



# Savannah River Site Supplied-Air Suits



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# Savannah River Site (SRS)

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- **Department of Energy site**
- **Constructed in the 1950's to support the U.S. defense programs**
- **Less recognized missions**
  - Neutrino first discovered
  - Had first nuclear reactor operated by computer
  - Produced Pu-238 used as heat sources for deep space missions
  - Radioisotopes for nuclear medicine and research
- **In addition to continuing the support of our defense program**
  - Radioactive waste solidification – borosilicate glass and grout
  - Mixed waste soil remediation programs
  - Radioactive waste tank cleaning and closure
  - Hydrogen fuel cell technology
- **<http://www.srs.gov/general/about/history1.htm>**

# **SRS Overview Of Supplied-Air Suits**

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- **What is a supplied-air suit**
- **Discuss the SRS suit**
- **Describe suits in DOE facilities circa 1984 - LA-UR-84-846**
- **Current suit use in DOE facilities as of 2007**
- **Discuss unique considerations applicable to using suits**
- **Future**

# What Is A Supplied-Air Suit

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- **Currently defined by DOE-STD-1167-2003**
  - **Constructed for entire body**
  - **Primarily protects breathing zone**
  - **Normally also protects skin depending on the contaminant**
  - **Air supplied to head and preferably to body**
  - **Includes hoses, attachments, and accessories**
  - **Addresses user program**
- **Not a NIOSH certified hood taped to garments**

# History of the SRS Supplied-Air Suit

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- **First documented use in 1960's**
- **Initially used for tritium - migrated to use in other facilities**
- **Initially 6-mil PVC**
- **Various versions & modifications**
  - **One-piece and two-piece**
  - **Improved durability & tritium protection with 12-mil PVC**
  - **Welding addressed with welding helmet features**
  - **Improved comfort with vortex tubes and 'ice barrels'**
  - **Improved tritium protection with Saranex®**
  - **Addressed fall protection**
  - **Reduced cross contamination with shells or oversuits**

# SRS 12-mil Supplied-Air Suit

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- **Single use**
- **Two-Piece**
  - 12-mil PVC top and pants
  - 20-mil PVC viewing area
- **Airflow of 16-24 cfm**
- **Air distributed to helmet and pants**
- **Can be used with a vortex tube or ice barrel**
- **Typically worn with 2 pair of coveralls over Level D clothing**



# SRS Tritium Suit

- **Single use**
- **Two-Piece**
  - **9-mil top and pants**
    - Chlorinated polyethylene
    - Saranex®
    - Polyester scrim
    - Layers bonded with ethylene vinyl acetate
    - 40-mil PVC viewing area
- **Superior breakthrough and permeation characteristics for tritium**



## Key Steps In The Production Of The SRS Suit

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# Suit In Use And Process Of Removal

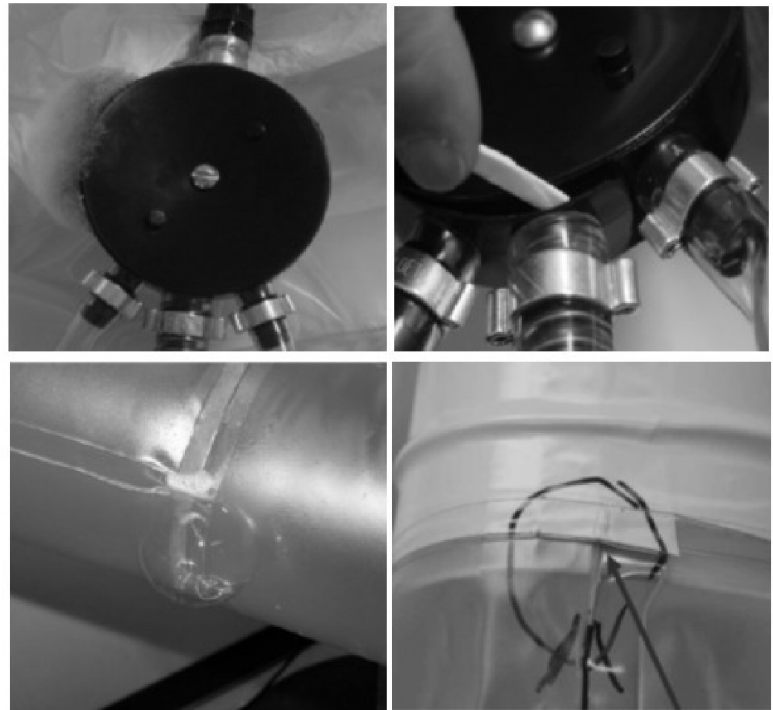
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## Opportunities For Improvement With SRS Suits

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- **Air Distribution System issues**
- **Material change (PVC to alternative) to eliminate pinholes**
- **Improved cuff design (sealed versus stitched)**
- **Reduce noise level**



# Suit Status In DOE Facilities 1984

LA-UR-84-846

User If Listed Manufacturer	Style	Comments
Rocky Flats JJ Avery	2-Piece 12-mil PVC 6 CFM 20K APF	1-Piece in use Half mask respirator during doffing
SRS Rich Industries	2-Piece 6-mil PVC 6 CFM 10K APF	Upgraded & now available in 4 styles
LANL Fab Ohio	2-Piece 6-mil PVC 6 CFM 10K APF	2 versions with different air distributions
Oak Ridge Fab Ohio	2-Piece 6-mil PVC 8 CFM 10K APF	
Rich Industries	1-Piece 20-mil PVC 6-CFM 10K APF	

## Current Status In DOE Facilities

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<b>SRS</b>	<b>4 suit styles with various sizes &amp; features Annual usage currently ~3,500 Peaked at 67,000 in1990</b>
<b>LANL</b>	<b>Uses SRS suit</b>
<b>Idaho</b>	<b>Using a suit that evolved at Rocky Flats after the 1984 report APF limited to 1,000</b>
<b>Y-12</b>	<b>Supplied-air suit used for product protection</b>

# Unique Considerations In Designing Suits

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- **Major design consideration**
  - Avoid creating O<sub>2</sub> deficient or elevated CO<sub>2</sub> condition
    - Air Off results in 19.5% O<sub>2</sub> in less than 20 seconds
    - Air Off results in 16% O<sub>2</sub> 40-70 seconds depending on conditions
- **Address loss of air**
  - Unassisted removal
  - Built in 'escape' cartridge
  - Egress air
    - SRS breathing air systems typically provide 5 minutes
- **Assigned Protection Factor**
  - Historically 10K within DOE

# Unique Considerations In Designing Suits

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- **Volume of air required may impact breathing air systems**
  - 4 - 10 CFM for NIOSH approved masks & hoods
  - Much higher volume may be required for suits to address cooling or protection factor
- **Donning & removal**
  - One-piece
  - Two-piece
  - Typically requires additional person
- **Body Types**
  - Height
  - Girth
  - Inseam

# Unique Considerations In Designing Suits

- **Suit materials - PVC - is a balancing act**
  - In cold weather PVC films become rigid and can break
  - In hot weather PVC films may sag and distort vision
- **Self-extinguishing characteristics**
  - **Acceptable suit materials DO burn**
    - Self-extinguish when flame is removed
    - Film does not drip during burn



# Unique Considerations In Designing Suits

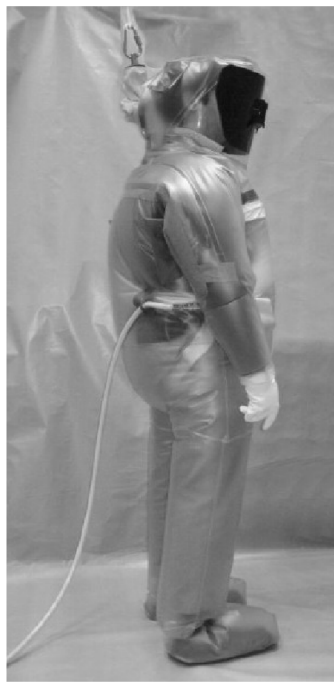
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- **Noise levels**
  - Higher than hoods
  - Suit design affects noise level
    - Location of where air enters suit
    - Higher air volume generally increases noise
- **Heat Stress**
  - Air may need supplemental cooling
- **Chemical Permeation**
- **Additional equipment**
  - Hard hats
  - Communication devices
  - Body harness



# Unique Considerations In Designing Suits

- Suits **MUST** be designed with use of harness in mind
  - Workers should not don harness over suit
  - Improper use may result in reduced APF
  - Improper use may affect how fall arrest operates



# FUTURE

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- **DOE facilities beyond SRS expressing interest in using suits**
- **PAPR Suits**
- **Efforts beyond DOE**
  - ASTM
  - NIOSH