# Ultra Technology Incorporated

3836 Brighton Drive N.W. Calgary, Alberta, Canada T2L 1G8

403-289-4507

February 16, 1987

Docket No: 030-20421 License No: 50-23363-02 Control No: 70493

United States Nuclear Regulatory Commission Region V 1450 Maria Lane, Suite 210 Walnut Creek, California 945096

Attn: Ms. Beth A. Riedlinger Health Physicist (Licensing) Nuclear Materials Safety Section

Dear Ms. Riedlinger:

The attached sample examination and answer key is submitted in response to your letter of February 5, 1987. A statement defining the passing mark is given on the cover page of the examination. The same paragraph states that the candidate will be re-examined, once only, following further instruction in areas of knowledge which are shown to be deficient in the original examination.

We have found it necessary to revise the "Specific Instructions" section of the training manual. These instructions were written prior to our license being issued and because they were written before we could possess a gauge we did not foresee one particular problem which has appeared. We had expected that CPN could supply the short handle mentioned in our instructions but fabricating of this part has not been successful. We had expected that the handle would place the technicians hand about 20 inches from the source but in reality the hands are just over 14 inches from the source.

Although the radiation levels from these gauges are very low we are still concerned because our people use these things at least 70 hours a week. In fact, each member of our three man crews will make about 240 tests a day. In response to this situation we have secured film monitors which are worn on each crew members wrist. To date, the reports we have received from Landauer indicate that radiation levels are below their reporting threshold. We are also returning the badges to Landauer for assessment at the end of each crews two week shift rather than follow the normal monthly cycle because we wish to know timely if procedures need further modification.

8708100284 870320 REG5 LIC30 50-23363-02 PDR The revised Specific Instructions are divided in two parts because we have had to develop two distinct devices to position the gauge on the pipe. Section 8.03.01 describes the procedure for a device which holds the gauge on the pipe magnetically while 8.03.02 describes the procedure for a device which rolls along the pipe. We use the terms "spider" and " trash can" in the instructions because these are the slang names the crews have attached to these devices to identify them.

æ

Yours very truly,

D. S Hecken

D. S. Heiken Radiation Safety Officer

### 8.03 Specific Instructions:

2

THE FOLLOWING STEP BY STEP INSTRUCTIONS ARE TO BE READ DAILY PRIOR TO USE OF THE MOISTURE GAUGE

A MOISTURE GAUGE IS ALWAYS ON. THERE IS NO SHUTTER OR OTHER DEVICE WHICH WILL RETRACT THE SOURCE INTO A NON RADIATING POSITION. ONLY THE ELECTRONICS CAN BE SHUT OFF.

ALTHOUGH THE RADIATION EMITTED BY THE GAUGE IS VERY VERY LOW, THE FOLLOWING PROCEDURES MUST BE FOLLOWED TO ENSURE THAT PERSONAL EXPOSURE IS AS LOW AS POSSIBLE AND THAT NO EXPOSURE OCCURS TO THE GENERAL PUBLIC.

The neutron source of the CPN Corporation 503 moisture gauge is contained within a 1.5" diameter by 14 " long probe designed to be lowered from the bottom of the gauge (source castle) into a cased hole in soil or to be removed from the gauge body (source castle) and lowered into a cased hole. When the source is below ground the soil provides shielding but because you will use the gauge above ground you will not have the shielding of soil available. Therefore you must, at all times, keep the probe as far as possible from your body.

The probe should be gripped securely the electrical connection, quickly removed from the "source castle" held at arms length and inserted into the reciving tube on the appropriate jig (spider of trash can). Moving the probe in this manner will ensure that the Americium/Beryllium source is never closer to your body than one yard. (Thus the radiation field which could be applied to the trunk portions of your body is less than 0.11 mr/hr.)

The source is shielded by about one half value layer of paraffin wax when it is in the source castle. The manufacturer states that the average dose rate at the surface of the removable probe is less than 0.5 mrem/hr. The half value layer and the distance between the shield and the devices' outer case ensures that the dose rate at the surface of the gauge is less than 0.25 mrem per hour. Although this is a very small dose rate, the gauge should always be carried with the arms fully extended such that the source is lower than knee level. Never carry the device over the shoulder in a manner which would put the source and probe close to the trunk of your body.

# 8.03.1 Specific Instructions for use of the Magnetic Jig (Spider)

- Before removing the gauge from locked storage or entering a vehicle that is used for transporting or storing the gauge in the field, ensure that your assigned film badge is on your person and that you are wearing a zeroed dosimeter.
- 2. Ensure that other employees who may work with or near you while you are using the gauge are wearing film badges and dosimeters.
- 3. Make the appropriate entries in the Source Utilization Log before removing the device from locked storage or departing for a field location if the vehicle is used for temporary storage.
- Remove the transport case and probe from storage and place it in your vehicle.

If the device is to be transported in an open pickup without a lockable box ensure that the carrying case is secured to the floor of the truck box such that, in the event of an accident, the source and carrying case will not be thrown out of the truck. <u>Never</u> leave the device unattended in the back of a pick up. If you must leave the vehicle unattended, place the device within its transport case on the cab floor and lock the truck cab for that period of time. Cover the case so that it does not become an attraction to a thief. Never transport the device with you in the truck cab.

If the device is to be transported in an enclosed van, secure the transport case to the floor as far to the rear as possible. Never allow other crew members to be seated closer than three feet from the source.

- 5. Post the work area with Radiation Warning signs before removing the device from its transport case.
- 6. Move jigs and ancillary equipment needed to the work site before removing the moisture gauge from its transport case.
- 7. Move the moisture gauge to the work site taking care to carry the device at about knee level.
- 8. Place the magnetic jig (spider) on the bottom of the pipe where the moisture reading is to be obtained.
- 9. Locate the probe and its source castle as close as possible to the above location.
- 10. Ensure that you have solid footing and unobstructed movement between the source castle and the above location.

- Unlatch the probe body from the source castle by depressing the indent on the latch ring. Grasp the probe body at the electrical attach point.
- 12. While holding the probe with the arms fully extended and both hands on the cable attach point, quickly and carefully withdraw the probe from the source castle and insert it into the jig (spider) previously secured to the pipe.
- 13. Push the probe (away from your body) until the latch on the gauge is engaged. Carry source castle with you and move at least 10 feet or more away from the source in the direction of the next vertical support member (VSM). Do not return to the probe until your partner who is monitoring the remote read out panel signals that the count is complete.
- 14. Remove the source from the jig when relocating the jig to the next "count" location or pipe section. This is accomplished by releasing the latch on the jig, pulling the probe out of the jig and inserting the probe into the source castle. Latch the probe to the source castle before carrying it to the next location.
- 15. Upon completion of the survey and before placing the source castle in the transport case ensure that the probe body is securely latched to the source castle.
- 16. If no further survey work is to be done, upon returning to the office, either place the device in its locked storage area (preferably) or lock the device within the body (cab) of the transporting vehicle and retain possession of the ignition keys.
- 17. Upon completion of the days shift, ensure that the source is properly latched in the source castle, that the device is placed on charge to maintain battery life and that the device is locked within its approved storage area.
- 18. Complete the required entry in the Source Utilization Log.

See Section 11.00 on Emergencies.

# 8.03.3 Specific Instructions for use of the Rolling Shuttle (Trash can)

.

- 1. Before removing the gauge from locked storage or entering a vehicle that is used for transporting or storing the gauge in the field, ensure that you are wearing your assigned film badge and a zeroed dosimeter.
- 2. Ensure that other employees who may work with or near you while you are using the gauge are wearing film badges and dosimeters.
- 3. Make the appropriate entries in the Source Utilization Log before removing the gauge from locked storage or departing for a field location if the vehicle is used for temporary storage.
- 4. Remove the transport case and probe from storage and place it in your vehicle.

If the device is to be transported in an open pickup without a lockable box ensure that the carrying case is secured to the floor of the truck box such that, in the event of an accident, the source and carrying case will not be thrown out of the truck. <u>Never</u> leave the device unattended in the back of a pick up. If you must leave the vehicle unattended, place the device within its transport case on the cab floor and lock the truck cab for that period of time. Cover the case so that it does not become an attraction to a thief. Never transport the device with you in the truck cab.

If the device is to be transported in an enclosed van, secure the transport case to the floor as far to the rear as possible. Never allow other crew members to be seated closer than three feet from the source.

- 5. Post the work area with Radiation Warning signs before removing the gauge from its transport case.
- 6. Move jigs and ancillary equipment needed to the work site before removing the moisture gauge from its transport case.
- 7. Move the moisture gauge to the work site taking care to carry the device at about knee level.
- 8. Place the "trash can" on the the pipe where the moisture readings are to be obtained.
- 9. Locate the probe and its source castle as close as possible to the above location.
- 10. Ensure that you have solid footing and unobstructed movement between the source castle and the above location.

- Unlatch the probe body from the source castle by depressing the indent on the latch ring. Grasp the probe body at the electrical cable attach point.
- 12. While holding the probe with the arms fully extended and both hands on the cable attach point, quickly and carefully withdraw the probe from the source castle and insert it into the jig previously secured to the of the pipe.
- 13. Push the probe (away from your body) until the latch on the jig is engaged. Carry the 'push bar" and source castle with you and move at least 6 feet or more away from the source. Do not return to the probe until your partner who is monitoring the remote read out panel signals that the count is complete.
- 14. Leave the source castle where you stationed yourself while the count was being made, and when signalled that the count is complete, attach the 'push bar' to the "trash can" and push it to the next position. When the "trash can" has been relocated, signal to your partner to commence the "count". (Use of the push bar as directed will keep the trunk of your body 6 to 8 feet from the source for most of your working day.) If the 'count' period is greater than 4 seconds move away further. Repeat this procedure until it is necessary to remove the jig from the pipe and relocate it between the next vertical support members VSMs.
- 15. Remove the source from the "trash can" when relocating the "trash can" to the next pipe section. This is accomplished by releasing the latch on the "trash can", pulling the probe out of its receptacle and inserting the probe into the source castle. Latch the probe to the source castle before carrying it to the next location.
- 16. Upon completion of the survey and before placing the source castle in the transport case ensure that the probe body is securely latched to the source castle.
- 17. If no further survey work is to be done, upon returning to the office, either place the device in its locked storage area (preferably) or lock the device within the body (cab) of the transporting vehicle and retain possession of the ignition keys.
- 18. Upon completion of the days shift, ensure that the source is properly latched in the source castle, that the device is placed on charge to maintain battery life and that device is locked within its approved storage area.
- 19. Complete the required entry in the Source Utilization Log.

See Section 11.00 on Emergencies.

4

#### INSTRUCTIONS TO CANDIDATES

Note that the correct answers to questions 3 though 6 use the answer obtained in question 2. An arithmetic or other error on this question will result in incorrect answers for the following questions, however marks will be given for questions 3 through 6 even if the answer to question 2 is incorrect PROVIDED your calculations show that you understand the basic rules of exposure calculations.

The passing mark is 80%. If this percentage in not attained with this examination further instruction will be given immediately on those areas in which the candidate appears to have insufficient understanding. The candidate will re-examined upon completion of the additional instruction. If the candidate does not show sufficient understanding of the course material upon re-examination he/she will be removed from consideration for work with nuclear gauges.

Name\_\_\_\_\_ Date

The marks granted for each question are shown thus (5)

Several units which apply to radioactive substances were discussed in the lecture portion of this training program. Fill in the blank space with the appropriate word in the following -

- a. The \_\_\_\_\_\_ is a term used to describe the size of a radioactive source.
- ( 4 ) b. The \_\_\_\_\_ is a term describing the amount of radiation exposure.
  - c. The \_\_\_\_\_\_ is a term which provides a common base for the effects of radiation on mankind.
  - d. The \_\_\_\_\_\_ is a unit which describes 1/1000 of the total dose accumulated.
- 2. Section 3.01 of the Ultra Technology training manual states that the radiation level 2 feet from the CPN PORTAPROBE is less than 0.5 MREM/HR. The "Specific Instructions" for using the PORTAPROBE permit you to withdraw the probe from the "source castle" and place it in a magnetic jig (commonly called 'the spider') which is attached to the pipe. If your hand is 12 inches from the source when the probe is withdrawn from the "source castle" calculate the level of radiation at your hand. Show your calculations below and identify the units that apply to your answer.

(10)

1.

3.

If it takes 5 seconds to remove the probe from the "source castle" and place it in position in the magnetic jig in question 1, what is the dose your hand would receive? Show your calculations below and identify the units that apply to your answer.

(10)

Using your answer to question 3 above and using the same 5 second time period, calculate the "whole body dose" you would receive in moving the probe from the "source castle" and placing it in the magnetic jig. Assume that the source will be three feet ( 3 ) from the 'trunk' portions of your body.

(10)

4.

5.

During your training program you were shown how to remove the probe from the "source castle" and place the probe in the jig, known as the "trash can", which rolls along the pipe. The "trash can" is pushed along the pipe with a detachable handle which ensures that your body is at least six ( 6 ) feet from the source when it is being pushed along the pipe between the vertical support members (VSMs). VSMs are 40 feet apart on the average and you will be stopping to take a "count" every foot. Assuming that it will take 30 seconds to take the "count" and move between each foot location, calculate your expected dose while inspecting one section of pipe. (Question 1. stated that the radiation level 2 feet from the probe is 0.5 MREM/HR.) Show your calculations below and identify the units that apply to your answer.

(10)

Assume that your crew will inspect 21 sections 40 feet in length during day. Because of the very severe outside temperatures each member of your three member crew takes a turn moving the "trash can" along the pipeline. Using your answer calculated in question 4,

a. calculate the total dose your body would receive during the day,

(5)

b. calculate the number of days you could work in a year before you would exceed the maximum annual "whole body" dose permitted by the regulatory authorities.

(5)

- 7. Neutron emission occurs when an alpha particle emitter is mixed with beryllium powder. The alpha particle emitter used in the PCN Portaprobe is
  - a. Plutonium
- (3) b. Americium
  - c. Radium
- The regulatory authority which licenses Ultra Technology to posses and use radioactive materials is
  - a. The State of Alaska
- (3) b. The North Slope Borough
  - c. The United States Nuclear Regulatory Commission

6.

- Ultra Technology is licensed to use neutron producing sources for following purposes
  - a. determining the compaction of soils on construction projects
- (3)
- b. determining the moisture content of insulation and other construction materials
  - c. for corrosion measurements using a radiography procedure
  - d. all of the above
- 10. Although the Ultra Technology training manual states that a nuclear gauge can be transported by anyone provided it is locked with its carrying case, there are restrictions as to who may use a nuclear gauge. A person who us(s a nuclear gauge must be
  - a. at least twenty-five years old

- c. licensed by the Nuclear Regulatory Commission
- d. none of the above
- 11. The U.S. Government Department of Transportation requires that all shipping and storage containers such as those supplied with the CPN Portaprobe show a Yellow Label on the outside of the shipping case. Select the correct answer from one of the below.
  - a. III
- (3) b. I

c. II

12. If the nuclear gauge is to be shipped by a scheduled airline the gauge may be carried in -

a. a freight only aircraft

- (3) b any scheduled passenger carrying aircraft that flies the route
  - c. only in the pilots cockpit compartment of any aircraft

- 13. Fill in the blanks in the following sentences.
- ( 2 ) a. If a vehicle is used for temporary storage of the gauge, the gauge must be \_\_\_\_\_\_ within the cab of the vehicle and the \_\_\_\_\_\_ must be in the possession of the licensed technician at all times.
- (2) b. A sign which shows the words must be posted on the door of a permanent storage area.
- (2) c. Under the conditions of Ultra Technology's Nuclear Gauge License, a vehicle carrying a nuclear gauge must display signs which read
- 14. Ultra Technology provides the following radiation monitoring device which must be worn whenever a nuclear gauge is used.
  - a. pocket dosimeters
  - b 'pocket' film badges
- (3)
- c. 'wrist' film badges

d. all of the above

15. Protection of the General Public during field use is the responsibility of the gauge user. Explain below how you will accomplish this.

(3)

- 16. a. Who is the Company's Radiation Safety Officer?
- (3)

b. Where will you find his telephone number if you need to call him in an emergency situation?

- (3)
- 17. a. Describe what you would do if the gauge is damaged in an accident, but is intact and the source is obviously in place and not damaged.
- (5)
- b. Describe what actions you would take if the gauge is torn open or you cannot determine the condition of the source.

(5)

18. a. What action is to be taken if the gauge is stolen?

(3)

b. What action would you take to protect 'fire fighters' in Prudhoe Bay if your vehicle or the permanent storage area in the "South Hanger" was destroyed in a fire?

# (3)

the

- 19. The Radiation Safety Officer is responsible for maintaining certain record relating to licensing, personnel and training records, film badges etc. Although he is responsible for its, upkeep the Radiation
  (3) Safety Officer requires that the individual who removes the gauge from storage or returns it to storage to record the date and time of removal or return to storage. The record is known as
- 20. a. Can the Portaprobes source be retracted into a safe or a position where All radiation is absorbed in shielding ? (yes or no) ( 3 )
  - b. What is the effect of the off/on switch on the Portaprobe control panel?
- (2)

total	marks			
total	possible m	marks	104	
grade			%	

#### ANSWER KEY FOR NUCLEAR GAUGE EXAMINATION

The marks granted for each question are shown thus (5)

- Several units which apply to radioactive substances were discussed in the lecture portion of this training program. Fill in the blank space with the appropriate word in the following
  - a. The <u>CURIE</u> is a term used to describe the size of a radioactive source.
  - (4) b. The <u>ROENTGEN</u> is a term describing the amount of radiation exposure.
    - c. The <u>REM</u> is a term which provides a common base for the effects of radiation on mankind.
    - d. The MILLICURIE is a unit which describes 1/1000 of the total dose accumulated.
- 2. Section 3.01 of the Ultra Technology training manual states that the radiation level 2 feet from the CPN PORTAPROBE is less than 0.5 MREM/HR. The "Specific Instructions" for using the PORTAPROBE permit you to withdraw the probe from the "source castle" and place it in a magnetic jig (commonly called 'the spider') which is attached to the pipe. If your hand is 12 inches from the source when the probe is withdrawn from the "source castle" calculate the level of radiation at your hand. Show your calculations below and identify the units that apply to your answer.

(10)

 $\frac{24 \times 24 \text{ ins}}{12 \times 12 \text{ ins}} \times 0.5 \text{ MREM/HR} = \frac{4}{1} \times 0.5 = 2 \text{ MREM/HR}$ 

3. If it takes 5 seconds to remove the probe from the "source castle" and place it in position in the magnetic jig in question 1, what is the dose your hand would receive? Show your calculations below and identify the units that apply to your answer.

(10) 
$$2 \text{ MREM/HR} \times \frac{1}{60 \times 60} \times 5 \text{ sec} = \frac{10}{3600} = .0028 \text{ MREM}$$

Using your answer to question 3 above and the same 5 second time period, calculate the "whole body dose" you would receive in moving the probe from the "source castle" and placing it in the magnetic jig. Assume that the source will be three feet (3) from the 'trunk' portions of your body.

# (10) $\frac{12 \times 12 \text{ ins}}{32 \times 36 \text{ ins}}$ x .0028 MREM =

<u>1</u> x .0028 =

.0003 MREM

5.

During your training program you were shown how to remove the probe from the "source castle" and place the probe in the jig, known as the "trash can", which rolls along the pipe. The "trash can" is pushed along the pipe with a detachable handle which ensures that your body is at least six ( 6 ) feet the source when it is being pushed along the pipe between the vertical support members (VSMs). VSMs are 40 feet apart on the average and you will be stopping to take a "count every foot. Assuming that it will take 30 seconds to take the "count" and move between each foot location, calculate your expected dose while inspecting one section of pipe. (Question 1. stated that the radiation level 2 feet from the probe is 0.5 MREM/HR.) Show your calculations below and identify the units that apply to your answer.

<u>24 x 24 ins</u> x 0.5 MREM/HR x <u>30 sec</u> x 40

 $(10) = \frac{1 \times 1 \text{ ins}}{3 \times 3 \text{ ins}} \times 0.5 \text{ MREM/Hr} \times \frac{1}{3600} \times 30 \text{ sec} \times 40$ 

= .0185 MREM per section

4.

Assume that your crew will inspect 21 sections 40 feet in length during a day. Because of the very severe outside temperatures each member of your three member crew takes a turn moving the "trash can" along the pipeline. Using your answer calculated in question 4,

- a. calculate the total dose your body would receive during the day,
  - $\frac{21}{2}$  sections x .0185 MREM per section
    - = 7 x .0185
    - = .1295 MREM/DAY
    - = .13 MREM/DAY approximately
- b. calculate the number of days you could work in a year before you would exceed the maximum annual whole body dose permitted by the regulatory authorities.

5 REM = 5,000 MREM <u>5,000</u> = 38,461 days .13

- 7. Neutron emission occurs when an alpha particle emitter is mixed with beryllium powder. The alpha particle emitter used in the PCN Portaprobe is
  - a. Plutonium
- (3) b. Americium

c. Radium

- The regulatory authority which licenses Ultra Technology to posses and use radioactive materials is
  - a. The State of Alaska
- (3) b. The North Slope Borough
  - c. The United States Nuclear Regulatory Commission

6.

(5)

(5)

- 9. Ultra Technology is licensed to use neutron producing sources for following purposes
  - a. determining the compaction of soils on construction projects
- (3) <u>b.</u> determining the moisture content of insulation and other construction materials
  - c. for corrosion measurements using a rad caphy procedure
  - d. all of the above
- 10. Although the Ultra Technology training manual states that a nuclear gauge can be transported by anyone provided it is locked with its carrying case, there are restrictions as to who may use a nuclear gauge. A person who uses a nuclear gauge must be
  - a. at least twenty-five years old
- (3) b. certified by the employer
  - c. licensed by the Nuclear Regulatory Commission
  - d. none of the above
- 11. The U.S. Government Department of Transportation requires that all shipping and storage containers such as those supplied with the CPN Portaprobe show a Yellow Label \_\_\_\_\_\_ on the outside of the shipping case. Select the correct answer from one of the below.
  - a. III
- (3) b. I

c. II

12. If the nuclear gauge is to be shipped by a scheduled airline the gauge may be carried in -

a. a freight only aircraft

- ( 3 ) b. any scheduled passenger carrying aircraft that flies the route
  - c. only in the pilots cockpit compartment of any aircraft

- 13. Fill in the blanks in the following sentences.
- (2) a. If a vehicle is used for temporary storage of the gauge, the gauge must be locked / stored within the cab of the vehicle and the keys must be in the possession of the licensed technician at all times.
- (2) b. A sign which shows the words <u>CAUTION</u>, <u>RADIOACTIVE MATERIALS</u> must be posted on the door of a permanent storage area.
- (2) c. Under the conditions of Ultra Technology's Nuclear Gauge License, a vehicle carrying a nuclear gauge must display signs which read <u>CAUTION</u>, RADIOACTIVE MATERIALS.
- 14. Ultra Technology provides the following radiation monitoring device which must be worn whenever a nuclear gauge is used.
  - a. pocket dosimeters
  - b 'pocket' film badges
  - c. 'wrist' film badges

(3)

(3)

...

. .

d. all of the above

- 15. Protection of the General Public during field use is the responsibility of the gauge user. Explain below how you will accomplish this.
- (3) Post the area with CAUTION, RADIOACTIVE MATERIALS signs
- 16. a. Who is the Company's Radiation Safety Officer?
- (3) Donald Heiken
  - b. Where will you find his telephone number if you need to call him in an emergency situation?
  - his telephone number is in the operating manual
- 17. a. Describe what you would do if the gauge is damaged in an accident, but is intact and the source is obviously in place and not damaged.
- (5) place the gauge in its shipping container, return it to storage and telephone the factory for advice
  - b. Describe what actions you would take if the gauge is torn open or you cannot determine the condition of the source.
- (5) barricade the site, stop the vehicle if one is involved, remove the driver of a vehicle, rope off the area, prevent entry to the area, then call the RSO for help

- 18. a. What action is to be taken if the gauge is stolen?
- (3) notify the police and site security
  - b. What action would you take to protect 'fire fighters' in Prudhoe Bay if your vehicle or the permanent storage area in the "South Hanger" was destroyed in a fire?
- (3) inform the firemen that a SEALED radioactive source is involved
- 19. The Radiation Safety Officer is responsible for maintaining certain record relating to licensing, personnel and training records, film badges etc. Although he is responsible for its, upkeep the Radiation
  (3) Safety Officer requires that the individual who removes the gauge from storage or returns it to storage to record the date and time of removal or return to storage. The record is known as the <u>Source</u> Utilization Log.
- 20. a. Can the Portaprobes source be retracted into a safe or a position where all radiation is absorbed in shielding ? (yes or <u>no</u>)
- (3)

....

b. What is the effect of the off/on switch on the Portaprobe control panel?

(2)

the switch turns off the electronics

total marks \_\_\_\_\_ total possible marks 104 grade %