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Division of Workers' Compensation

Respirator Protection

Workplace Program

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DISCLAIMER

This Respirator Protection Workplace Program is a guide to help employers develop a safety plan to comply with the requirements of the Occupational Safety and Health Administration (OSHA). It contains helpful information and the basic elements to build a safety and health program. It is not meant to supersede OSHA requirements. Employers should review the OSHA standard for each specific worksite and customize the program accordingly.

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INTRODUCTION

Workplace Program

Effective respirator use is crucial to protect workers in environments where exposure to hazardous airborne agents—such as dust, particulate matter, gases, sprays, or volatile chemicals—occurs. Respirators serve as vital barriers against these threats, safeguarding employees from serious health risks, including lung damage, cancer, and even death.

Employers must establish and maintain robust respiratory protection programs, as mandated by the Occupational Safety and Health Administration (OSHA). These programs require selecting the correct respirator for the hazards present, conducting medical evaluations to assess employees' ability to use respirators, and performing regular fit testing to ensure a proper seal. In addition, employees must receive thorough training on the correct use, maintenance, and limitations of their respirators, as well as instructions for proper inspection and storage.

Modern advancements in respirator design enhance comfort, breathability, and communication capabilities, making prolonged use more manageable. Technologies such as wearable sensors and online tools assist in real-time monitoring of exposures and in selecting the appropriate respirator for specific tasks.

By following the practices outlined in this publication, employers reduce risks associated with hazardous environments and create a safer, healthier workplace. Also, employees gain clear instructions to protect themselves and understand their rights and responsibilities under OSHA regulations. Together, these efforts build a culture of safety that prioritizes the well-being of everyone on the job.

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Understanding Respiratory Hazards

Respiratory hazards, which often remain invisible and undetectable by smell or touch, take many forms, including dust, fumes, gases, vapors, extreme temperatures, and insufficient oxygen environments. These hazards can cause damage to the respiratory system and pose life-threatening risks.

Types of Hazards and Their Effects:

- **Particles:** Inhaled particles irritate and clog the nose, throat, and lungs. Air-purifying particulate filters remove these contaminants, including dust, mist, and fumes.
- **Gases and vapors:** These may enter the bloodstream and harm internal organs such as the brain. Air-purifying cartridges or canisters eliminate these hazards.
- **Extreme temperatures:** Exposure to very hot or cold air damages airway tissues, complicating normal breathing.
- **Oxygen Deficiency:** Environments with low oxygen levels lead to severe health issues, ranging from impaired judgment to cardiac arrest and death.

Identifying hazards and measuring exposure levels constitute the first steps in addressing these risks.

Possible side effects of reduced oxygen levels

- **20.9%** - Normal atmospheric oxygen content.
- **19.5-21%** - Impaired judgment, thinking, and attention.
- **16.0-19.0%** - Increased pulse and breathing rate, decreased muscle coordination, and reduced intellectual and physical performance.
- **12.5-16%** - decreased ability to work strenuously, rapid fatigue, increased respiration, emotional upset, and impaired respiration that may cause permanent heart damage, nausea, and vomiting.
- **10.0-12.5%** - judgement is severely impaired and there is a possibility of fainting within a few minutes without warning.
- **6.0-10.0%** - All of the symptoms above plus unconsciousness.
- **< 6.0%** - convulsions, cessation of breathing, cardiac arrest, and death. At this level, the effects are immediate and severe, with unconsciousness occurring after only one or two breaths.

Respirator Selection Criteria

OSHA's Respiratory Protection Standard (29 CFR 1910.134) *requires evaluating air contaminants and selecting suitable respirators based on specific workplace hazards. Selection involves identifying the type of hazard, measuring exposure levels, and using guidelines from sources such as the* ***National Institute for Occupational Safety and Health (NIOSH)*** *and the* ***American National Standards Institute (ANSI)*** *to determine the appropriate respirator type.*

Types of Respirators

Medical Evaluations for Respirator Use

Medical evaluations play a critical role in respiratory protection programs. Before assigning respirators, employers must ensure workers undergo evaluations by qualified physicians or licensed health care professionals to determine their ability to safely use respirators. This assessment considers factors such as medical history, physical fitness, and potential workplace conditions that may affect respirator performance or comfort.

Respirators fall into two primary categories:

1. **Air-purifying respirators (APRs):** Remove contaminants from the air through filters, cartridges, or canisters. APRs address particulate, gas, and vapor hazards but do not supply oxygen, therefore, **cannot be used in environments that are immediately dangerous to life or health (IDLH).**

2. **Atmosphere-supplying respirators (ASRs):** Provide clean breathing air from external sources, making them suitable for oxygen-deficient or IDLH environments.

Each category encompasses multiple designs, such as filtering facepiece respirators, elastomeric respirators, powered air-purifying respirators, supplied-air respirators, and self-contained breathing apparatus. Proper selection depends on hazard type, air quality testing, and workplace safety needs. Safety Data Sheets (SDSs) should be consulted to help determine the appropriate type of respiratory protection.

Air-Purifying Respirators (APRs)

APRs are often classified by either functionality or design. When classified by function, they are divided by their filtering capabilities: **particulate filtering** or **vapor and gas filtering**.

1. **Particulate filtering:** These respirators are specifically designed to remove solid particulates such as dust, mists, and fumes. They use filters to capture these particles from the inhaled air.

2. **Vapor and gas filtering:** These respirators use chemical cartridges or canisters to absorb harmful gases and vapors from the air. Some models may also incorporate particulate filters to provide dual protection against both particles and gases.

When APRs are classified by design, there are four main types: **filtering facepiece respirators (FFRs)**, **elastomeric half-mask respirators(EHMRs)**, **elastomeric full-mask respirators (EFMRs)**, and **powered air-purifying respirators (PAPRs)**.

1. **Filtering facepiece respirators (FFRs):**
Commonly known as dust masks, FFRs offer a physical barrier against dust, mists, fumes, and fibers. They are disposable and cover the nose and mouth but do not protect against gases, vapors, or oxygen deficiency.

2. **Elastomeric half-mask respirators (EHMRs):**
EHMRs are reusable respirators with exchangeable cartridges or filters. Made from synthetic or natural rubber, they allow for cleaning and reuse. When equipped with the proper filters or cartridges, EHMRs protect against gases, vapors, and particles. Fit testing is required at least annually to ensure a proper seal.

3. **Elastomeric full mask respirators (EFMRs):**
EFMRs are similar to EHMRs but they cover the entire face, including the eyes. EFMRs provide greater protection against airborne hazards like splashes of liquids and irritating vapors. Proper fitting is essential for effective use.

4. **Powered air-purifying respirators (PAPRs):**
PAPRs are reusable and often have a hood or helmet that covers the nose, mouth, and eyes. A battery-powered blower pulls air through filters or cartridges to protect against gases, vapors, or particles. They provide ease in breathing and protect the eyes. Loose-fitting PAPRs do not require fit testing and can be used with facial hair. Tight-fitting PARPs require fit testing.

Atmosphere-Supplying Respirators (ASRs)

ASRs provide breathable air in environments where APRs are insufficient or in oxygen-deficient atmospheres. Tight-fitting ASRs require fit testing before use. There are three basic types of ASRs: supplied-air respirators (SARS), self-contained breathing apparatus (SCBA), and combination SAR/SCBA respirators.

1. **Supplied-air respirators (SARs):**
   SARs deliver clean air from a remote source via a hose to a facepiece (tight-fitting mask, loose hood, or helmet). They are used when APRs do not provide adequate protection for the duration of the task.

2. **Self-contained breathing apparatus (SCBA):**
   A SCBA contains its own supply of breathable air which the user carries for use in IDLH. These are essential for firefighters, rescue workers, and other industrial personnel who work in environments with highly contaminated air, oxygen-deficient atmospheres, or extreme temperatures. They come in two types: **open-circuit** and **closed-circuit**.

   A. Open-circuit SCBAs:
   The user carries a pressurized cylinder on the back to supply breathable air for about 30-90 minutes. The exhaust air is exhaled instead of recirculated. The air can be either continuous flow (escape-only), on-demand, or on-pressure-demand configurations.

   B. Closed-circuit SCBAs:
   These devices, also known as rebreathers, recycle exhaled air by removing carbon dioxide and replenishing oxygen. They are approved for both entry and escape, or escape only, usually rated for 20-60 minutes of use. There are two basic categories of closed-circuit SCBAs: **on-site intervention devices** and **emergency escape breathing devices**.

   i. On-site intervention devices:
   These are designed for extended use in hazardous environments where breathable air is not available. Most are rated for up to four hours of use.

   ii. Emergency escape breathing devices (EEBD):
   This type of device is designed for use in emergencies to allow the wearer to escape from hazardous environments. EEBDs are typically compact and easy to use, providing a limited supply of breathable air for a short duration (usually 10-15 minutes) to facilitate a safe exit

from danger. They are commonly found in places like ships, oil rigs, and industrial settings where there is a risk of toxic gas releases or other emergencies. There are two basic types of EEBDs: **closed-circuit escape respirators** and **self-contained self-rescuers**.

a. Closed-circuit escape respirators (CCERs):
CCERs are designed for emergency escape situations, providing breathable air in environments that are IDLH. Typically compact and easily stored for quick access, CCERs offer limited breathable air, generally around 10-20 minutes, making these essential in industries such as mining, construction, and maritime operations where rapid evacuation is crucial.

b. Self-contained self-rescuers (SCSRs):
SCSRs are designed for self-rescue in emergencies. They generate breathable oxygen through a chemical reaction involving potassium superoxide (KO2) and moisture from the user's breath, effectively scrubbing carbon dioxide from exhaled air; some models may also use compressed oxygen. SCSRs typically provide a longer duration of breathable air compared to standard CCERs, offering around 30-60 minutes. While primarily used in mining, SCSRs are also suitable for other confined spaces and high-risk environments where immediate self-rescue is necessary.

3. Combination SAR/SCBA respirators:
This pressure-demand combination unit has a small self-contained air supply. It is suitable for IDLH environments such as entering confined spaces. This respirator provides air if the airline supply fails or becomes interrupted.

Fit Testing

Employers must ensure respirators fit securely and function effectively. OSHA mandates qualitative or quantitative fit testing before initial use, when changing facepieces, and annually thereafter.

1. **Qualitative fit testing:** Qualitative fit testing is a pass/fail method that relies on the wearer's senses—such as taste, smell, or reaction to an irritant—to detect any leakage into the respirator. During the test, a harmless substance, often a bitter-tasting chemical like Bittrex, is introduced into the environment around the wearer. If the wearer can taste or smell the substance while wearing the respirator, it indicates a poor fit, and the test is considered a failure. This test does not measure the actual amount of leakage.

2. **Quantitative fit testing:** Quantitative fit testing, on the other hand, provides a numerical assessment of the respirator's fit by measuring the amount of air that leaks into the respirator facepiece. This method uses special equipment to calculate a "fit factor" determined by comparing the concentration of an agent inside the respirator to its concentration in the surrounding environment.

Ensuring a Snug Fit

A secure fit is essential for effective protection. Make sure the respirator is the right size for your face. Facial hair and skin conditions can affect the fit. Test the fit by covering the cartridges with your palms; if fitted properly, the mask should suck in tightly around your face when you inhale.

Breathing Effort

Breathing through a respirator requires more effort than normal breathing. If you have medical limitations that could affect respirator use, inform your supervisor. A medical examination may be necessary to confirm your ability to work while wearing a respirator.

Maintenance

Regular maintenance, including cleaning, storage, and part inspections, prevents equipment failures and extends service life. Here are essential maintenance steps:

- Ensure all parts are clean and functional.
- Check facepieces for damage.
- Perform leak checks.
- Replace damaged valves, hoses, or filters.
- Inspect head harnesses for wear.
- Tighten loose connectors.
- Never share respirators without cleaning the device first.
- Store respirators in sealed containers away from dust, sunlight, extreme temperatures, moisture, or chemicals to prevent damage.
- Inspect respirators designated for emergencies each month to ensure they are reliable when needed.

Respiratory Protection Program

Employers are required to develop and implement a written respiratory protection program in any workplace where respirator use is mandatory (as determined by air monitoring) to protect the health of workers or where respirator use is required by the employer's judgment. A written respiratory protection program is also necessary when employers allow voluntary use of approved respirators, such as in instances of exposure to nuisance levels of airborne contaminants.

The voluntary-use respiratory protection program is simpler in both practice and protocol. Specific requirements for both mandatory and voluntary use are outlined in the Respiratory Protection Standard, 29 CFR 1910.134.

An effective respiratory protection program must include the following components:

1. **Written Standard Operating Procedures (SOPs):**
   Procedures for the safe and proper use of respirators.

2. **Regular Program Evaluation:**
   Ongoing assessment and modification of procedures as needed.

3. **Respirator Selection:**
   Selection must align with potential and existing hazards. Refer to Safety Data Sheets (SDS) and air sampling results to ensure proper protection.

4. **Training:**
   Provide training on respirator selection, use, and maintenance under the following circumstances:
   - When a new chemical is introduced
   - When a change in respirators is required.
   - When a new hire encounters workplace hazards.

5. **Fit Testing:**
   Fit testing must include:
   - Demonstration and practice in wearing and adjusting respirators.
   - Determination of proper fit.
   - Positive/negative seal tests.

6. **Respirator Maintenance:**
   Ensure all respirators are:
   - Inspected for wear and deterioration before and after each use.
   - Repaired by qualified personnel as needed.
   - Cleaned and disinfected after each use.
   - Properly stored to protect against dust, sunlight, heat, extreme cold, moisture, or damage.

7. **Medical Examinations:**
   Examinations by a qualified physician must assess:
   - Pertinent health and physical conditions.
   - Physical ability to perform job duties.
   - Continued ability to perform work through periodic medical reviews.

8. **Workplace Monitoring:**
   Regularly monitor work area conditions and assess worker exposure and stress levels.

9. **Air Quality Standards:**
   Ensure compliance with air quality standards for:

   - Remote respirator air supplies delivered by cylinders or air compressors.
   - Clearly marked containers of breathable gas.

10. **NIOSH-Approved Respirators:**
    Only use respirators approved by the National Institute for Occupational Safety and Health (NIOSH). Inspect for wear and damage before and after each use.

Employer and Employee Responsibilities

- **Employers:**
  - Employers must implement controls (e.g., ventilation) to reduce air contaminants.
  - When controls are insufficient, employers must provide appropriate respiratory protection. All equipment must meet OSHA standards.
  - When respirators are provided for mandatory use, employers must develop and implement a written Respiratory Protection Program. (See below.)
  - When respirators are used voluntarily against nuisance levels, a Voluntary Use Respiratory Protection Program is required.
  - Employers must train employees on how to protect themselves from hazardous materials, including the proper use of PPE, like respirators.
- **Employees:**
  - Employees must use protective equipment as directed.
  - Employees must follow workplace safety protocols.

OSHA Compliance

Review the following OSHA standards to protect employees from hazardous materials, including the proper use of PPE.

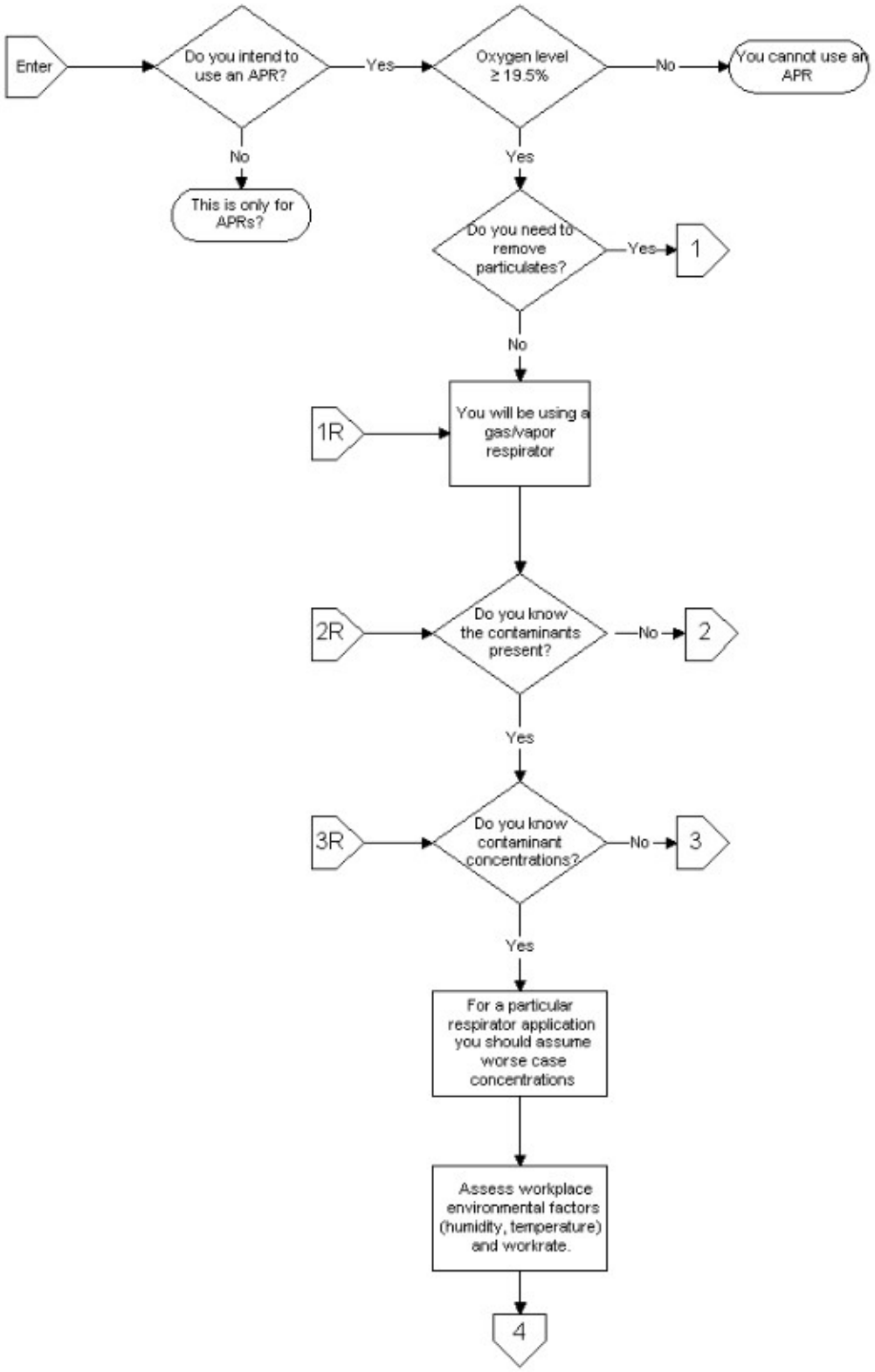
- **Respiratory Protection Standard (29 CFR 1910.134).**
- **Hazard Communication Standard (29 CFR 1910.1200).**
- **Personal Protective Equipment Standard (29 CFR 1910.134).**

1910.134 Respiratory protection requirement	Filtering face-piece (dust mask)	Elastomeric negative-pressure respirator	Powere-air purifying	Supplied-air respirator
Written respiratory program	No	Yes	Yes	Yes
Medical Evaluation	No	Yes	Yes	Yes
Fit testing	No	No	No	No
Annual Training	No	No		
Appendix D to 1910.134	Yes	Yes	Yes	Yes
Clean, inspect, maintain, and store	Yes	Yes	Yes	Yes

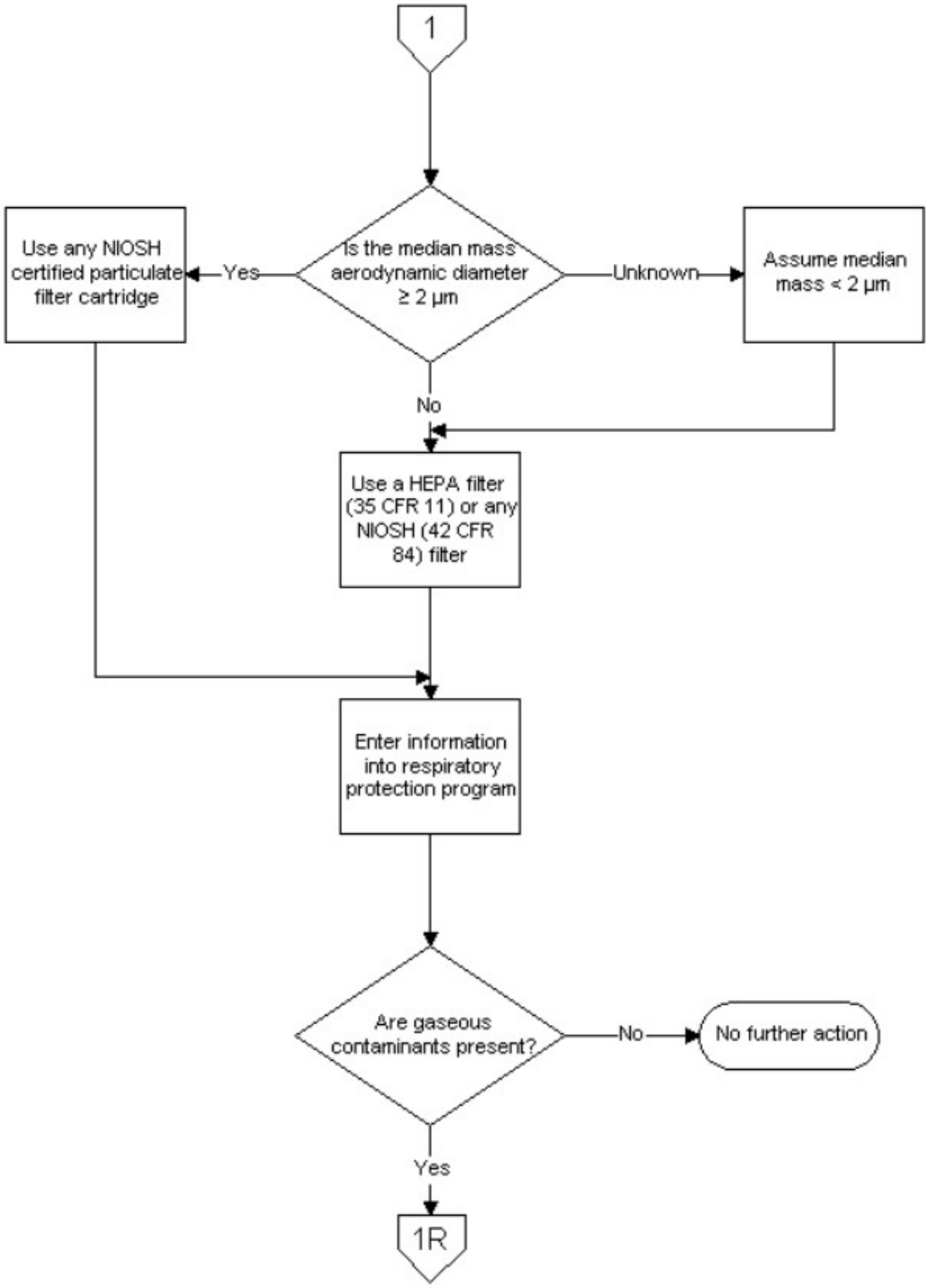
Conclusion

Comprehensive respiratory protection programs save lives by mitigating risks from hazardous airborne agents. Employers and employees must work together to maintain safety with proper respirator selection, proper training, medical evaluations, and adherence to OSHA standards. Prioritizing respiratory health creates safer workplaces and protects employees from life-threatening dangers.

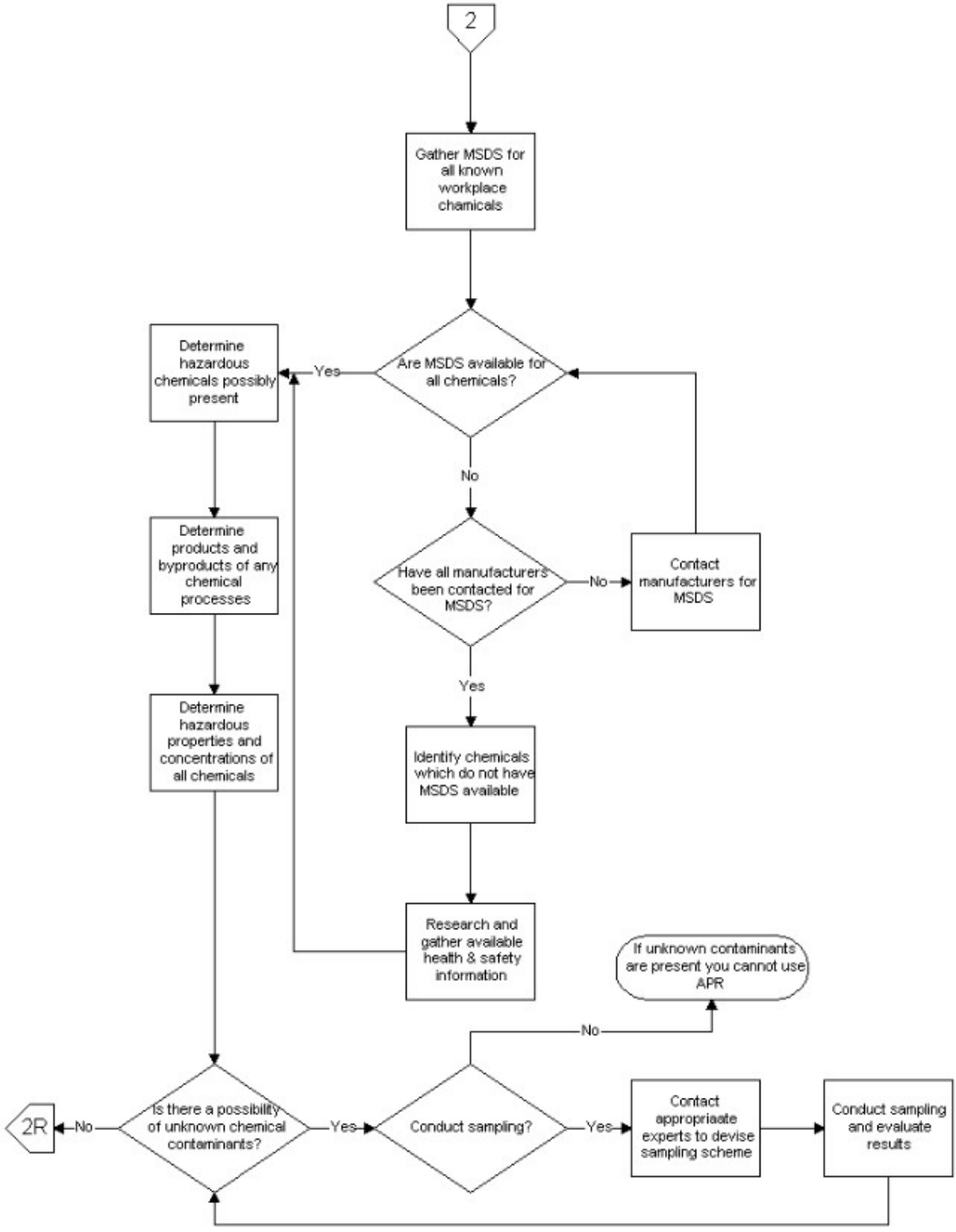
Appendix A:
Respirator Selection Flowchart



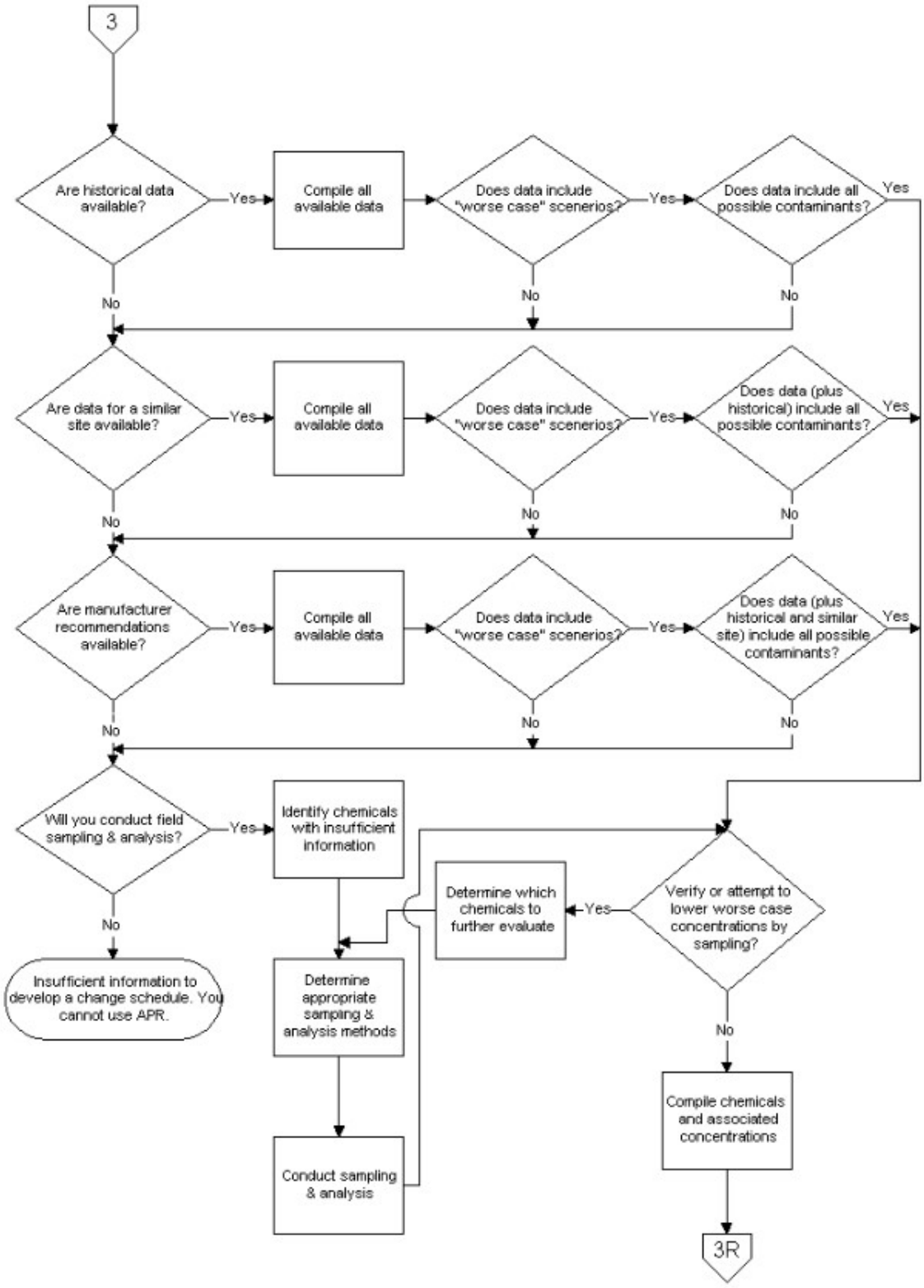
Appendix B:
Respirator Change Schedule-Decision Logic Flowchart 1



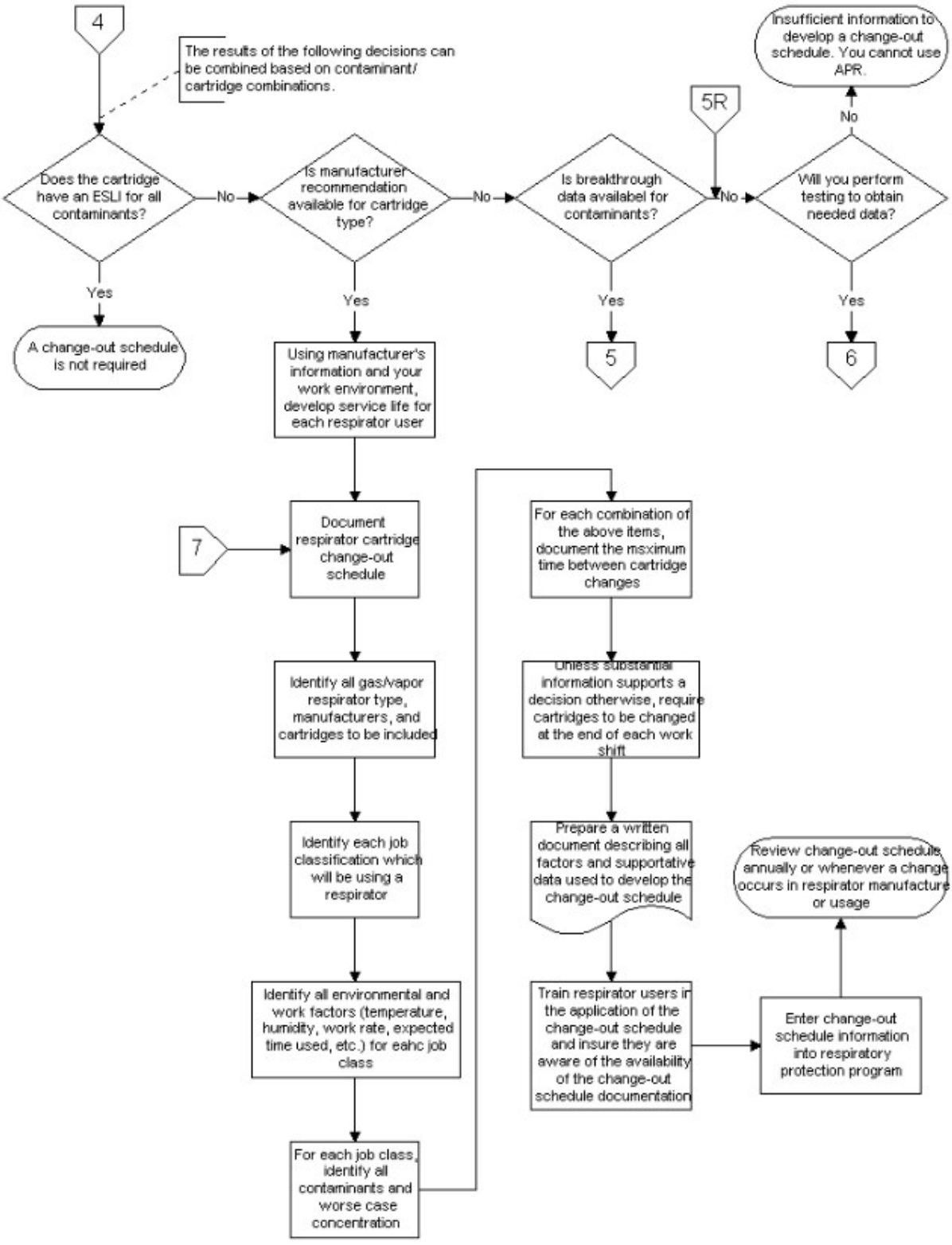
Appendix C:
Respirator Change Schedule-Decision Logic Flowchart 2



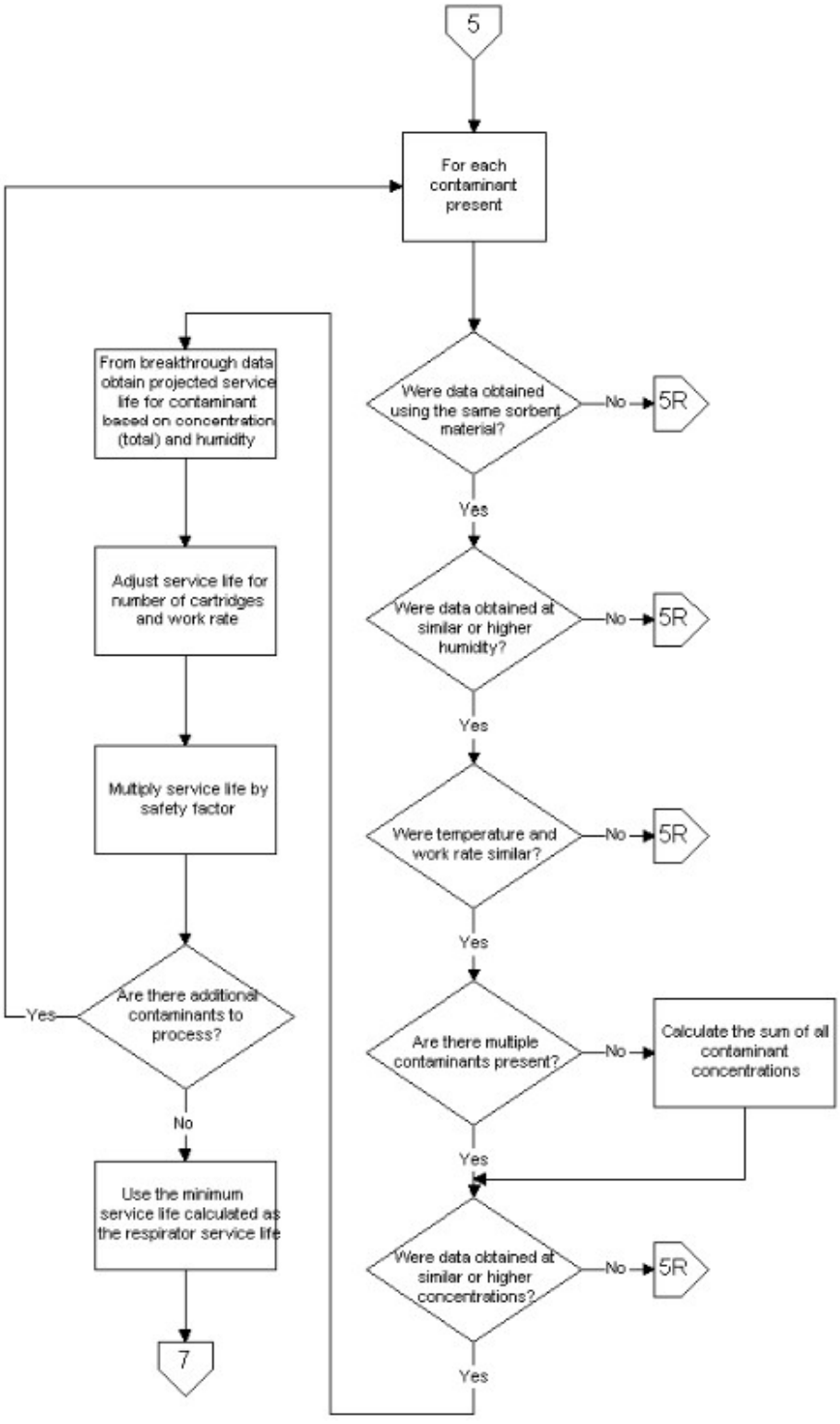
Appendix D:
Respirator Change Schedule-Decision Logic Flowchart 3



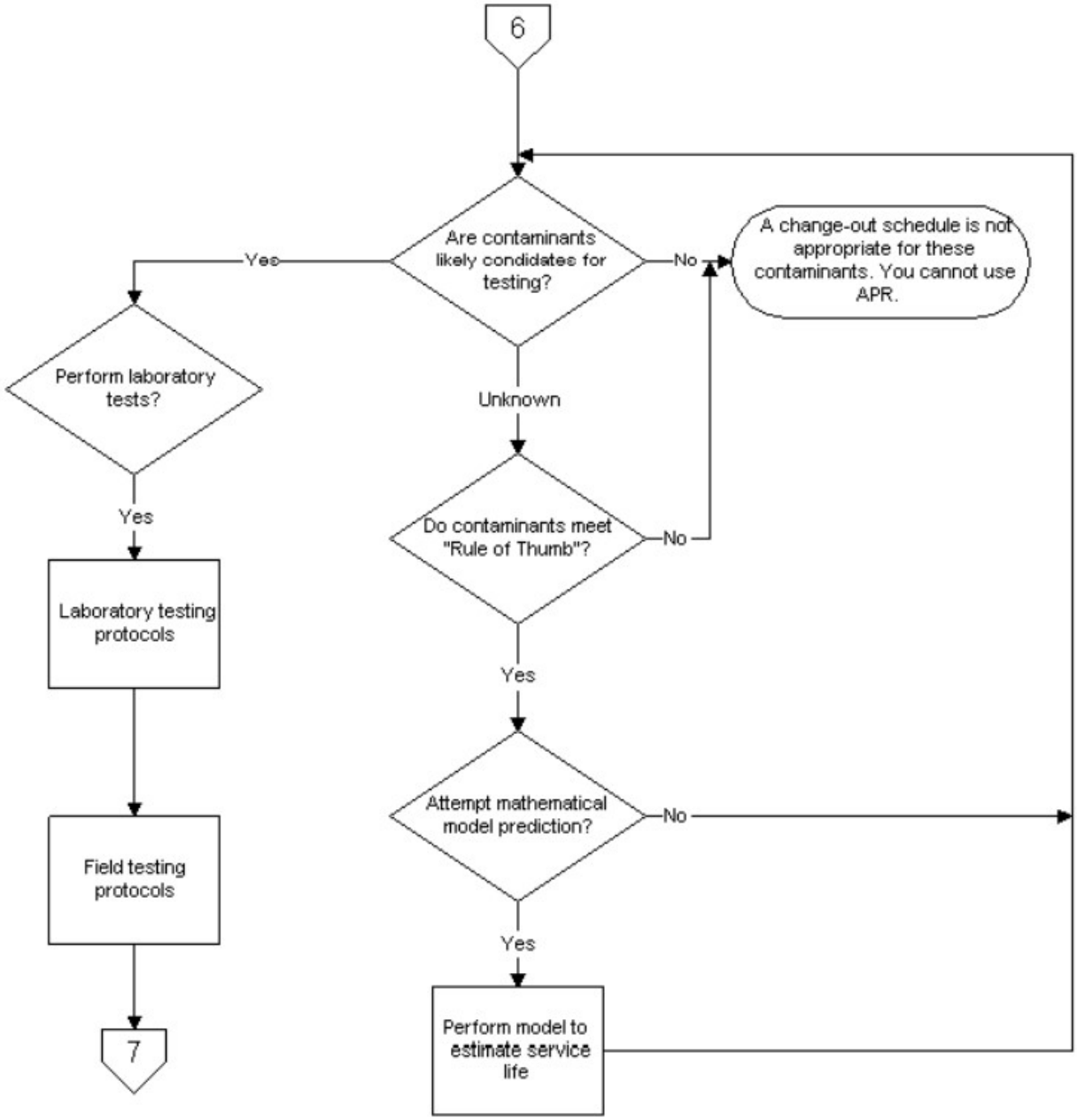
Appendix E:
Respirator Change Schedule-Decision Logic Flowchart 4



Appendix F:
Respirator Change Schedule-Decision Logic Flowchart 5



Appendix G:
Respirator Change Schedule-Decision Logic Flowchart 6



Appendix H:
NIOSH Filter Classifications