

**CBRN PAPR
Laboratory Respirator Protection Level (LRPL)**

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Laboratory Respirator Protection Level (LRPL)

- 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/m³ Corn Oil aerosol
- 0.4 to 0.6 Micrometer Mass Median Aerodynamic Diameter

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Pass / Fail Level

- LRPL = 10,000 for $\geq 95\%$ of test trials
- Tested with PAPR blower operating

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Laboratory Respirator Protection Level (LRPL) 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



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Anthropometric Parameters
(if applicable based on PAPR design)

- **Neck Circumference**
 - (for tight-fitting neck dam hooded models)
- **Head Circumference**
 - (for tight-fitting neck dam hooded models, 'Large' criteria)
- **Face Length**
 - (for models with tight fitting face-masks)
- **Face Width**
 - (for models with tight fitting face-masks)



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(LRPL) – Development of Subject Panel

- Anthropometric ranges established as part of CBRN Escape Hood standard
- Reviewed population distributions of head, neck, face length and width sizes
- Based on PAPR design, panel will only require subjects to meet applicable parameters

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

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- Based on latest (unpublished) survey data by Zhuang, et. al.
- Survey data 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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Laboratory Respirator Protection Level (LRPL) NIOSH LRPL PANEL

- NIOSH survey: Total Subjects = 3,997
- 2,243 subjects (1,140 male and 1,103 female) had complete measurements for:
 - Face width
 - Face length
 - Head Circumference
 - Neck Circumference
- Compared NIOSH survey data to 1988 Army data* previously considered for LRPL matrix

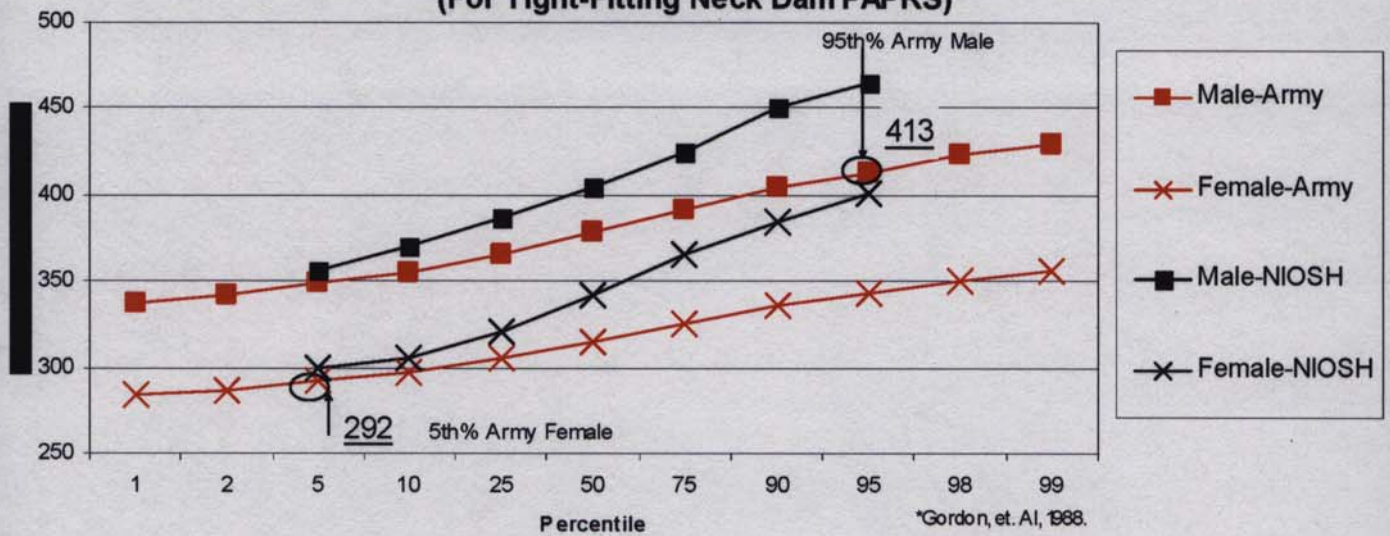
*Gordon, C.C., et al. "1988 Anthropometric Survey of U.S. Army Personnel: Summary Statistics Interim Report." Technical Report NATICK/TR-89/027. Compiled in DOD *Military Handbook Anthropometry of U.S. Military Personnel*. DOD HDBK-743A.



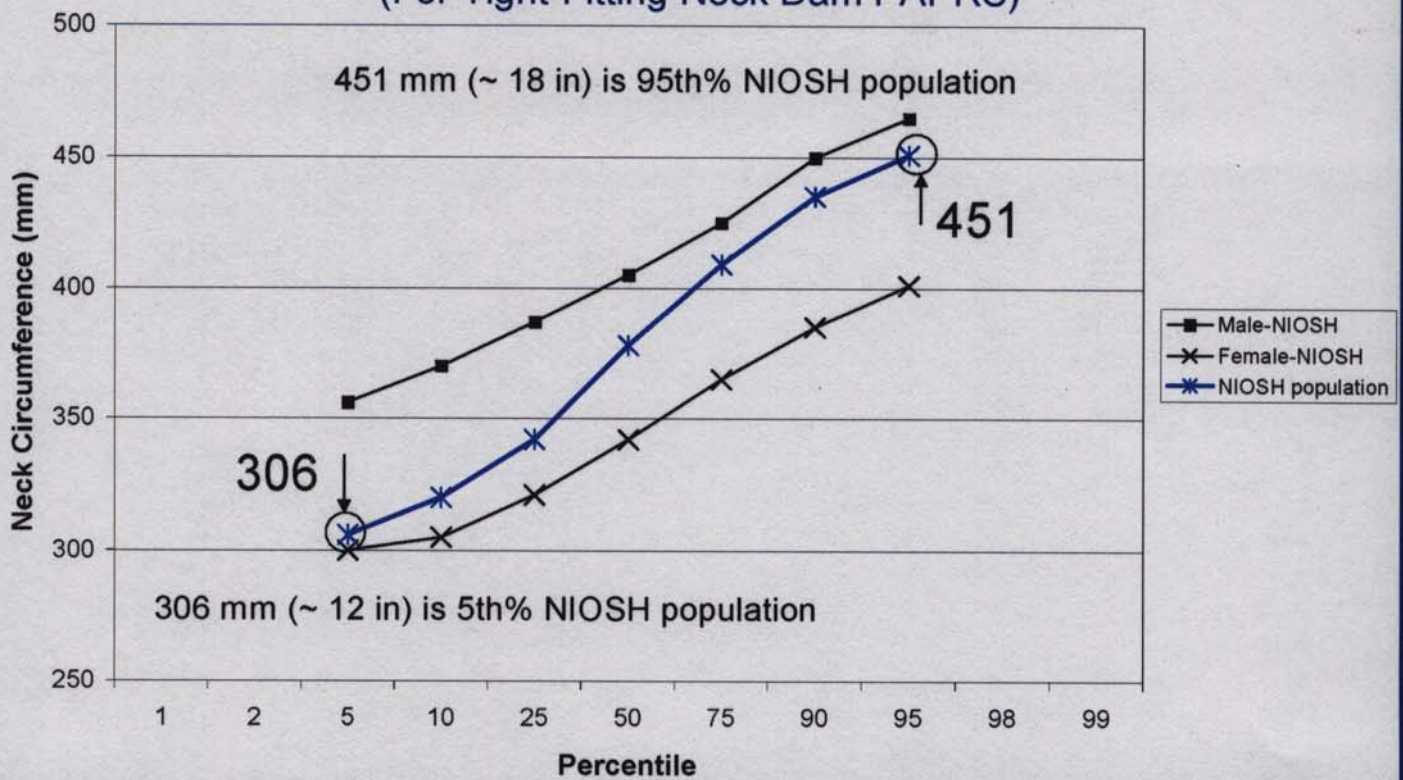
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Prior Approach to Neck Circumference Range Using Army Data* (For Tight-Fitting Neck Dam PAPRS)



Current Approach to Neck Circumference Range Using NIOSH Data (For Tight-Fitting Neck Dam PAPRS)



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Overlapping Ranges of 'Size' for Neck Circumference

(For Tight-Fitting Neck Dam PAPRS)

Using NIOSH Population Data

- Expanded Neck circumference 'Size' ranges increases the chance of subject overlapping into same 'Size' range of face measurement criteria



**CBRN PAPR
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(For Tight-Fitting Neck Dam PAPRS)**

**Head Circumferences for 'Large' Criteria
(millimeters)**

	Lower Boundary (50th %)	Upper Boundary (95th %)
Population (NIOSH)	570	603
Men (Army)*	568	594

Current Approach →

Prior Approach →

*Gordon, C.C., et al. (1988)



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3 Size Model: Test Each Column Corresponding with Unique Size
 'One-Size-Fits-All': Must Meet Criteria of All 3 Size Columns

	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; (2 or 3 subjects each box, 2 trials per subject) Subjects= 17 Trials= 34	Cell G Use LANL boxes 7, 8, 9, 10; (2 or 3 subjects each box, 2 trials per subject) Subjects= 11 Trials= 22
Head Circumference = updated	Cell B N / A Subjects= 0 Trials= 0	Cell E N / A Subjects= 0 Trials= 0	Cell H 568-603 570-603 mm Subjects= 10 Trials= 20
Neck Circumference = updated	Cell C 292-332 306 - 378 mm Subjects= 10 Trials= 20	Cell F 333-403 355 - 403 mm Subjects= 10 Trials= 20	Cell I 374-413 378 - 451 mm Subjects= 10 Trials= 20

