



**American Council for  
Accredited Certification**

Council-certified Indoor Environmental Consultant (CIEC) and  
Council-certified Microbial Consultant (CMC)

Summary Report of  
Cut Score Studies

Prepared by  
Adam B. Andrews, CIEC  
Assistant Director  
ACAC

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## **Cut Score Study: Methodology and Rationale**

### **The Angoff Method**

At the 2012 ACAC Executive Meeting, the CIEC and CMC certification boards elected to determine the cut scores for their certification exams using a modified form of the Angoff method, which has been widely used in high-stakes testing for more than forty years.<sup>1</sup> According to this procedure, a panel of experts is chosen to review test items and estimate the probability that a minimally qualified performer would answer the items correctly. The estimates for each test item are averaged, and those averages are used to determine the cut score.

The Angoff method was deemed appropriate for ACAC certification exams for two reasons. First, Angoff utilizes the expertise of a focus group to gather cut score data – a feature that fits well with the CIEC and CMC programs’ traditional reliance upon their certification boards for exam development. As certification board members gather at the ACAC executive meeting, a score setting session using the Angoff method is convenient and efficient. Secondly, the Angoff method is robust and defensible without being arcane or overly complex. As Kathryn Ricker argues, “The main strength of the Angoff method... is simplicity. This method is relatively simple to explain to judges and to stakeholders. It uses simple statistics that are easy to compute and understand.”<sup>2</sup> While it can be somewhat burdensome to judges who are required to rate a large number of items, it is the most efficient method for setting a defensible cut score known to ACAC, and was the unanimous choice of both the CIEC and CMC certification boards.

## **Cut Score Study: Procedures**

### **Composition of the rating panel: CIEC**

Ten (10) judges were chosen from among the CIEC certification board based on a matrix of demographic characteristics developed by the ACAC board of directors. Judges submitted written documentation of their qualifications and field experience which is preserved in the ACAC files.

Six (6) judges were chosen from among the CMC certification board based on a matrix of demographic characteristics developed by the ACAC board of directors. Judges submitted written documentation of their qualifications and field experience which is preserved in the ACAC files.

### **Review of Test Forms and Purpose of Tests**

The two panels of judges met in different rooms of the same building to conduct their exam reviews. After a brief orientation, each panel reviewed its examination form. ACAC staff then explained to the CIEC panel that the purpose of the exam is to identify qualified candidates for board review as indoor environmental consultants. The CMC panel was reminded that the purpose of its exam is to identify qualified candidates for board review as microbial consultants. Judges on both panels were reminded that

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<sup>1</sup> William H. Angoff, “Scales, norms and equivalent scores.” *Educational Measurements*. Washington, DC: American Council on Education, 1971.

<sup>2</sup> Kathryn L. Ricker, “Setting Cut Scores: A Critical Review of the Angoff and Modified Angoff Methods.” *The Alberta Journal of Educational Research*, vol. 52, No. 1, Spring 2006, 53-64.

their examinations are designed to verify subject matter knowledge only and that verification of field experience is the function of the certification board review.

### **Standard of Competence and Characterization of the Marginal Candidate**

Led by ACAC staff, the judges on each panel then reviewed and discussed the standard of competence that their examination is designed to uphold. The blueprint and content domains for each exam and results of the associated Job/Task analysis were provided to each judge. For purposes of the cut score study, the standard of competence was defined as “demonstrable grasp of the knowledge and skills reflected in the content domains of the examination.”

Once the standard of competence was understood by each panel, judges were then directed to discuss the performance characteristics that would distinguish a minimally qualified certification candidate from an individual who is not qualified for certification . For each content domain, the panel attempted to conceptualize the knowledge, skills and abilities of this “Marginal Candidate.”

### **Rating with the Angoff Question**

After helping judges on each panel define and describe their Marginal Candidate, ACAC staff then explained the Angoff rating method. This method requires judges to assign a score to each test item by answering the following question: "What percent of Marginal Candidates will answer this item correctly?"

CIEC and CMC judges practiced on a subset of items from their respective examination forms and then discussed their ratings with the other members of their panels. ACAC staff answered questions from the judges regarding the intent of the Angoff question and made sure all judges understood the procedure.

ACAC staff then asked judges on each panel to independently rate the entire 120 question examination using the Angoff question, giving each item a percentage score as described above. 120 separate ratings from each judge were assembled in a spreadsheet and forwarded to ACAC staff for processing.

## **Cut Score Study: Results**

### **Angoff Scores**

According to the Angoff method, the recommended cut score is determined by averaging the ratings collected across all judges and all items in the examination. In order to preserve data relative to standard error and reliability, the variance and standard deviation of individual scores for each item were also recorded, as was the standard deviation of the judges' individual cut scores.

The Angoff procedure for the CIEC examination yielded a cut score of 74.55%. The CIEC certification board discussed this rating and followed its existing procedure of rounding to the nearest percentage point, giving a passing score of 75% for the CIEC exam.

The Angoff procedure for the CMC examination yielded a cut score of 75.42%. The CMC certification board discussed this rating and followed its existing procedure of rounding to the nearest percentage point, giving a passing score of 75% for the CMC exam.

### Standard Errors

Standard error of measurement for the study was computed using the standard deviation of the judges individual cut scores. Additionally, standard deviations of individual cut scores were examined to identify problem items. Judges looked for items with a standard deviation above 10.0 for possible modification or replacement. In fact, no item on either the CIEC or the CMC test form had a standard deviation above 10.0, so replacement/modification was not necessary.

The standard error for the CIEC study was reported as 1.88 percentage points. The standard error for the CMC study was reported as 2.02 percentage points.

### Reliability Coefficients

A reliability coefficient for the judges' cut scores was computed for both the CIEC panel and the CMC panel using Cronbach's alpha, a common measure of internal consistency.<sup>3</sup> Values of Cronbach's alpha range from 0 to 1.0, with values above 0.8 considered acceptable.

Cut score results for the CIEC study yielded a reliability coefficient of 0.87. Cut score results for the CMC study yielded a reliability coefficient of 0.83. Data from the cut score study is summarized as follows:

Parameter	CIEC	CMC
Cut Score Method	Mod. Angoff	Mod. Angoff
Cut Score	74.55%	75.42%
Standard Error	1.88	2.11
Reliability (Cronbach's $\alpha$ )	0.87	0.90

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<sup>3</sup> L.J. Cronbach, "Coefficient alpha and the internal structure of tests." *Psychometrika* **16** (3): 297–334 (1951).