CBRN PAPR
Laboratory Respirator Protection Level (LRPL)

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NIOSH/NPPTL Public Meeting

Hilton Garden Inn, Canonsburg, Pa

CBRN PAPR
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- Description- Fit-factor corn oil aerosol test
- Purpose- Establishes a benchmark level of protection under laboratory conditions
- Not intended as an indication of protection in an actual response scenario

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Challenge Aerosol Criteria

- 20 – 40 mg/m^3 Corn Oil aerosol
- 0.4 – 0.6 μm Mass Median Aerodynamic Diameter

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Pass/Fail Level

- LRPL ≥ 10,000 for ≥ 95% of test trials
- Evaluated over 11 test exercises
- Tested with PAPR blower operating

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Subject Exercises

1) Normal Breathing
2) Deep Breathing
3) Turn Head Side to Side
4) Move Head Up and Down
5) Recite the Rainbow Reading Passage or equivalent
+ 6) Sight a Mock Rifle
7) Reach for the Floor and Ceiling
+ 8) On Hands and Knees, Look Side to Side
9) Facial Grimace
+ 10) Climb Stairs at a Regular Pace
11) Normal Breathing

+ emergency response exercises

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Human Subject Anthropometric Parameters

(applicable based on PAPR design)

- Neck Circumference
  - –(example: for tight-fitting neck dams)
- Head Circumference
  - –(example: for hooded models, 'Large' criteria)
- Face Length
  - –(example: for tight fitting face-masks)
- Face Width
  - –(example: for tight fitting face-masks)

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Development of NIOSH LRPL Panel

- Anthropometric ranges established as part of CBRN Escape Respirator standard
- Ranges established through review of population data of head, neck, face length, and width sizes

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Development of NIOSH LRPL Panel

- 'Face Length' and 'Face Width' Ranges
  - Adapted from Los Alamos panel report *Selection of Respirator Test Panels Representative of U.S. Adult Facial Sizes.* LA5488. 1974

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Development of NIOSH LRPL Panel

- Neck and Head circumference ranges are based on latest NIOSH research data by Zhuang, et. al.
- NIOSH survey conducted for purposes of establishing updated panels for NIOSH respirator certification and international standards
- Subjects recruited from industries nationwide (manufacturing, construction, health care, law enforcement, and firefighting)

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Development of NIOSH LRPL Panel

- NIOSH survey: Total Subjects = 3,998
- 2,243 subjects (1,140 male and 1,103 female) had complete measurements for:
  - Face Length and Width
  - Head Circumference
  - Neck Circumference

CBRN PAPR LRPL Test Panel

	Small	Medium	Large
Face Length and Face Width	Cell A Use LANL boxes 1, 2, 3, 4 (2 or 3 subjects each box, 2 trials per subject) Subjects= 10 Trials= 20	Cell D Use LANL boxes 3, 4, 5, 6, 7, 8; panel size 17 (2 or 3 each box, 2 trials per subject) Subjects= 17 Trials= 34	Cell G Use LANL boxes 7, 8, 9, 10; panel size 11 (2 or 3 each box, 2 trials per subject) Subjects= 11 Trials= 22
Head Circumference	Cell B N / A Subjects= 0 Trials= 0	Cell E N / A Subjects= 0 Trials= 0	Cell H 570-603 mm Subjects= 10 Trials= 20
Neck Circumference	Cell C 306-378 mm Subjects= 10 Trials= 20	Cell F 355-403 mm Subjects= 10 Trials= 20	Cell I 378-451 mm Subjects= 10 Trials= 20

3 Size Model → **Test Each Column Corresponding with Unique Size**

'One-Size-Fits-All' → **Test All Size Columns**

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Overlapping Size Ranges for Neck Circumference Using NIOSH Population Data

Expanded Neck circumference ranges increase the chance a subject will fulfill multiple ranges of anthropometric criteria.

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Practical Performance

- Evaluated during Laboratory Respirator Protection Level testing
- Evaluates that the power switch is not accidentally switched off
- Evaluates that hoses and electrical wires do not tangle and cause the respirator facepiece or hood to move to an improper position, such as being removed
- Evaluates wear in accordance with manufacturer's user instructions

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Summary- Test Considerations

- Possibility of facepiece particle concentration being affected by particles generated by PAPR blower lubricants

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Summary- Timeline

- Develop Standard Test Procedures (May-June 04)
- Perform Verification Testing (August-September 04)