

A satellite view of Earth at night, showing the curvature of the planet and the glowing lights of cities and continents. The lights are concentrated in the eastern United States and western Europe, with a dense network of lights in the eastern US. The background is the dark, starry space.

PE Licensure: Supply Power to Your Career to Help Power the World

Friday, May 21

 **ANS** Events

Professional Engineering Licensure

From Point A to P.E.



Write the equation of motion and position of mass in closed form

$$zF = D - W =$$

where $D = \text{drag force}$
 $W = \text{weight}$
 $F = \text{acceleration}$

$$\Rightarrow c_D \frac{1}{2} \rho A v^2$$

divide by m $\frac{c_D \rho A}{2m} v^2$

or $\frac{dv}{dt} =$
 $\frac{du}{dt} =$
 $du =$

$$\frac{du}{1 - \frac{c_D \rho A}{2m} v^2}$$

simplify: $\frac{c_D \rho A}{2m} v^2$

say $z =$

$$\Rightarrow \frac{du}{1 - z^2 u^2}$$

integrate $\int \frac{du}{1 - z^2 u^2}$



Panelists

Alexandra Siwy
Tracy Stover
Paul Edelmann



NCEES
advancing licensure for
engineers and surveyors

The P.E. License

What is it?

A professional engineer

- Has the education, experience, and technical knowledge to lead
- Has an obligation to protect the public

It works both ways:

- You stand out in a crowd as a P.E.
- You have demonstrated an established level of competency
- The public is protected from incompetent or unethical practice





Engineering Practice

(the interface between science and society)

Advantages to Having a P.E. License

- Greater career opportunities
- A higher salary
- A high ethical standard

$$F = \rho A = 706 \text{E}3 \left(\frac{.152}{4} \right)^2 \pi = 12,696$$

$$\frac{12,696}{8} = 827 \text{E}6 \left(\frac{\pi d^2}{4} \right) (.2) = 1587 = 12$$

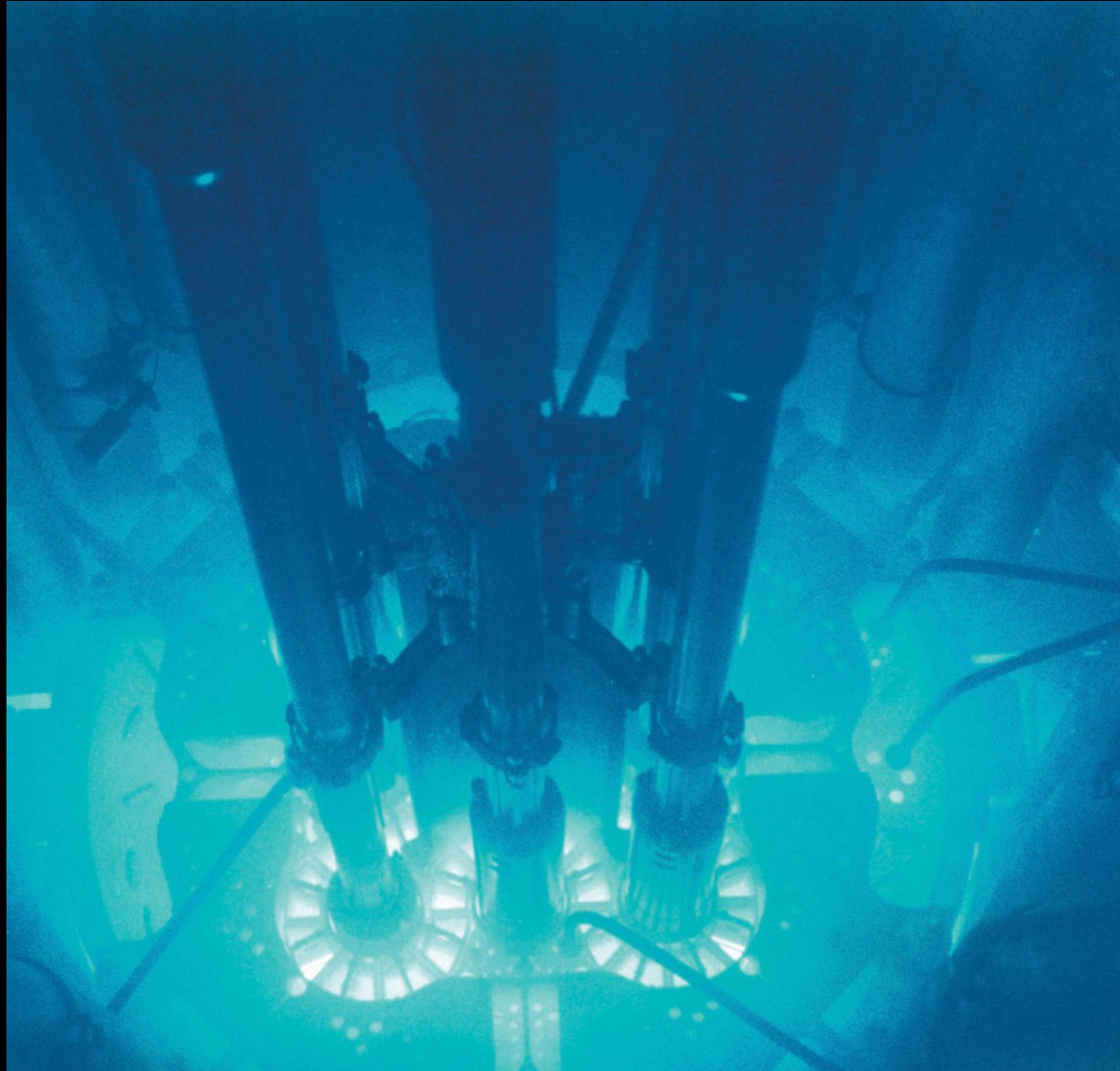
$$d = 3.5 \text{ mm} = 0.35 \text{ cm} \approx$$

Why Should I Get a P.E. License?

- If a P.E. license is not important, then why not go to a doctor who is not licensed?
- Would you allow a surgeon to operate on you who is not credentialed?
- No, because that is the minimum qualification that you would expect from a medical professional before retaining them.
- Why should clients accept any less from engineers?



Why the Nuclear P.E. License is Necessary



Reactor Core Energy

1 pellet: 5/8-inch in length

1 fuel pin: 11 ft long

~211 pellets per pin

Fuel Bundles: [17x17] and [14x14]

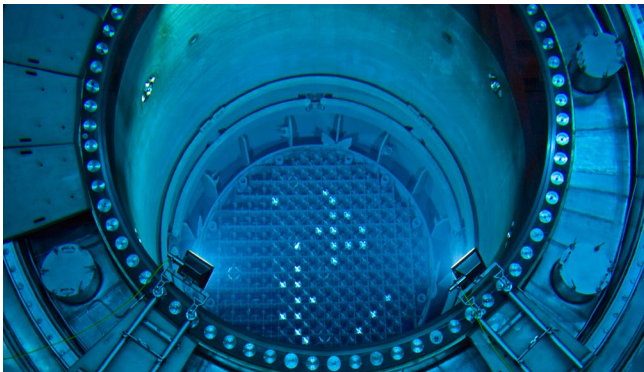
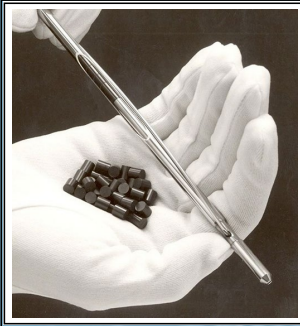
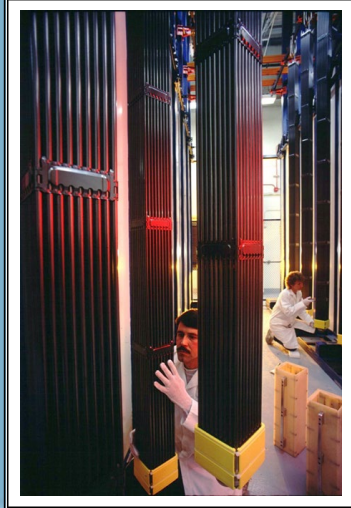
~250 fuel pins per bundle

193 bundles in a PWR

(~3,400 MWt plant)

48,000 pins in reactor core

10 million fuel pellets per reactor



Mount Everest



Height
8848 m/
29029 ft.

Known in Nepali as Sagarmatha and in Tibetan as Chomolungma, is Earth's highest mountain



Country/Range
Nepal/Tibet
Himalaya

The international border between Nepal and China runs across Everest's summit point



First ascent
1953

Sir Edmund Hillary and Sherpa Tenzing Norgay



Total summits
9006

5 839 from the Nepal side
3 167 from the Chinese side



Total deaths
297

102 people die trying to climb without oxygen



Reactor Core Equivalent Energy

1 fuel pellet = 2 cords wood

10 million fuel pellets per reactor

1 reactor = 20 million cords of wood

1 cord of wood = 128 ft³

1 reactor_(wood) = 2,560,000,000 ft³

1 acre = 43,560 ft² (~ size of a football field)

A pile of wood covering 1 acre would be ~59,000 ft in height.

Two times as high as Mt. Everest, which is 29,000 ft.



Professional Licensure Matters

- Engineering is not merely knowing and being knowledgeable, like a walking encyclopedia;
- Engineering is not merely analysis;
- Engineering is not merely the possession of the capacity to get elegant solutions to non-existent engineering problems...
- Engineering is practicing the art of the organized, forcing technological change... Engineers operate at the interface between science and society...

3

steps

Getting from point A to P.E.

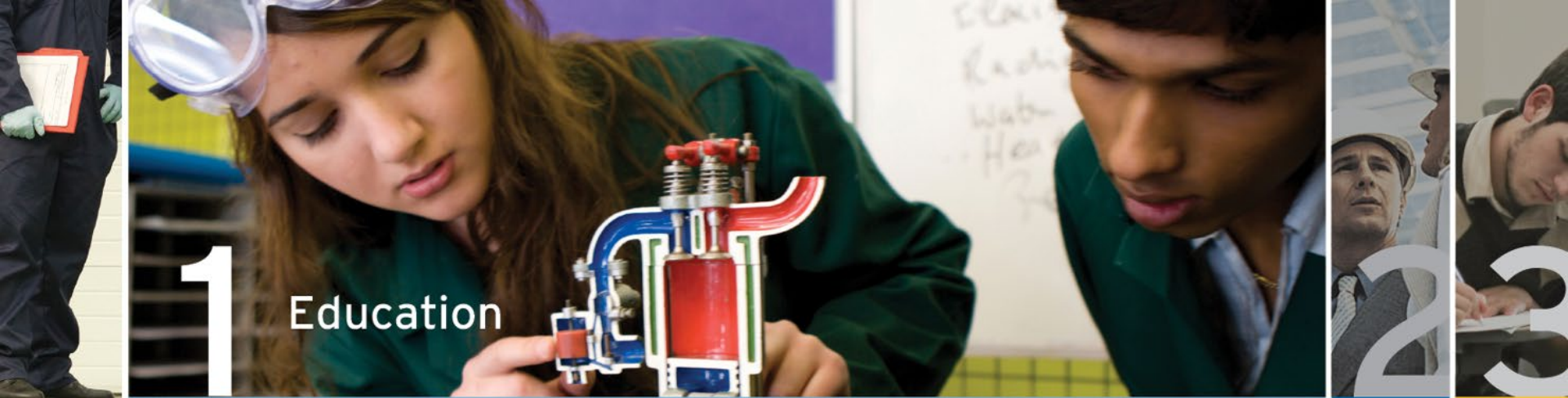
- Education
- Experience
- Exams



1

2

3



1 Education

- Get an engineering degree from an accredited program.
 - Bachelor's or master's (or both)
 - The Engineering Accreditation Commission of ABET accredits college engineering programs.



1

2

Experience

- Work under the supervision of a P.E.
- Four years, progressive

3

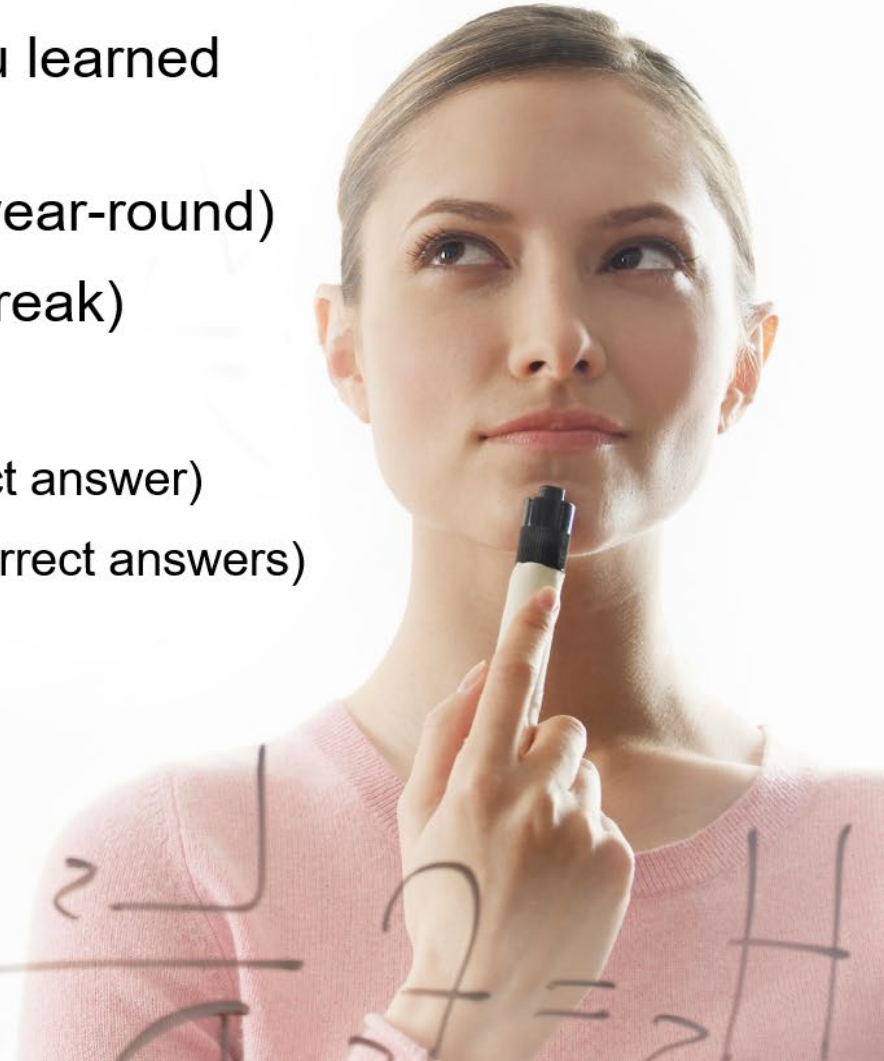


3 Exams

- Pass the FE exam in your senior year of college (or shortly after graduation).
- Pass the PE exam in your engineering discipline.

FE exam

- ❑ Fundamentals: what you learned in college
- ❑ Computer-Based Test (year-round)
- ❑ 6-hour exam (optional break)
- ❑ 110 questions
 - multiple choice (one correct answer)
 - multiple option (multiple correct answers)
 - point and click
 - drag and drop
 - fill in the blank





FE Exam Knowledge Domains (Other Disciplines)



Mathematics (8-12)	Statics (9-14)
Probability and Statistics (6-9)	Dynamics (9-14)
Chemistry (5-8)	Strength of Materials (9-14)
Instrumentation and Controls (4-6)	Materials (6-9)
Engineering Ethics and Societal Impacts (5-8)	Fluid Mechanics (12-18)
Safety, Health, and Environment (6-9)	Basic Electrical Engineering (6-9)
Engineering Economics (6-9)	Thermodynamics and Heat Transfer (9-14)



FE Exam Knowledge Domains (Mechanical Discipline)



Mathematics (6-9)	Mechanics of Materials (9-14)
Probability and Statistics (4-6)	Material Properties and Processing (7-11)
Ethics and Professional Practice (4-6)	Fluid Mechanics (10-15)
Engineering Economics (4-6)	Thermodynamics (10-15)
Electricity and Magnetism (5-8)	Heat Transfer (7-11)
Statics (9-14)	Measurements, Instrumentation, and Controls (5-8)
Dynamics, Kinematics, and Vibrations (10-15)	Mechanical Design and Analysis (10-15)

The PE exam: the final step

- ❑ Reflects real-world practice
- ❑ Developed by your peers
- ❑ Tests for minimal competency
- ❑ Find specifications and study materials at NCEES.org
- ❑ Single reference handbook provided at testing center

$$F = pA = 706E3 \left(\frac{.152}{4} \right)^2 \pi = 12,696$$

$$\frac{12,696}{8} = 827E6 \left(\frac{\pi d^2}{4} \right) (.2) = 1587 = 129$$

$$d = 3.5 \text{ mm} = 0.35 \text{ cm} \approx 0.$$

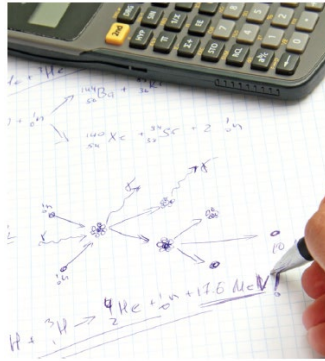
The Nuclear PE examination

- ❑ Computer-Based Test (offered once per year – October)
- ❑ 9.5-hour exam (optional break)
- ❑ 85 questions
 - multiple choice (one correct answer)
 - multiple option (multiple correct answers)
 - point and click
 - drag and drop
 - fill in the blank

Handwritten calculations in the background:

$$F = pA = 706E3 \left(\frac{.152}{4} \right)^2 \pi = 12,696$$
$$\frac{12,696}{8} = 827E6 \left(\frac{\pi d^2}{4} \right) (.2) = 1587 = 129$$
$$1 = 3.5 \text{ mm} = 0.35 \text{ cm} \approx 0.$$

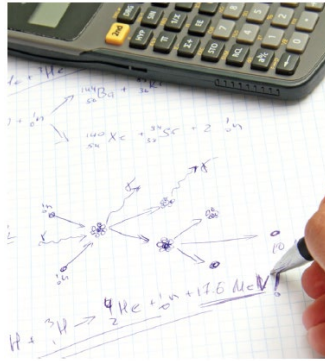
Nuclear P.E. Examination Knowledge Domains



1. Radiological Analysis and Consequences (18-27)
2. Nuclear Fuel Cycle (9-14)
3. Nuclear Systems and Components (13-20)
4. Reactor Physics and Criticality Safety (19-29)
5. Safety Analysis (11-17)



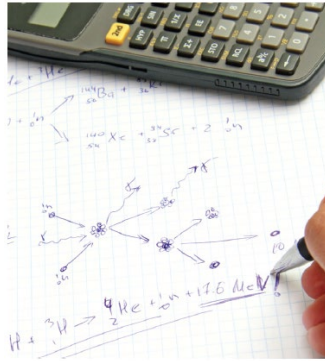
Example Problems



For 2-MeV gamma rays, the linear attenuation coefficient (cm^{-1}) for concrete ($\rho = 2.53 \text{ gm/cc}$) is most nearly:

- (a) 0.0240
- (b) 0.0445
- (c) 0.0607
- (d) 0.1130

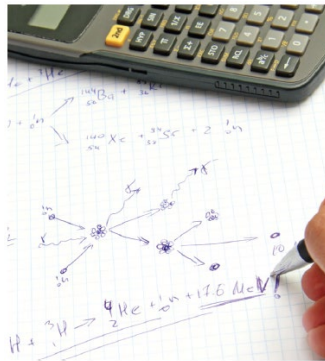
Example Problems



In a Boiling Water Reactor, if the normal heat removal system is operable when the reactor is tripped, then shutdown cooling is provided by:

- (a) condensate/feedwater system
- (b) reactor core isolation cooling system
- (c) makeup service water system
- (d) suppression pool system

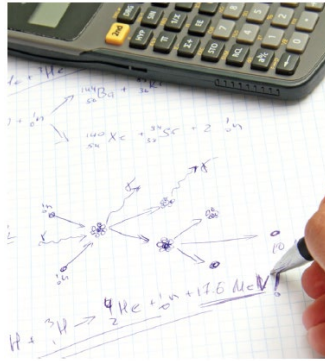
Example Problems



The frequency for loss of offsite power is 0.052/year. The probability that offsite power is lost during the 40-year lifetime of the plant is most nearly:

- (a) 0.11
- (b) 0.36
- (c) 0.88
- (d) 1.0

Example Problems



If an 80-kg person is found to have 8,000 Bq of K-40 (beta energy = 1.33 MeV followed by gamma of 1.46 MeV) in their body, the annual dose to the person in micro-sieverts (μS) due to beta decay from K-40 is closest to:

- (a) 200
- (b) 700
- (c) 1,000
- (d) 1,500

The background of the slide is a photograph of a large industrial port. In the foreground, two men are standing on a concrete pier. One man is wearing a bright orange jumpsuit and a yellow hard hat, while the other is wearing a dark suit and a yellow hard hat. They are both looking at a tablet computer held by the man in the suit. Behind them, several large red gantry cranes are visible, extending over a body of water. In the distance, a city skyline with several skyscrapers is visible under a clear sky. The overall scene is bright and sunny.

The big picture

- It's tough—for a reason.
- Keep your eye on the target.
- There are resources that can help you get there.

Study Materials
We Are Here to
Help

The Nuclear PE

Professional Engineering Licensure for Nuclear Engineers

The Credential that Gives you the Edge

The American Nuclear Society offers the following materials to help you prepare for the PE Nuclear Exam:

[PE Nuclear Exam Preparation Module Program](#)

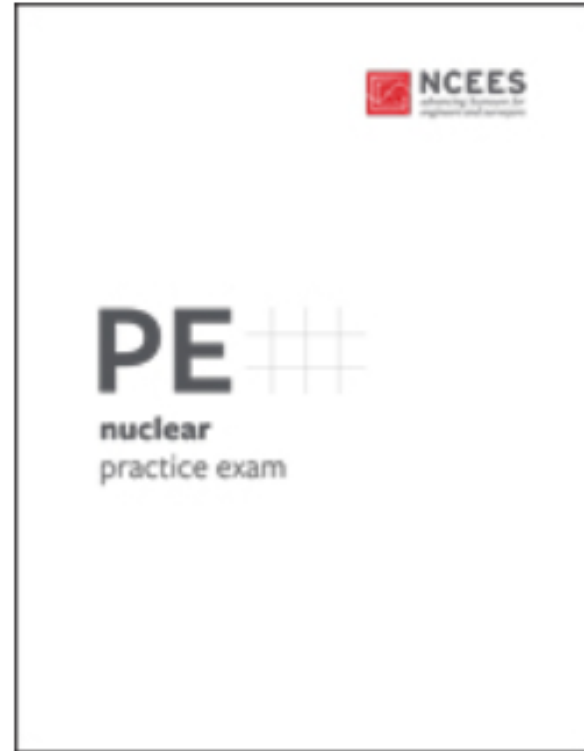
A self-study video-based program covering the specification areas that make up the PE Nuclear Exam.

[ANS Study Guide for the Professional Engineering Examination in Nuclear Engineering](#)

<https://www.ans.org/pe/>



Study Materials
We Are Here to
Help



<https://account.ncees.org/exam-prep/384>



Key Takeaways / Conclusions

- Obtain meaningful, progressive engineering experience
- Take advantage of prep courses / study materials
- Take exams as soon as you are eligible

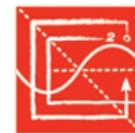
<https://ncees.org/engineering/pe/nuclear/>

<https://ncees.org/supplemental/launch-login/>

Create a myNCEES account

MyNCEES

Download a FREE version of the Nuclear PE
Single Reference Handbook.



NCEES

*advancing licensure for
engineers and surveyors*

Licensure

Take the Next Step

- Practicing engineers should demand more from our education system, the engineering profession, and ourselves.
- Licensure is the mark of a professional.
- It's a standard recognized by employers and their clients, by governments and by the public as an assurance of dedication, skill and quality.
- Why should we settle for anything less?

