineering control to minimize the spread of airborne radioactivity.
- Through the use of HEPA ventilation units, the use of respirators can be eliminated for many jobs.
- HEPA ventilation units also help control the spread of contamination during jobs involving high contamination levels.

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- HEPA ventilation units also help control the spread of contamination during jobs involving high contamination levels.

Selection of HEPA and Vacuum Equipment

- The decision to use HEPA ventilation or vacuum equipment, and the type required, will be made based on the work activity and the expected radiological conditions and the implementing instructions will be included in the RWP or ALARA plan.
- Prior to determining the proper engineering controls the potential airborne activity will be projected during the TEDE ALARA process used by the station. The potential airborne generation takes into consideration the work methods being used, plant ventilation systems, and environmental conditions (e.g. wet surfaces). Once the airborne generation rate has been projected the proper equipment can be selected.

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Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.

- Unless site specific information is provided, use Attachment 1, Capture Velocity Chart, to determine the capture velocity needed based on the work activity. If the work activity has been completed successfully in the past then historical information can be used to determine the capture velocity requirements.
- Unless site specific information is provided, use Attachment 2, Effective Capture Velocity and Distance Chart, to determine the ventilation hose size requirements for the work activity.

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Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.

- In order to use these charts, it is important to understand a few items:
 - Capture velocity is the minimum air velocity required to overcome the motion of airborne particulates (or gases) and accelerate them into the capturing airstream.
 - If the capture velocity is not adequate for the contamination generated, capture of the contaminants will not occur.
 - If the hose face is moved away from the work, the ability to capture contamination is seriously compromised.
 - Capture velocity needed for the 'contaminant' (particulate or gas) is measured in Feet Per Minute (FPM). Capture velocity is also based on the manner in which the contaminant is intended to be dispersed.
 - Flow rate (or capacity, or size) of ventilation equipment (that is, the blower or fan) is provided in Cubic Feet per Minute (CFM).

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- Flow rate (or capacity, or size) of ventilation equipment (that is, the blower or fan) is provided in Cubic Feet per Minute (CFM).

Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.

- We will now work through an example using Attachment 1, Capture Velocity Chart, and Attachment 2, Effective Capture Velocity and Distance Chart, to determine the needed ventilation equipment for the work activity.
- Problem statement: You will need to provide HEPA ventilation equipment for a welding job that will use a welding spray booth. The hose of the equipment will only be allowed to be 9" away from the work. The ventilation hose that you have available is 6" in diameter. Determine the flow rate needed for the blower (or fan) for this work.

We will now work through an example using Attachment 1, Capture Velocity Chart, and Attachment 2, Effective Capture Velocity and Distance Chart, to determine the needed ventilation equipment for the work activity.

Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.

▪ Solution:

- If not provided, you will first need to estimate the capture velocity (in feet per minute, or FPM). Using the capture velocity chart in the procedure (Attachment 1), we estimate that a capture velocity of 150 FPM will be needed (see next slide).
- Then, using the Effective Capture Velocity and Distance chart for a 6" hose in the procedure (Attachment 2), and knowing that the hose will be 9" away from the work, we enter the column for **@ 9"** (see following slide).
- We need a capture velocity of 150 FPM. Going down the column we are looking for a minimum capture velocity of 150 FPM. We see that this is achieved with a blower (or fan) rated with a flow rate of 900 CFM (leftmost column) – which can achieve a capture velocity of 155 FPM. See the following slide. If you do not have a 900 CFM rated blower or fan – you will then want to use the next larger size, likely a 1000 CFM rated blower, which will still provide at least 150 FPM capture velocity.

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Attachment 1 – Capture Velocity Chart

Dispersion of Contaminant	Examples	Typical Capture Velocity (FPM)
Release with practically no velocity into still air	<ul style="list-style-type: none">Evaporation from tanksWork on “wet” components	50 – 100
Released at low velocity into moderately moving air	<ul style="list-style-type: none">Welding spray boothsIntermittent container transferHand tool work on contaminated items	100 - 200
Active generation into rapidly moving air	Spray Painting, Barrel Filling	200 – 500
Released at high velocity into very rapidly moving air	Grinding, abrasive blasting	500 - 2000

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This is the capture velocity chart from the procedure. Note the typical capture velocity in feet per minute (FPM) – right column.

Also, point out the left column shows the intended manner in which the contaminant will be dispersed.

Attachment 2 – Effective Capture Velocity and Distance

Flow Rate In CFM	Capture Velocity in Feet per Minute (for 6" Hose)					
	@ Face	@ 3"	@ 6"	@ 9"	@ 12"	@ 15"
85	442	104				
125	650	153	47			
200	1040	245	74	34		
300	1560	368	112	52		
400	2080	490	149	69	39	
500	2600	613	186	86	49	32
600	3120	736	223	103	59	38
700	3640	858	260	120	69	44
800	4160	981	298	138	78	50
900	4680	1103	335	155	88	57
1000	5200	1226	372	172	98	63

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This is the appropriate effective capture velocity and distance chart from the procedure. It shows the capture velocity for a given hose size (that is, diameter) at a given flow rate (that is, blower or fan size – left column) and the distance from the face of the hose.

There are four such tables in the procedure – one for each of four hose (diameter) sizes: 6", 8", 10" and 12".

**Describe conditions that would require the need for:
HEPA Filter, Charcoal Filter, Spark Arrestor, Wet Vacuum**

- Select the proper ventilation equipment by taking into consideration the following additional factors:
 - Weight loading of the equipment on floor or grating
 - Ability to position the hose at the required distance to provide proper capture velocity and allow the workers the visibility to perform the task.
 - Spark arrestors should be installed for all spark producing work activities. Consider the use of fire resistant hose material if available.
 - Consider the use of a noise suppressor on the discharge of the unit to facilitate a better work environment.
- Select the proper vacuum unit depending on the following conditions
 - Wet or dry conditions are expected during the work process
 - Distance the material will have to be transported through the hose from the suction point to the receptacle.
 - Potential dose rates on the material being vacuumed

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 - Potential dose rates on the material being vacuumed

**Describe conditions that would require the need for:
HEPA Filter, Charcoal Filter, Spark Arrestor, Wet Vacuum**

- In applications where iodine gas is expected, charcoal filters should be considered / utilized. ³
- If a charcoal filter bank is being used take additional steps to monitor for iodine at the discharge of the unit. Several factors contribute to the charcoals ability to remove iodine including humidity which can change over the course of a work activity.

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- If a charcoal filter bank is being used take additional steps to monitor for iodine at the discharge of the unit. Several factors contribute to the charcoals ability to remove iodine including humidity which can change over the course of a work activity.

State the types of vacuum or ventilation units that are approved for use in the RCA.

- Only HEPA certified vacuum units can be used inside the RCA.
- All HEPA units and vacuums used in the RCA, while not in use, will be controlled in a manner to prevent unauthorized removal and use.
- When not in the use, the openings of the HEPA ventilation unit and hoses will be covered to prevent access to any potentially contaminated surface or component.

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Examples of HEPA Ventilation Equipment



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An example of HEPA ventilation equipment. HEPA ventilation unit rated at 2000 CFM. This configuration comes in smaller sizes as well. The technician needs to verify the CFM rating on the ventilation equipment that is intended to be used.

Examples of HEPA Ventilation Equipment



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An example of HEPA ventilation equipment. HEPA ventilation units rated at 125 CFM.

Examples of HEPA Ventilation Equipment



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An example of HEPA ventilation equipment. HEPA ventilation units rated at 500 CFM (come in sizes up to 2000 CFM).

Example of Spark Arrestors



An example of HEPA ventilation equipment. Example of spark arrestors.

Examples of HEPA Vacuums



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An example of HEPA ventilation equipment. Tall unit on the left is a wet vacuum. The shorter unit on the right is a dry vacuum.

Examples of HEPA Vacuums



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An example of HEPA ventilation equipment. Unit in on the left with the orange top a dry vacuum. The unit to the right of the dry vacuum is a 500 CFM ventilation unit.

Use and Control HEPA Filtration and Vacuum Equipment

- General Requirements
- Selection of HEPA Equipment
- **HEPA Setup**
- Monitoring of HEPA Operation
- Storage of HEPA Equipment

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Describe how to verify efficiency testing of the HEPA equipment is current.

- HEPA and vacuum units shall be DOP/PAO tested based on the manufacturer recommendations but as a minimum will be tested once every 24 months or when HEPA filter media is changed. Date for retesting will be displayed on the unit.

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Describe the steps and precautions in the set-up of HEPA equipment.

- Verify the HEPA or vacuum unit DOP/PAO testing is current prior to setup in the field.
- Verify the tamper proof seal or equivalent is in place on the unit.
- Validate the current radiological conditions of the unit are indicated on the RAM label or tag.
- Check the physical condition of the unit including the condition of the power cord. Do not plug into an electrical power source if the cord shows signs of damage.
- Each HEPA and vacuum unit shall have a unique numbering system and should be signed out to the work location using Attachment 3, HEPA/Vacuum Issue and Return Log, or electronically using site specific processes.
- Use caution when removing end covers of hoses or HEPA units due to the potential for internal contamination. Proper contamination control measures should be implemented prior to removing the covers.

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- Verify the HEPA or vacuum unit DOP/PAO testing is current prior to setup in the field.
- Verify the tamper proof seal or equivalent is in place on the unit.
- Validate the current radiological conditions of the unit are indicated on the RAM label or tag.
- Check the physical condition of the unit including the condition of the power cord. Do not plug into an electrical power source if the cord shows signs of damage.
- Each HEPA and vacuum unit shall have a unique numbering system and should be signed out to the work location using Attachment 3, HEPA/Vacuum Issue and Return Log, or electronically using site specific processes.
- Use caution when removing end covers of hoses or HEPA units due to the potential for internal contamination. Proper contamination control measures should be implemented prior to removing the covers.

Describe the steps and precautions in the set-up of HEPA equipment.

- Ensure exhaust of the HEPA unit is directed away from a contamination area boundary to prevent the potential for airborne generation.
- Ensure the HEPA exhaust screen is intact which prevents personnel injury from rotating equipment.
- Use the following guidance to route the ventilation hose
 - Minimize the amount of hose used to prevent the potential collapsing of the trunk. Keep the hose as straight as possible from the unit to the work site
 - Make sure the suction of the hose is located in the proper location to provide the capture velocity necessary to provide the proper ventilation
 - Minimize sharp bends or curves which can reduce the suction flow and prevent the desired CFM from being achieved. If sharp bends are necessary consider the use of fabricated joints.
 - Route hose in low traffic areas or in the overhead to prevent trip hazards to personnel. As appropriate use safety flagging to make personnel aware of the hazard.
 - If the hose is being routed vertically consider the need for hose supports based on the weight of the HEPA hose being used

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 - If the hose is being routed vertically consider the need for hose supports based on the weight of the HEPA hose being used

Describe the steps and precautions in the set-up of HEPA equipment.

- After inspection and installation of the HEPA hose, connect the unit to power source. If the unit uses greater than 120V AC the unit must be connected by a qualified individual.
- Power up the unit and observe the magnehelic gauge, if equipped, and ensure it falls within the band established for that unit. If the magnehelic gauge is outside the band then secure the unit and take the following actions
 - Validate the hose did not collapse while the unit was in operation.
 - Validate the magnehelic gauge connections are not loose
 - The end of the hose is open and free
 - There are no sharp bends in the hose which could reduce the air flow
 - If no issues were found during a-c above consider the need to replace the HEPA and/or Pre-filters using site guidance.
 - For units operating on 3 phase 220/480V AC it may be necessary to verify the rotation of the unit upon initial startup.
- For operation of vacuum units individuals should review the requirements in Attachment 5, Worker Instructions for Vacuum Operation.

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- For operation of vacuum units individuals should review the requirements in Attachment 5, Worker Instructions for Vacuum Operation.

Describe the correct assembly of HEPA ventilation or vacuum equipment.

- In general, the preferred order of assembly for HEPA-outfitted equipment is for the HEPA filter to be placed upstream of any installed charcoal filter. The reason for this is allow for removal of particulate material before it reaches the charcoal filter – this eliminates unwanted ‘loading’ of the since the charcoal filter is intended to predominantly remove gaseous iodine.
- A spark arrestor, if used, is to be installed at the open end of the suction line to prevent any sparks from entering the ventilation equipment.

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- A spark arrestor, if used, is to be installed at the open end of the suction line to prevent any sparks from entering the ventilation equipment.

Describe the correct assembly of HEPA ventilation or vacuum equipment.

- Additionally, it is preferred that both the HEPA and charcoal filters be located in the suction line; that is, upstream of the blower or fan.
- The reason for this to ensure 'capture' of the contaminant due to the negative pressure created by the blower or fan.

- If the HEPA and / or charcoal filter were to be located in the exhaust line (that is, downstream of the blower or fan) – then a hole in the hose or line between the blower or fan, and the filter would allow some or all of the contaminant to be dispersed without being captured by the filter(s).

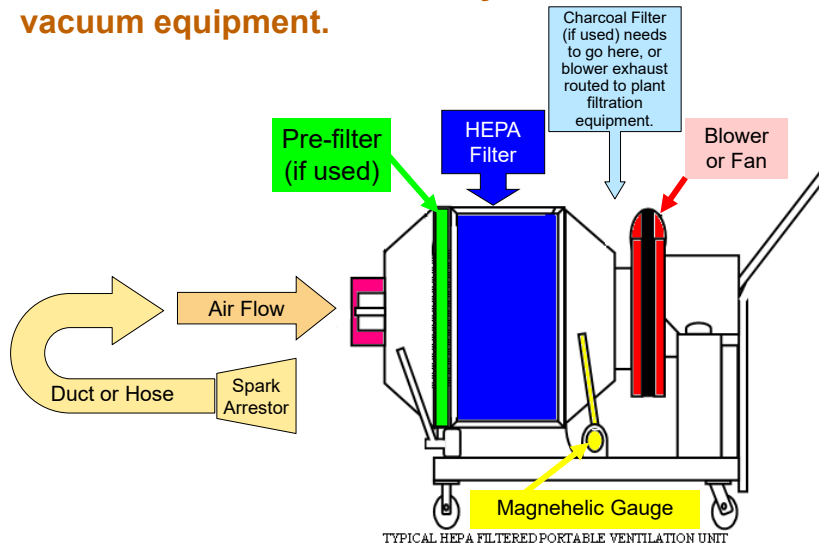
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Describe the correct assembly of HEPA ventilation or vacuum equipment.



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Describe the correct assembly of the equipment.

Clarifying Notes

- At some sites the discharge of the HEPA units may be directed towards, or attached directly to, the plant's containment purge or ventilation system. Ensure the equipment is installed according to site specific documents and tested as required prior to use.
- Note that in such instances, the intent is to utilize the plant's permanently installed contaminant filtration equipment.

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- Note that in such instances, the intent is to utilize the plant's permanently installed contaminant filtration equipment.

Clarifying Notes

- HEPA ventilation equipment could transport harmful vapors or fumes to other areas of the plant or the HEPA media could be damaged. Ensure a proper safety evaluation has been completed prior to using HEPA ventilation equipment when other industrial hazards are present.
- Due to the flow of oxygen a fire in a ventilation hose can spread rapidly. Ensure proper precautions are taken if spark producing work is taking place in the area.

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Describe the proper location for a charcoal filter.

- If a charcoal filter is required install the device in the suction of the HEPA unit or per the manufacturer's instructions.

If a charcoal filter is required install the device in the suction of the HEPA unit or per the manufacturer's instructions.

Use and Control HEPA Filtration and Vacuum Equipment

- General Requirements
- Selection of HEPA Equipment
- HEPA Setup
- **Monitoring of HEPA Operation**
- Storage of HEPA Equipment

NOTE:

This presentation has been developed primarily for use as a Computer-Based Training (CBT) lesson. Consequently, all performance objectives for this Common Industry RP (CIRP) Task are located in the associated Performance Evaluation. If this presentation is used in an Instructor-Led Training (ILT) course, then the performance objectives from the Performance Evaluation should be utilized to create demonstration scenarios for the students. Additionally, the Performance Evaluation performance objectives can be used as part of on-the-job training (OJT) for students to gain proficiency in the objectives prior to conducting the Performance Evaluation for credit.

Describe actions and considerations for monitoring the operation of HEPA vacuums and ventilation, including potential for changing conditions such as dose rates of accumulated filtered material.

- Dose rates monitoring frequency for HEPA and vacuum units should be based on the potential for changing conditions. In most cases the units should be checked daily when in use or at a survey frequency determined by RP supervision. Survey frequency is documented on attachment 4.
- Consider installing a telemetry device, if available, and there is the potential for the HEPA or vacuum unit to become a source of exposure. Install the monitoring device on the inlet of the filter assembly.
- Use Attachment 4, HEPA Shift/Daily Inspection, to validate the operation of the unit once per Day/Shift or at the frequency determined by RP supervision while in operation.

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- Use Attachment 4, HEPA Shift/Daily Inspection, to validate the operation of the unit once per Day/Shift or at the frequency determined by RP supervision while in operation.

Explain the actions to be taken if the operation of HEPA ventilation or vacuum equipment is not as expected.

- If equipment or conditions are not as expected:
 - Stop work until the issue or question can be resolved.
 - Note that specific guidance is provided in Attachment 5 of the procedure for workers using vacuum equipment. These should be briefed to the worker prior to the start of the job.

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 - Stop work until the issue or question can be resolved.
 - Note that specific guidance is provided in Attachment 5 of the procedure for workers using vacuum equipment. These should be briefed to the worker prior to the start of the job.

Attachment 5 – Worker Instructions for Vacuum Operation

- If at any time you are uncertain about your responsibilities, place work in a safe condition and immediately contact RP for guidance.
- Only use a vacuum unit that has been DOP/PAO tested within the last 24 months
- Do **NOT** open a vacuum unit without contacting RP.
- Do not use the vacuum for any other job or task than the one for which the vacuum was issued.
- Do not use wet vacuums for dry work or dry vacuums for wet work
- If a dry vacuum inadvertently collects liquids, **then** stop work, shut off unit and contact RP.
- Ensure that the vacuum cleaner and associated equipment has a yellow radioactive material label or tag with dose rate information. If the tag is not attached, contact RP prior to use for surveying.
- If you have reason to believe that dose rates or contamination levels on the vacuum cleaner or attachments have changed during use, then contact RP to perform a radiological survey and update the radioactive material label or tag
- Verify the unit has a tamper proof seal or equivalent installed and is intact.
- Cover the openings on the suction lines after use, or between uses, to prevent release of contamination.
- Immediately discontinue the use of vacuum cleaner(s) that do not perform properly, have safety issues, or appear to be leaking or discharging at any location other than the normal discharge port.
- If the vacuum becomes full and needs to be emptied, then contact RP
- Return vacuum cleaner to issue station when no longer needed.

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Worker instructions for vacuum operation:

- If at any time you are uncertain about your responsibilities, place work in a safe condition and immediately contact RP for guidance.
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- If the vacuum becomes full and needs to be emptied, then contact RP
- Return vacuum cleaner to issue station when no longer needed.

Describe the purpose of HEPA/Vacuum Issue and Return Log (NISP-RP-08, Attachment 3).

- This log is used to identify the location of the equipment so that the unit can be checked or surveyed.

Attachment 3: This log is used to identify the location of the equipment so that the unit can be checked or surveyed.

Describe the purpose of HEPA Shift/Daily Inspection Log (NISP-RP-08, Attachment 4).

- This log is used to validate that the equipment is continuing to operate properly.

Attachment 4: This log is used to validate that the equipment is continuing to operate properly.

Describe the use of continuous air monitors for high risk activities (i.e. steam generators ventilation) to provide a quick indication of HEPA equipment failure.

- The effectiveness of HEPA unit operation should be monitored based on the risk associated with failure of the unit.
- For high risk activities (for example, Steam generators ventilation) consider the use of continuous air monitors to provide a quick indication of equipment failure.
- For other medium to low risk activities smear the discharge of the unit and/or obtain air samples to validate the units operation.

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Use and Control HEPA Filtration and Vacuum Equipment

- General Requirements
- Selection of HEPA Equipment
- HEPA Setup
- Monitoring of HEPA Operation
- **Storage of HEPA Equipment**

NOTE:

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Describe storage requirements for HEPA equipment, including proper storage of charcoal filters to prevent damage from moisture.

- HEPA and Vacuum equipment should be stored in a controlled manner to prevent unauthorized personnel from placing equipment in service.
- RP personnel will maintain the control of HEPA and vacuum units by issuing equipment using Attachment 3, HEPA/Vacuum Issue/Return Log, or site electronic processes or forms.
- Fire loading should be considered before storing HEPA ventilation equipment inside the plant.
- HEPA and vacuum equipment shall be clearly tagged in accordance with NISP-RP-04, Radiological Posting and Labeling.
- Charcoal filtration units should be stored to prevent damage from moisture based on manufactures recommendations.

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Must-Know Operating Experience – INPO 12-005

Important Points

- In each event described in this document, personnel could have been prevented from receiving unplanned exposures through implementation of more rigorous radiological protection measures.
 - Radiological protection technicians were not always aware of the radiological conditions encountered, did not always recognize changes in the radiological conditions, or failed to take the proper actions in response to unusual conditions.
 - In each of the events described, work practices used by one or more individuals indicated a disregard for good radiological protection practices and requirements or demonstrated a lack of knowledge.

Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to HEPA equipment.

If material is presented as instructor-led training, instructor should review appropriate events from INPO 12-004.

Operating Experience: ICES 322834

Important Points

- During Refueling Outage, elevated airborne contamination levels in containment led to evacuation of the containment. Individuals alarming the Radiological Controlled Area (RCA) egress portal monitor were sent for investigational whole body counts (WBC). A number of individuals had documented intakes of greater than 10 mRem and work was stopped in Containment causing a delay to Outage Critical Path.
- The Radiation Protection Organization did not follow procedures or standards, effectively turnover, effectively communicate, maintain a low threshold for initiating condition reports and did not process data timely and collectively to get a big picture of containment airborne conditions. This allowed for Steam Generator (SG) Eddy Current Testing (ECT) to continue and led to evacuation of containment due to airborne conditions.
- The set-up, control and monitoring of the portable air filtration system and vacuum system used to control airborne contaminants during Steam Generator Eddy Current Testing was not commensurate with the radiological conditions encountered during the task.

Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to radiation and contamination surveys.

If material is presented as instructor-led training, instructor should review appropriate events from INPO 12-004.

Operating Experience: ICES 315577

Important Points

- This event is noteworthy because inadequate planning and communication by work management department resulted in several workers receiving internal uptakes and causing two personnel contamination events.
- During reactor disassembly for a refueling outage, reactor pressure vessel (RPV) level was raised with the high efficiency particulate air (HEPA) hose detached from the RPV flange. Reactor water level was not at the flange level when the RPV vent piping was removed, contrary to procedure guidance. Bringing the subcooled water level up to the flange caused the coolant to flash to steam and exit the open RPV vent piping. This resulted in airborne contamination affecting the refueling floor. In addition, several workers received internal uptakes and there were two personnel contamination events (PCEs).
- Poor Planning & Communication: Timely and accurate communications within and between work groups would have identified the need to reconnect the HEPA hose before adjusting RPV level. Additionally, strict adherence to the schedule would have ensured the HEPA hose was connected prior to adjusting RPV level.
- Ineffective Oversight: Effective oversight would have identified gaps in communication and schedule adherence.

Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to radiation and contamination surveys.

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Operating Experience: ICES 204665

Important Points

- During work to support reactor head inspection and repair, a release of airborne radioactivity resulted in work stoppage and minor internal contamination of 22 personnel.
- Eddy current testing of the reactor head required the use of portable HEPA ventilation.
- Airborne monitors alarmed at 0.54 DAC and trended up to 0.65 DAC.
- 4000 dpm/100cm² found on the HEPA unit exhaust while it was running.
- Water from the eddy current testing entered the HEPA hose causing failure of the filter.

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Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to radiation and contamination surveys.

If material is presented as instructor-led training, instructor should review appropriate events from INPO 12-004.

Operating Experience: ICES 225486

Important Points

- Supplemental workers were performing work on components to be used in the containment sump modification. A HEPA unit was being used to remove fumes from grinding and welding operations. Sparks from welding/grinding entered the inlet of a HEPA filter causing the HEPA filter media to smolder. It was determined that the HEPA filter did not have a spark arrestor installed.
- The apparent cause is human performance error by the supplemental craft, first line supervisor, superintendent and safety professional. All failed to recognize the potential safety hazard presented by the HEPA paper filters in close proximity to the hot work in progress
- The filter was in an area where it could be moved so that the smoldering filter media could be extinguished. If the filter was being used in a confined area such as in containment, the smoke generated could be hazardous.

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Must-Know Operating Experience for Radiological Protection is available in INPO document 12-004, as well as, INPO's ICES database. This slide summarizes the lessons learned from INPO 12-004 as they pertain to radiation and contamination surveys.

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Expectations for Radiological Protection

The RP Technician:

- Is expected to be able to accurately assess the need for HEPA equipment in support of plant work. The appropriate application, set-up, use and monitoring of these devices is critical to ensuring that radiological hazards are minimized, and that workers are not inadvertently contaminated.
- Is expected to use human performance tools to reduce errors. Applicable tools are self-verification, questioning attitude and procedure adherence.

Consequences of Inadequate Performance:

- Failure to properly protect workers from airborne radiological hazards, spread of contamination or environmental hazards.
- Potential to have a contamination or radioactive material control event, NRC identified finding and / or Technical Specification violation.

Expectations for Radiological Protection are shown on the slide.

Enabling Objectives

1. Describe the general requirements for set-up, use and control of HEPA and vacuum units.
2. Select equipment and hose size by using capture velocity chart or historical data (as appropriate), or as specified in the RWP or ALARA plan.
3. Describe conditions that would require the need for:
 - HEPA Filter
 - Charcoal Filter
 - Spark Arrestor
 - Wet Vacuum
4. Describe how to verify efficiency testing of the HEPA equipment is current.
5. State the types of vacuum or ventilation units that are approved for use in the RCA.
6. Describe the steps and precautions in the set-up of HEPA equipment.
7. Describe the correct assembly of HEPA ventilation or vacuum equipment.

If material is presented as instructor-led training, review the objectives with the students; preferably, by asking directed questions.

Enabling Objectives

8. Describe the proper location for a charcoal filter.
9. Explain the actions to be taken if the operation of HEPA ventilation or vacuum equipment is not as expected.
10. Describe the purpose of HEPA/Vacuum Issue and Return Log (NISP-RP-08, Attachment 3).
11. Describe actions and considerations for monitoring the operation of HEPA vacuums and ventilation, including potential for changing conditions such as dose rates of accumulated filtered material.
12. Describe the purpose of HEPA Shift/Daily Inspection Log (NISP-RP-08, Attachment 4).
13. Describe the use of continuous air monitors for high risk activities (i.e. steam generators ventilation) to provide a quick indication of HEPA equipment failure.
14. Describe storage requirements for HEPA equipment, including proper storage of charcoal filters to prevent damage from moisture.

If material is presented as instructor-led training, review the objectives with the students; preferably, by asking directed questions.

Performing Radiation & Contamination Surveys Training Conclusion

- Questions: Contact Tom Stroschein, 361-972-7734
- Feedback: Email tmstroschein@stpegs.com
- Conclusions: In our industry it is vitally important to be able to appropriately use and control HEPA equipment. The Radiation Protection Technician is expected to ensure that such equipment is set-up correctly and monitored appropriately such that workers are not inadvertently contaminated.



Together...Shaping the Future of Electricity

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Provide course feedback to EPRI STE program: clear@epri.com