

THE GROWTH OF THE NATIONAL RADON
MEASUREMENT PROFICIENCY (RMP) PROGRAM

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ABSTRACT

The Environmental Protection Agency's (EPA) National Radon Proficiency (RMP) Program is a voluntary measurement proficiency program available to companies offering radon and radon decay products measurements to the public. The program commenced in February 1986 in response to requests from States for assistance to identify companies with known measurement capabilities and to provide participating laboratories with an opportunity to compare their measurements with internationally established levels in a Federal EPA radon chamber as well as with companies in the program. Since implementation, the National RMP Program has grown from 39 companies participating in test round 1 to over 1000 in test round 5. Eight measurement methods are presently allowed in the program. Companies meeting program requirements using these methods are listed in reports distributed by all 50 States.

INTRODUCTION

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The Environmental Protection Agency's (EPA) Office of Radiation Programs has established the National Radon Measurement Proficiency (RMP) Program within its Radon Division to assist States and the public in selecting companies to measure indoor radon and radon decay products. The immediate objective of this program is to provide information to the public about the technical competence of companies measuring indoor radon. Interested radon measurement companies are tested and the names of those successfully participating are listed in public proficiency reports. The longer-term objective of the program is to promote standard measurement and quality assurance procedures for all indoor radon measurement companies.

PROGRAM OPERATIONS AND REQUIREMENTS

The National RMP Program is not a Federal certification program for radon measurement laboratories or companies. The EPA does not certify, recommend or endorse participating laboratories or companies, but merely lists laboratories and companies that have voluntarily demonstrated capabilities for measuring radon and radon decay products levels. Therefore, participating laboratories and companies should not advertise certification, accreditation, recommendation, or endorsement by EPA. However, the program serves as a core element by which States can establish certification or accreditation programs of their own.

This program is available to all indoor radon measurement companies, primary and secondary. Primary companies provide radon measurement services to the public and have laboratory analysis capability. Secondary companies also provide radon measurement services but do not have laboratory analysis capability. These companies must use the analysis capability of a primary company which successfully participates in the program.

On an EPA scheduled basis, usually annually, indoor radon measurement companies are invited to participate in the National RMP Program. The National RMP Program offers measurement companies the opportunity to voluntarily participate in radon measurement proficiency testing as they will receive relevant statistical data on their indoor radon measurement capabilities and instrumentation. To successfully participate in the program, a primary company must meet the following requirements.

- (1) follow EPA measurement protocols in EPA documents "Interim Indoor Radon and Radon Decay Product Measurement Protocols" (EPA Document No. EPA-520/1-86-04), "Interim Protocols for Screening and Follow-up Radon and Radon Decay Product Measurements (EPA Document No. EPA-520/1-86-014-1), "Interim Protocol for Using e-PERMS to Measure Indoor Radon

Concentrations", and "The National Radon Measurement Proficiency Program. Application and Participation Manual" (EPA Document No. EPA 520/1-87-022). A copy of these documents may be obtained by writing to.

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(2) demonstrate management tracking capability, i.e., the ability to get indoor radon measurement results to the proper homeowner, and

(3) demonstrate the ability to measure radon and/or radon decay products within the established program measurement criteria

To successfully participate in the National RMP Program, a secondary company must satisfy items 1 and 2 of the above requirements. Additionally secondary companies must provide the names of all primary companies which provide laboratory analysis for their radon measurement devices. These primary companies must successfully participate in the performance test round.

Although the National RMP Program is voluntary, to maintain their proficiency listings, companies must participate in every test round. These performance test rounds do not routinely include re-tests. Only those companies that are participating for the first time or that have never performed successfully in the National RMP Program are allowed a re-test during the scheduled performance test round.

The EPA has developed measurement protocols for eight different methods and believes any of them, when used in accordance with EPA protocols can produce valid results. The eight measurement methods which National RMP Program participants are tested for are included in two main categories.

- A. Passive or Mail-in Detectors
 - Activated Charcoal Absorption (CC)
 - Alpha-Track Detectors (AT)
 - Radon Progeny Integrated Sampling Units (RP)
 - Electret Passive Environmental Radon Monitors (EP)

B. Active or Walk-in Detectors

Continuous Radon Monitors (may also be passive) (CR)
Continuous Working Level Monitors (may also be
passive) (CW)
Grab Radon Monitors (GR)
Grab Working Level Monitors (GW)

Each company enrolls its measurement method(s) for evaluation in the performance test round. The EPA instructs the primary companies to submit a specific number (at least five) and type of passive detectors for exposure to known levels of radon and/or radon decay products. Next, the detectors are exposed in EPA's radon chambers at its Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama, and/or Las Vegas Facility (LVF) in Las Vegas, Nevada. After exposure, EPA returns them to the companies without revealing the radon or radon decay product levels. The companies analyze all detectors and report their measurements to EPA. The EPA compares the companies' measurements to the known levels of radon exposure. If the results are within the established program measurement criteria the method meets the proficiency requirements for the test round's performance test.

Primary companies providing measurement services with an instrument that requires a skilled operator and that cannot be mailed in for testing, must bring the instrument to EPA's designated testing facility. Each company is responsible for the costs of transportation to and from EPA's designated testing facility.

Instrument operators are not selected by EPA, but companies with multiple operators are required to send a different operator each test round. Because of limited space at EPA's testing facilities only one operator per company may test during a test round. Anyone accompanying the designated operator is not allowed in the testing area. One operator may represent more than one company if that operator is employed by those companies for their measurement services. Operators must enroll and participate with the detectors they regularly use in the field for each company they represent.

Instrument operators are notified by mail of their test appointments. The EPA makes every attempt to accommodate participants' schedules.

Each performance test round, every company's proficiency with a specific method is assessed on the basis of continued participation, compliance with all administrative requirements of the National RMP Program, and sufficient correlation between

the primary companies' measurements and the known levels of radon or radon decay products exposure. If a company's method meets all the program requirements, its name and methods are published in that performance test round's proficiency reports. If a company's method does not meet proficiency requirements for the measurement test, or if it does not meet all program requirements for the test round it is not listed in that test round's proficiency reports which are distributed by all 50 States. However, that company is still encouraged to participate in future test rounds. After the test round is completed, regardless of performance, the primary companies are sent their results and relevant statistical data in a coded analytical report which is separate from public proficiency reports.

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PROGRAM GROWTH. INCREASED PARTICIPATION

The National RMP Program has experienced tremendous growth in a relatively short period of time since its inception in 1986 as evidenced by the figures listed in Table 1. Participation numbers and the popularity of the methods are listed in Table 1.

The growth of the National RMP Program is largely due to the public demand for proficient radon measurements and requirements established by a number of States for radon measurement companies. For example in November 1985, EPA knew of only two companies that provided radon measurement services. In addition, many States are using the voluntary National RMP Program as core element of their own radon measurement certification programs and are requiring successful participation in the National RMP Program as a pre-requisite for operating a radon measurement company in that State.

At the end of each test round, EPA publishes proficiency reports for all 50 States to distribute to their residents as a component of their radon public information packets. The growth of the program along with wide distribution of reports by the States make radon measurements by proficient companies available to virtually every US citizen.

PROGRAM DEVELOPMENT. THE RADON MEASUREMENT INDUSTRY

Table 2 depicts the increased development of the radon measurement industry as indicated by growing participation of radon measurement companies by detection methods in the National RMP Program. The industry is maturing and expanding which is evidenced by this participation as well as the development of new measurement equipment.

TABLE 1. PROGRAM GROWTH

<u>Test Round</u>	<u>Date of Test Round</u>	<u>Proficiency Report. Companies Listed</u>	<u>Proficiency Report. Methods Listed</u>
1	April 1986	35	48
2		75	109
3		143	213
4	June - July 1987	253	437
5	June - August 1988		

TABLE 2. PARTICIPATION BY DETECTION METHOD

	<u>TEST ROUND</u>				
	1	2	3	4	5
Successful Participants*	35	75	143	253	
Methods*	48	109	213	437	

Methods Employed	<u>TEST ROUND</u>									
	1		2		3		4		5	
	%P	%M	%P	%M	%P	%M	%P	%M	%P	%M
Activated Charcoal Adsorption	74	55	67	48	78	52				
Alpha-Track Detectors	23	17	24	17	24	16				
Grab Working Level Monitors	14	11	18	13	18	13				
Continuous Working-Level Monitors	14	11	14	10	12	08				
Grab Radon Monitors	03	02	11	08	12	08				
Radon Progeny Integrated Sampling Units	06	04	04	03	03	02				
Continuous Radon Monitors	00	00	01	02	02	01				
Electret-Passive Environmental Radon Monitors	NA	NA	NA	NA	NA	NA	NA	NA		

P = Participants

M = Methods

NA = Not Approved by EPA

* = listed in EPA published proficiency reports

TABLE 3. NATIONWIDE DISTRIBUTION COMPANIES AND SERVICES

	<u>TEST ROUND</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Successful Participants*	35	75	143		
National Companies*		57%	50%		

<u>Methods*</u>	<u>% Company Distribution</u>				
	<u>TEST ROUND</u>				
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Activated Charcoal Absorption		69	79		
Alpha-Track Detectors		27	24		
Grab Working-Level Monitors		07	11		
Continuous Working-Level Monitors		04	08		
Grab Radon Monitors		07	10		
Radon Progeny Integrated Sampling Units		04	04		
Continuous Radon Monitors		04	03		
Electret-Passive Environmental Radon Monitors	NA	NA	NA	NA	

* = listed in EPA published proficiency reports

For example, the 35 successful participants in test round 1 provided detection services to only twelve States with the majority of companies using only one detection method. Test 5 indicates that every State has successful companies participating from in-State and a majority of the companies provide measurement services nationwide as well as to the US Territories. Figures 1 and 2 illustrate the growth in the number of State-based radon measurement companies and the types of measurement methods employed.

Not only has the availability increased but also the number of measurement methods entered into the program has increased from seven in test rounds 1 through 4 to eight in test round 5. The additional method, the Electret-Passive Environmental Radon Monitor (E-Perm), is an example of the radon measurement industry's successful continued research and development in the private sector.

A review of the performance data for test rounds 1 through 5, in terms of bias and precision measurement errors, reveals some interesting results. Figures 3 and 4 portray by method the distribution of within company bias and precision estimates for test rounds 1 through 5. Tables 4 and 5 present more detailed information on these distributions, such as, minimum and maximum estimates and their cumulative frequency distributions. Obviously, these results are based on measurements made under controlled conditions where the exposure conditions were held relative constant for the entire testing period.

The mean bias estimates for all the methods fall within _____ of zero bias with the _____ showing the smallest mean errors. Approximately _____ of the estimates for all methods, except _____, are within a zero bias. The grab sampling methods show the greatest variability in performance of all the methods. _____ methods perform comparably with _____ showing a slightly greater negative bias. All methods indicate a negative bias of between _____ % and _____ %/ This may be the result of the disagreement that exists among the experts in the field on the correct radon calibration factor to be used. Although the number of estimates for _____ were too few to ascertain reliable distributions, their mean estimates are within _____ % of zero bias.

The mean precision error estimates for all the methods fall within _____ % and _____ %. _____ % of the estimates for all the methods, except _____, indicate less than _____ % error, and _____ % of the estimates show less than _____ % error. _____ perform comparably with a _____ mean error and a distribution between _____ % and _____ % error. _____ all had mean estimates around _____ % error with a distribution between _____ % and _____ % error.

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For an overall rating, considering bias and precision error, _____ is the most accurate followed by _____. The number of estimates of _____ are too small to rate them with the other methods, but they do appear to perform at a level between _____ and _____.

Table ~~5~~. DISTRIBUTION OF WITHIN COMPANY BIAS

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EP

AT CC CR CW GR GW RP

Sample Size
 Mean Error*
 Standard Deviation*
 Minimum Error
 Maximum Error

<u>Bias Error</u>	<u>Cumulative Frequency (%)</u>
5%	
10%	
15%	
20%	
25%	
+25%	

*No estimates were excluded, although some estimates appear to exceed three standard deviations.

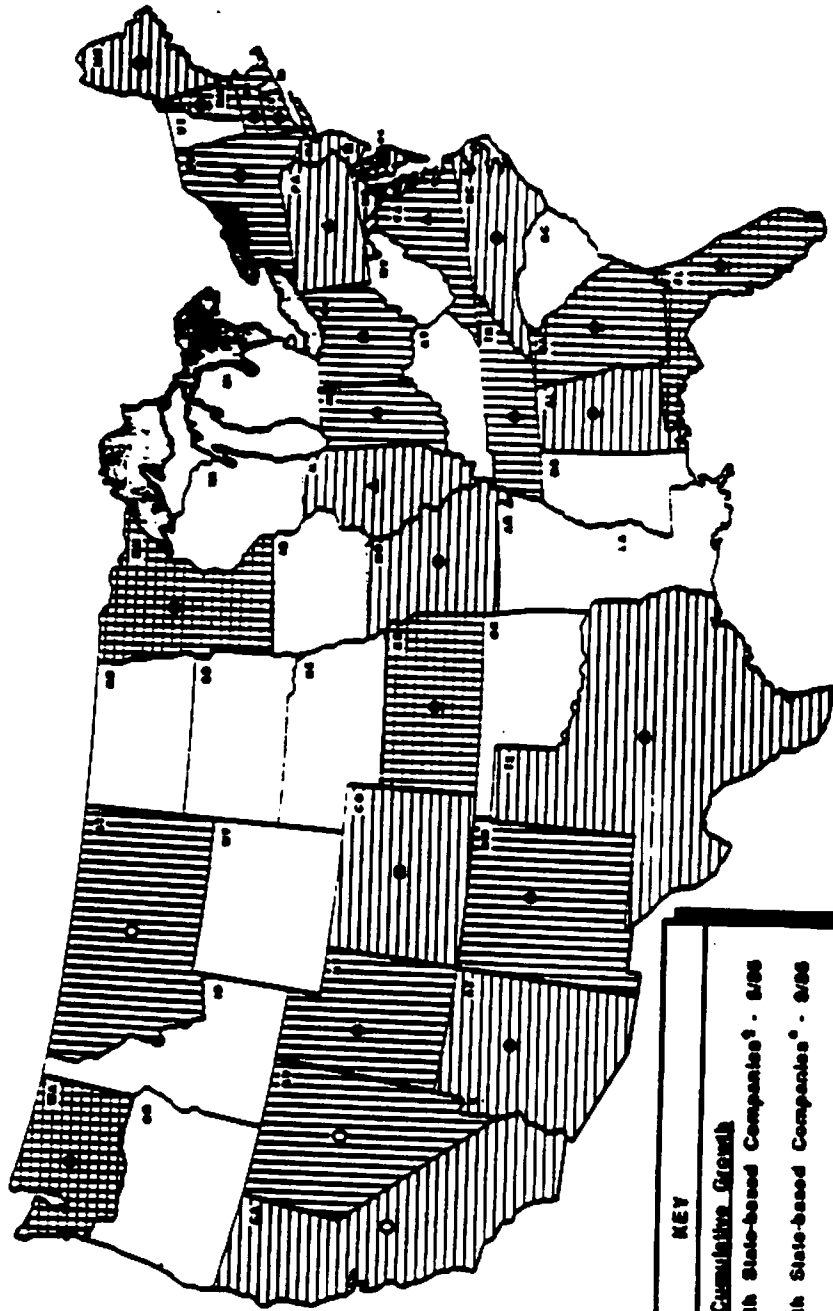
Table ~~5~~⁵. DISTRIBUTION OF WITHIN COMPANY PRECISION

AT CC CR CW GR GW RP EP

Sample Size
 Mean Error*
 Minimum Error
 Maximum Error

<u>Precision Error</u>	<u>Cumulative Frequency (%)</u>
5%	
10%	
15%	
20%	
25%	
+25%	

*No estimates were excluded, although some estimates appear to exceed three standard deviations.



KEY

Cumulative Growth

- States with State-based Companies¹ - 5/86
- States with State-based Companies² - 8/86
- States with State-based Companies³ - 2/87

Number of Companies per State (2/87)

- Zero
- 1-5
- 6-10
- ▲ 11-20
- ★ > 20

*All Companies Are Radon/Radon Progeny Measurement Proficiency (RMP) Program Participants.

Figure 1. Cumulative growth of State-based measurement companies* from May 1986 to February 1987.

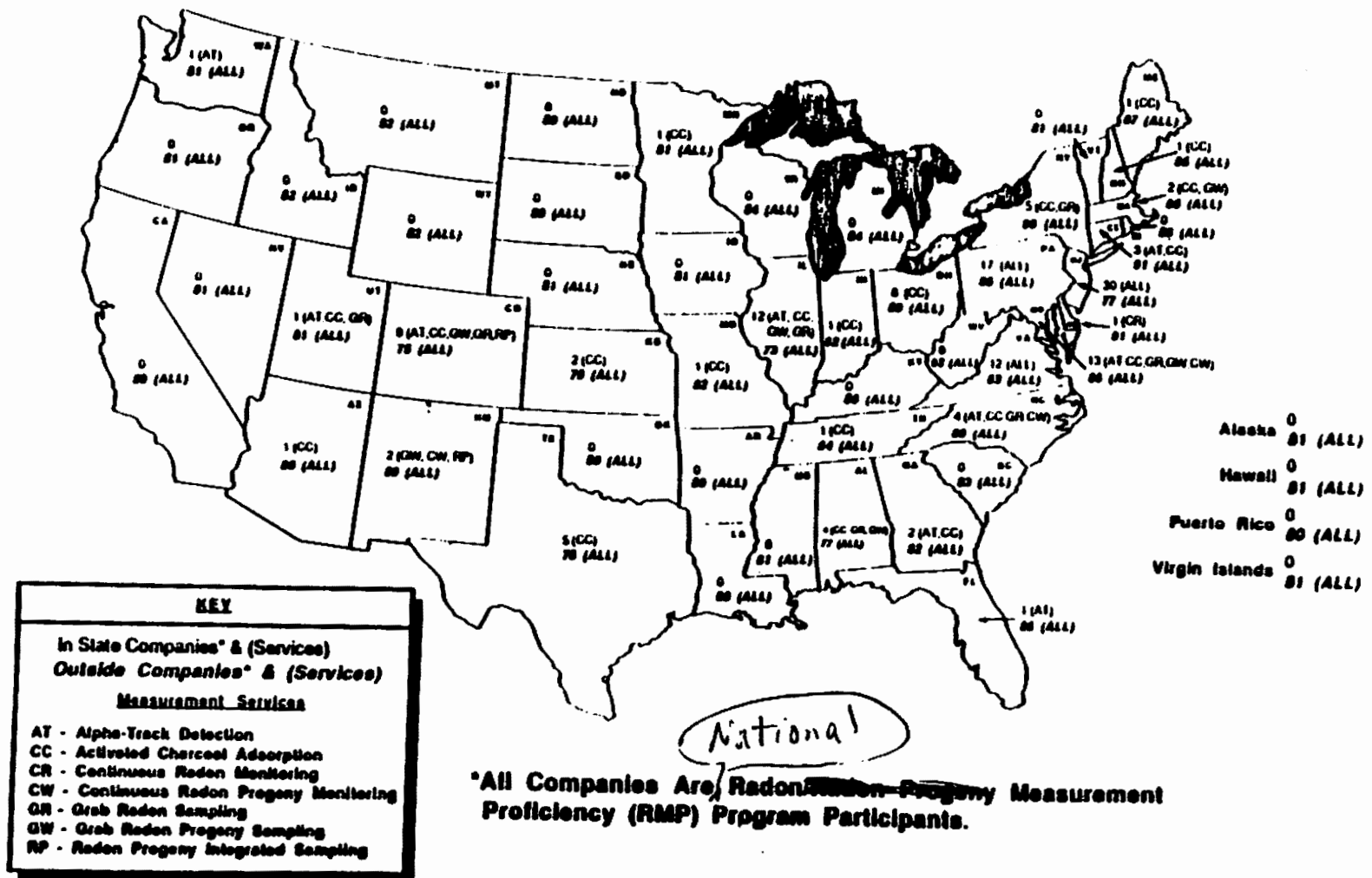


Figure 2. Number of State-based and nationwide distribution measurement companies and the type of measurement services provided.

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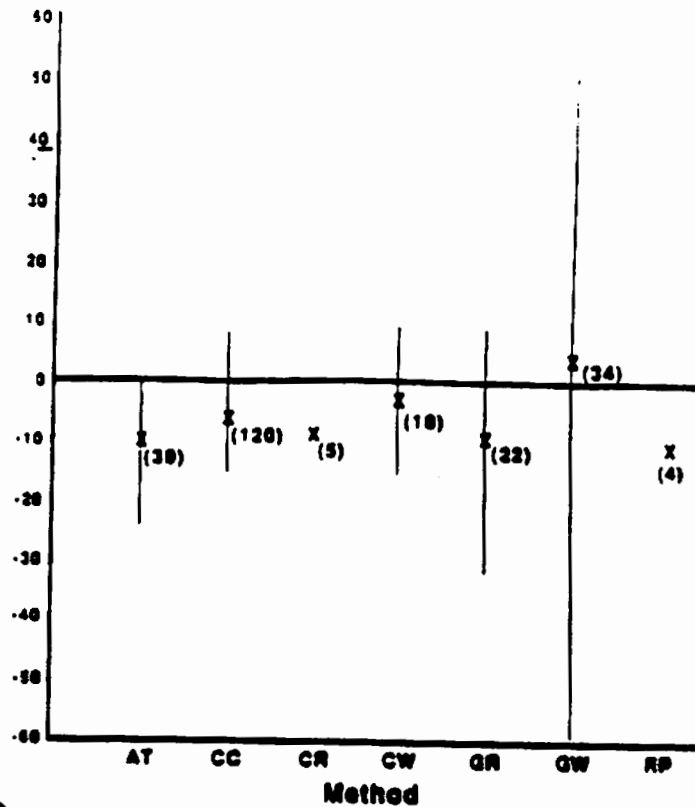


Figure 3. Within company bias distribution—mean, 10th and 90th percentiles. Aggregate number of bias estimates for test rounds 1 through 5 are shown in parentheses.

through

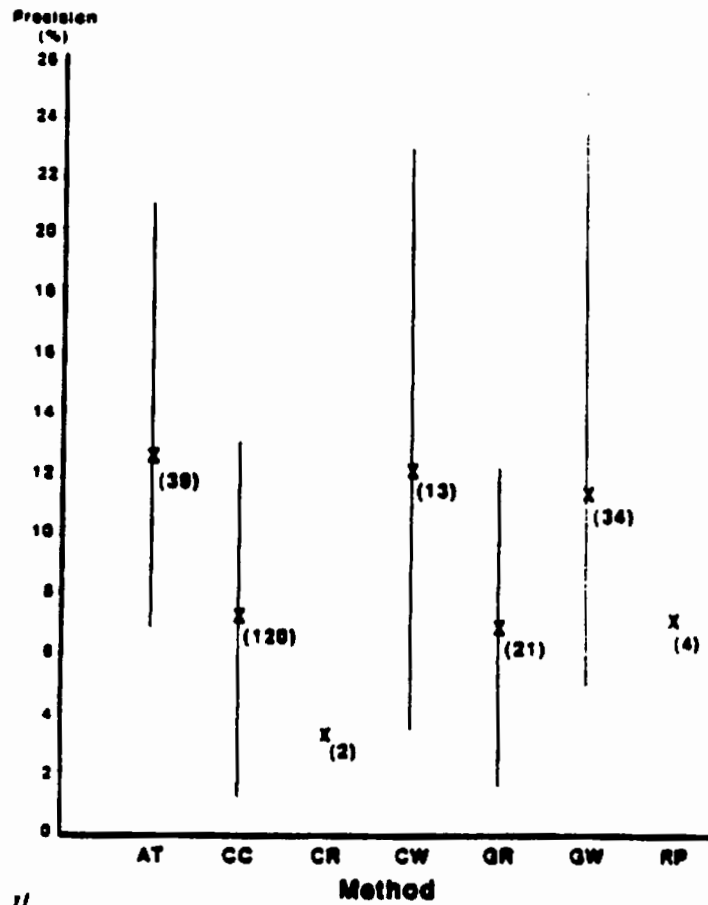


Figure 4. Within company precision distribution—mean, 10th and 90th percentiles. Aggregate number of precision estimates for rounds 1 through 5 are shown in parentheses.

test rounds 1 through 5 are