

May 29, 1979

UNITED STATES
NUCLEAR REGULATORY COMMISSION

SECY-79-330A

INFORMATION REPORT

For: The Commissioners

From: Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Thru: Executive Director for Operations *Jus*

Subject: A STATISTICAL PROFILE OF LICENSED OPERATORS AND SENIOR OPERATORS
AND A STATISTICAL PROFILE OF COMMERCIAL AIRLINE PILOTS, AND
MERCHANT MARINE ENGINEERING PERSONNEL

Purpose: To inform the Commission of the results of a survey to determine
a profile of operators and senior operators and the comparison
of this profile with a profile of people in other regulated
industries.

Discussion: In a memorandum from Samuel J. Chilk to Lee V. Gossick dated
April 30, 1979, NRR was requested to inform the Commission
regarding seven items relating to procedures for qualifying
reactor operators.

Item 2 of the memorandum requested that we should determine by
suitable statistical sampling of available records, an estimate
of the years of operating experience for currently licensed
operators and senior operators, and, if possible, provide the
information separately for the reactor plants designed by
each of the major NSSS vendors. Also, we were requested to
provide a comparison of licensed reactor operators (age,
educational level, salary) with people in other regulated
industries with similar responsibilities (e.g., air traffic
controllers, commercial airline pilots, etc.).

We reviewed the information contained in individual dockets of
licensed individuals employed at nine sites with three sites
having dual units. Three units at two sites were GE NSSS, five
units at three sites were Westinghouse NSSS, two units at two sites

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1916 223

were B&W NSSS, and two units at two sites were CE NSSS. Sites selected were located in the Northeast, Southeast, Midwest and Western parts of the country. Facilities possessed operating licenses for 0.4 years (Arkansas Unit No. 2) to 8.6 years (Point Beach, Unit No. 1). The sample consists of 303 licensed operators and senior operators, out of a total of 2552 currently licensed operators and senior operators.

This sample was not chosen at random but rather was selected from the 69 currently licensed LWRs to reflect the possible effects of vendor and length of reactor operation on operator characteristics. While we believe that results of this survey provide a useful profile, the sample chosen may not fully represent all possible features of the total population of operators of LWRs because of its limited size. A fully accurate picture would necessitate examining all of the currently licensed LWRs.

The following findings are based on the sample data:

The median nuclear power plant experience for currently licensed operators and senior operators is about nine years, with about one-third non-commercial (mostly naval). The minimum nuclear experience is three years.

The median age is 36 for currently licensed senior reactor operators, and 33 for reactor operators, with all over 25 years of age. About 80% of the currently licensed senior reactor operators and about 50% of the reactor operators have formal education beyond high school.

There were no important differences among vendors.

Salaries for operators varied from \$18,600 to \$26,000, depending upon geographic location and seniority. Salaries for senior operators varied from \$19,000 to \$40,000, also depending upon geographic location and seniority.

Enclosure 1 contains a detailed statistical analysis.

The Bureau of Labor Statistics, U. S. Department of Labor, has furnished us with the following information regarding age, education and salary for other selected occupations.

1916 224

Commercial Airline Pilots

Applicants for a commercial pilot's license must be 18 years old and have at least 450 hours of flight experience and be a high school graduate. However, most airlines require individuals to have two years of college and prefer to hire college graduates. Applicants for a transport pilot's license (captains) must be 23 years old and have a minimum of 1,500 hours of flying experience during the previous eight years, including night and instrument flying. The average age of currently licensed airlines pilots is 41 years.

In 1976, the average salary for airline pilots was \$46,253. Some senior captains on the largest aircraft earned as much as \$110,000.

Air Traffic Controllers

Applicants for Air Traffic Controllers must be less than 31 years old, have three years of general work experience or four years of college, or a combination of both. They are selected through the competitive Federal Civil Service System. The average age of currently licensed air traffic controllers is 35 years.

In 1978, the average earnings for all controllers was \$25,400 a year.

Mechanical Marine Engineering Department Personnel

The Mechanical Marine Personnel Division, U. S. Coast Guard provided the following information.

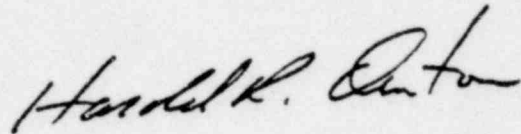
Applicants for a third engineer's license must be 19 years old and have three years of sea service or be a graduate of a Coast Guard approved Maritime School. An individual must be 21 years old to apply for a second engineer's and higher licenses up to Chief Engineer. These officers are the only Mechanical Marine Engineering Personnel who require licenses.

Other members of the engineering department, firemen, oilers and junior engineers must be 19 years old and have six months sea service upon entry to the position.

The average salary for Chief Engineers is \$50,000 a year and for second and third engineers between \$25,000 to \$30,000 a year. Information regarding average age and average number of years of experience were not available.

Coordination:

This paper has been coordinated with the Office of Policy Evaluation and Office of Management and Program Analysis for statistical aspects. The Office of the Executive Legal Director has concurred with this paper.



Harold R. Denton, Director
Office of Nuclear Reactor Regulation

Enclosure:
Detailed Statistics

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1916 226

ENCLOSURE 1

2. "Determine by suitable statistical sampling of available records, an estimate of the years of operating experience for currently licensed operators and senior operators. If possible, information should be provided separately for the reactor plants designed by each of the major NSSS vendors. In addition, the staff should provide a statistical profile of currently licensed reactor operators (age, educational level, salary)..."

Sample Results

Based on a sample of 12 licensed power reactors at nine sites, 202 senior operators (SROs) have nuclear experience as follows:

	<u>SRO Experience (Years)</u>		
	<u>Lower Quartile¹</u>	<u>Median¹</u>	<u>Upper Quartile¹</u>
. Non-commercial (e.g., naval, other military or test reactors) ^{2 3}	<u>0</u>	<u>2.5</u>	<u>5.9</u>
. Commercial	<u>5.9</u>	<u>7.3</u>	<u>10.0</u>
. Total Nuclear	<u>7.5</u>	<u>9.0</u>	<u>12.1</u>

Of the 82 SROs for which records are complete, 66 (80%) have no conventional power plant experience. For the 16 SROs with some conventional power plant experience, the median conventional experience is 2.4 years.

1/ The median is the 50th percentile, i.e., half the data points are greater than the median and half are lower. The lower and upper quartiles are, respectively, the 25th and 75th percentiles, i.e., one-quarter of the data points are less than the lower quartile while three-quarters are less than the upper quartile.

2/ Based on 101 SROs for which non-commercial experience is recorded. Most of this non-commercial experience is naval.

3/ Of these 101 SROs, 31 (31%) have no non-commercial nuclear experience.

At the same units, 79 operators (ROs) have nuclear experience as follows:

	<u>RO Experience (Years)</u>		
	<u>Lower Quartile</u>	<u>Median</u>	<u>Upper Quartile</u>
. Non-commercial (e.g., naval, other military or test reactors) 4 :	<u>0</u>	<u>4.4</u>	<u>5.5</u>
. Commercial	<u>4.3</u>	<u>6.2</u>	<u>8.3</u>
. Total Nuclear4	<u>6.4</u>	<u>8.5</u>	<u>10.4</u>

Of the 54 ROs for which records are complete, 48 (89%) have no conventional power plant experience.

Detailed breakdowns of nuclear experience of Senior Operators and Operators by unit and by vendor are depicted in Figures 1-4. A key to the unit abbreviations is given in the section on sample selection below.

Sample Selection

The above results were based on a manually retrieved and processed sample of 202 SROs and 101 ROs from a total of 1483 currently licensed SROs and 1069 ROs. This sample consists of all SROs and ROs at 12 licensed power reactor units at nine sites. These 12 reactors were chosen from the 69 currently licensed LWRs to reflect the range of vendors and length of operation, as listed below.

4/ Based on 52 ROs for which non-commercial experience is recorded.
Most of this non-commercial experience is naval.

5/ Of these 52 ROs, 20 (38%) have no non-commercial nuclear experience.

<u>VENDOR</u>	<u>ABBREVIATION</u>	<u>UNIT</u>	<u>Years of Operation (as of 5/31/79)</u>
GE	PBM	Peach Bottom 3	4.7
		Peach Bottom 2	5.3
	MSTN	Millstone 1	8.5
WEC	FRLY	Farley	1.8
		Turkey Point 4	5.9
	TP	Turkey Point 3	6.6
		Point Beach 2	6.8
	PTB	Point Beach 1	8.6
B&W	DB	Davis Besse 1	1.8
	RS	Rancho Seco	4.6
CE	ARK	Arkansas 2	0.4
	FTCN	Ft. Calhoun	5.8

Multiple units at the same site are included in the sample because operators at such units are cross-licensed and can work at either unit. Non-commercial nuclear and fossil data were not available for all the operators included in the sample.

Age and Education

Ages of sampled SROs and ROs by vendor are as follows:

AGES

	<u>Operators in Sample</u>		<u>Lower Quartile</u>		<u>Median</u>		<u>Quartile</u>	
	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>
GE	49	20	35	32	40	35	46	36
WEC	93	31	31	30	35	32	39	36
B&W	39	15	32	31	35	32	40	37
CE	21	13	33	30	35	31	39	32
Total	202	79	32	30	36	33	41	36

1916 229

The educational background of the operators whose records are complete is as follows. All other operators have at least a high school or equivalent education.

EDUCATIONAL BACKGROUND

	<u>Operators in Sample</u>		<u>High School</u>		<u>Some College</u>		<u>B.S. B.A.</u>		<u>Masters</u>	
	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>	<u>SRO</u>	<u>RO</u>
GE	13	8	31%	88%	-	12%	61%	-	8%	-
WEC	40	20	10%	35%	48%	60%	32%	5%	10%	-
B&W	20	11	40%	64%	30%	27%	25%	9%	5%	-
CE	10	13	20%	31%	40%	69%	30%	-	10%	-
Total	83	52	22%	48%	35%	48%	35%	4%	8%	-

The salary range for licensed individuals based on a survey of twelve facilities is as follows:⁶

	<u>Northeast</u>	<u>Southeast</u>	<u>Midwest</u>	<u>West</u>
Operators	\$22,000 to \$26,000	\$18,600 to \$21,800	\$21,000 to \$22,000	\$23,000 to \$25,000
Senior Operators	\$27,000 to \$40,000	\$19,000 to \$36,000	\$21,500 to \$35,000	\$28,000 to \$37,000

^{6/} Some of these were different from those facilities included in the age, education and experience survey.

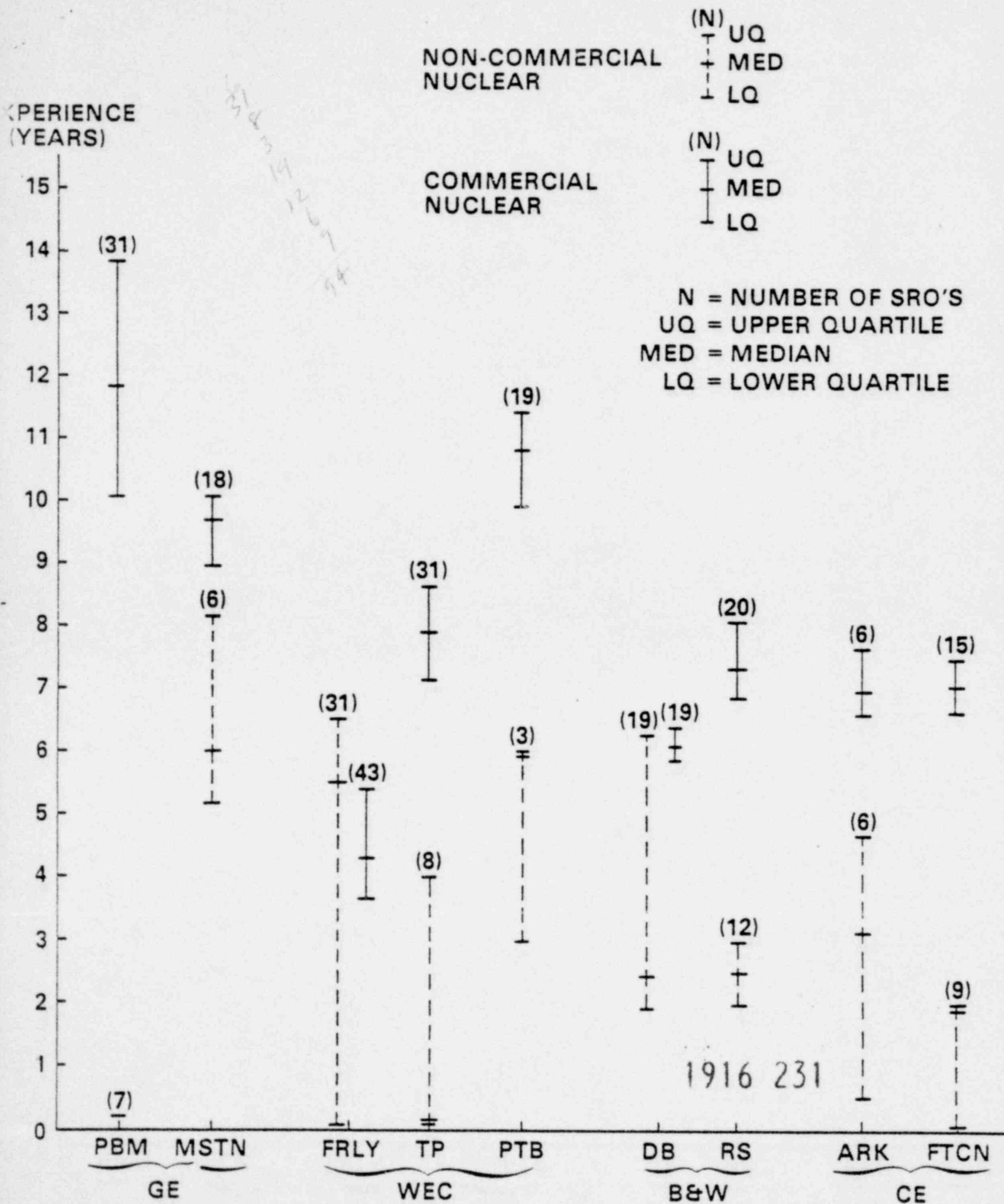


Figure 1. Senior Reactor Operator Experience by Unit

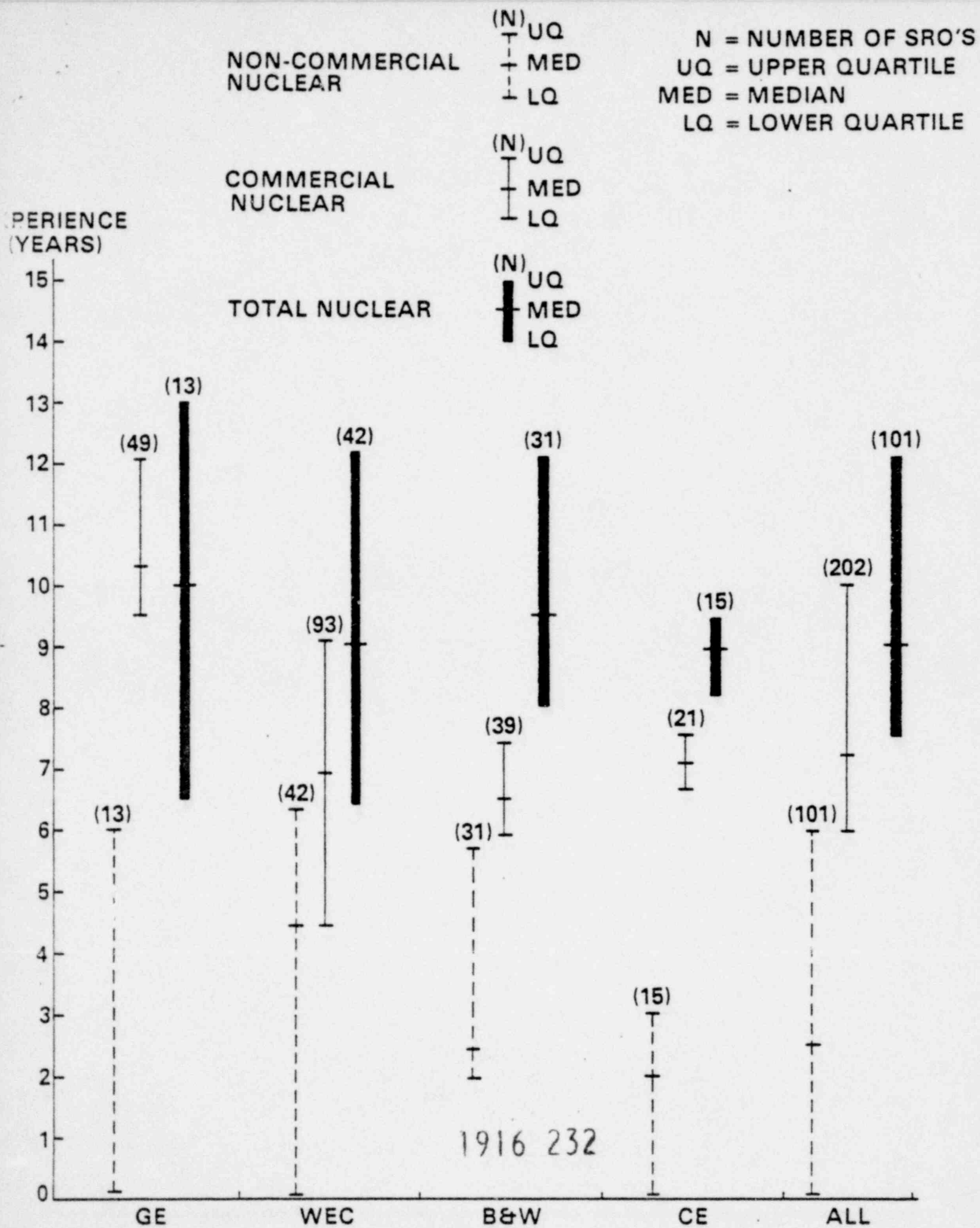


Figure 2. Senior Reactor Operator Experience by Vendor

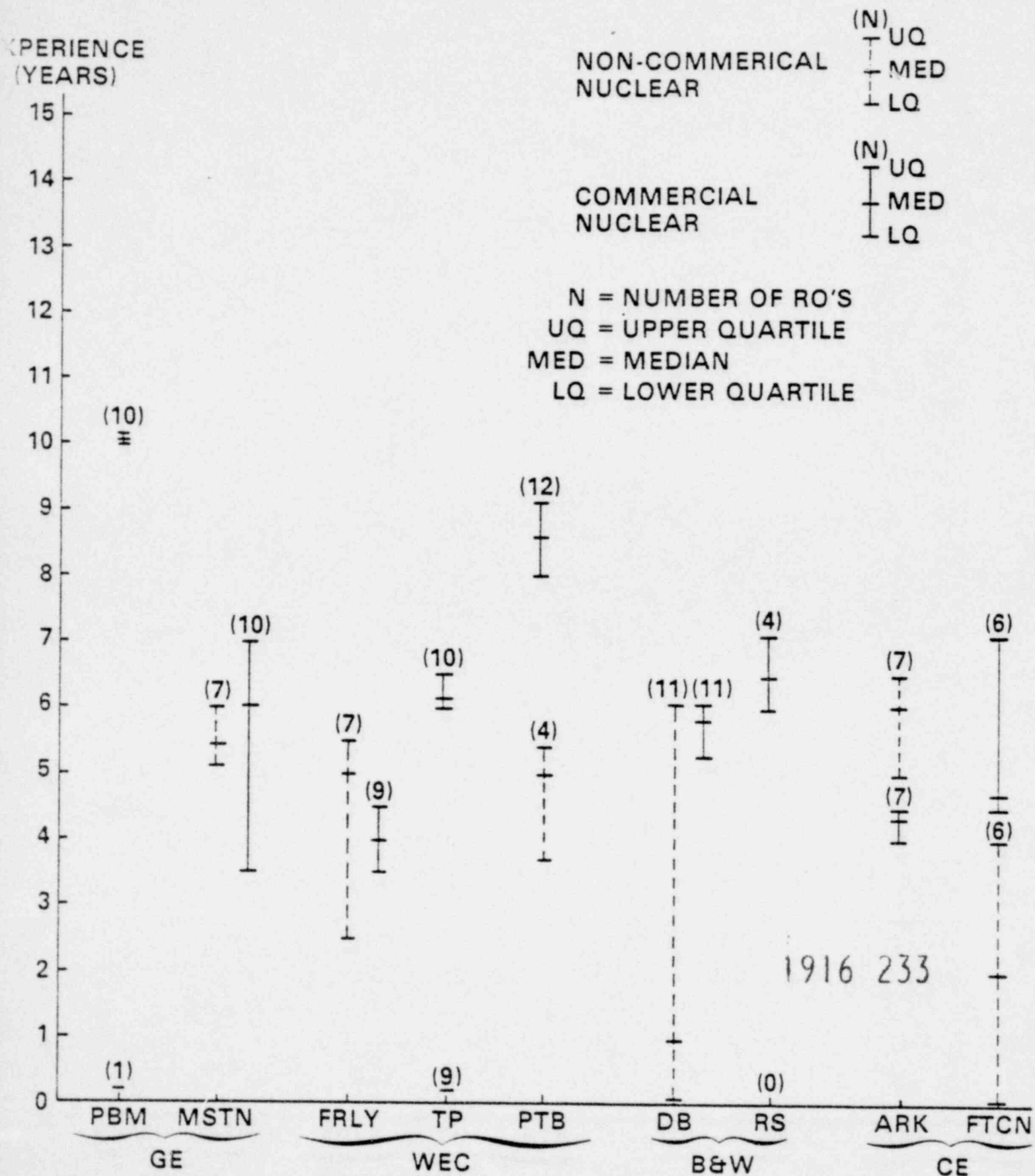


Figure 3. Reactor Operator Experience by Unit

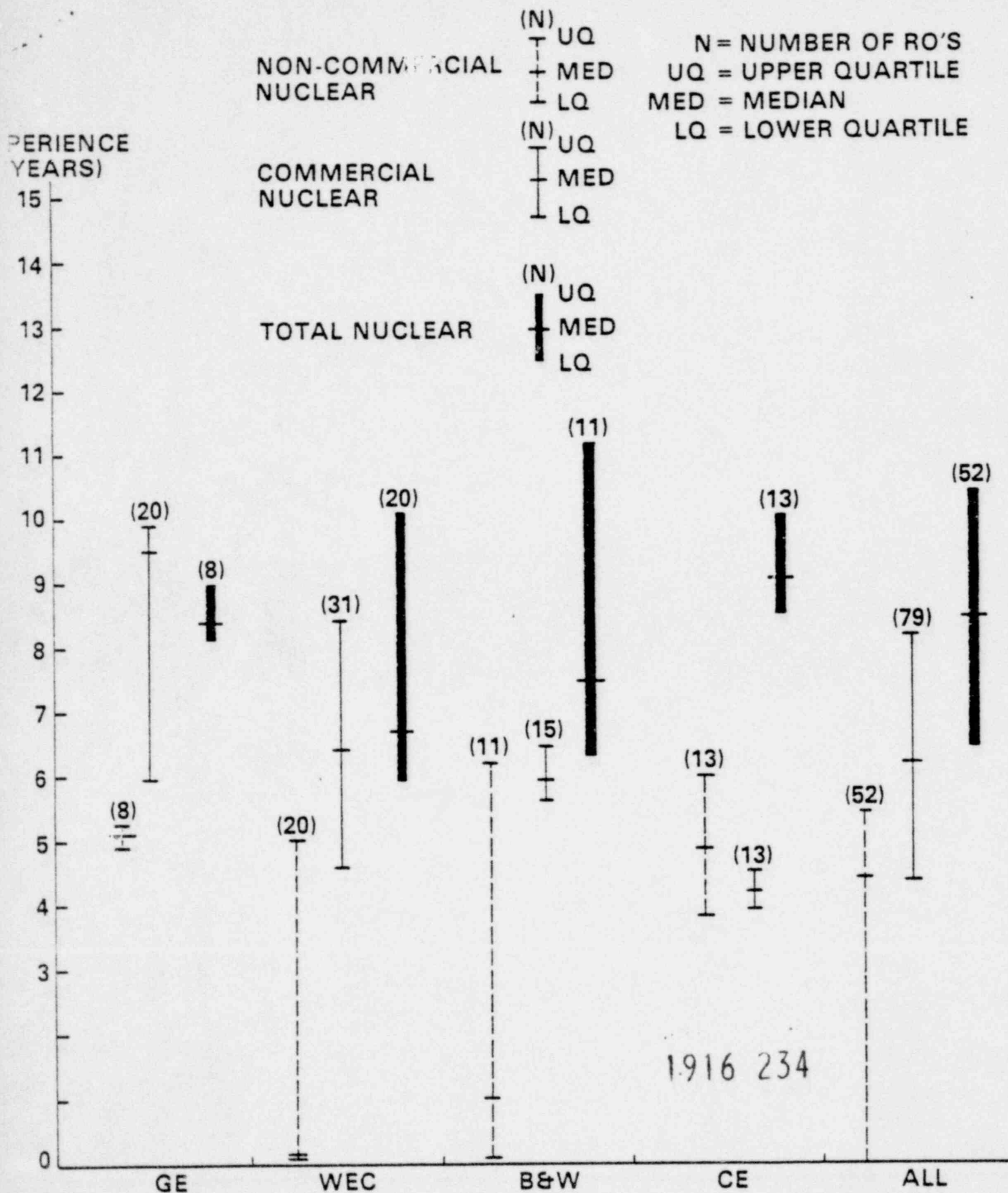


Figure 4. Reactor Operator Experience by Vendor