RONAN
Measurements Division

# Density Compensated Level Monitor Systems




Ronan Engineering Co.
8050 Production Drive
Florence, KY 41042 USA

PHONE: (859) 342-8500
FAX: (859) 342-6426




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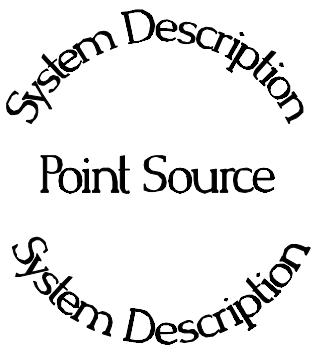


**Chapter 1** provides a general overview of the Ronan Density Compensated Level Monitor System and its individual components.

The section on "Options" explains features that may or may not be included in each system depending upon user's specific needs and applications.

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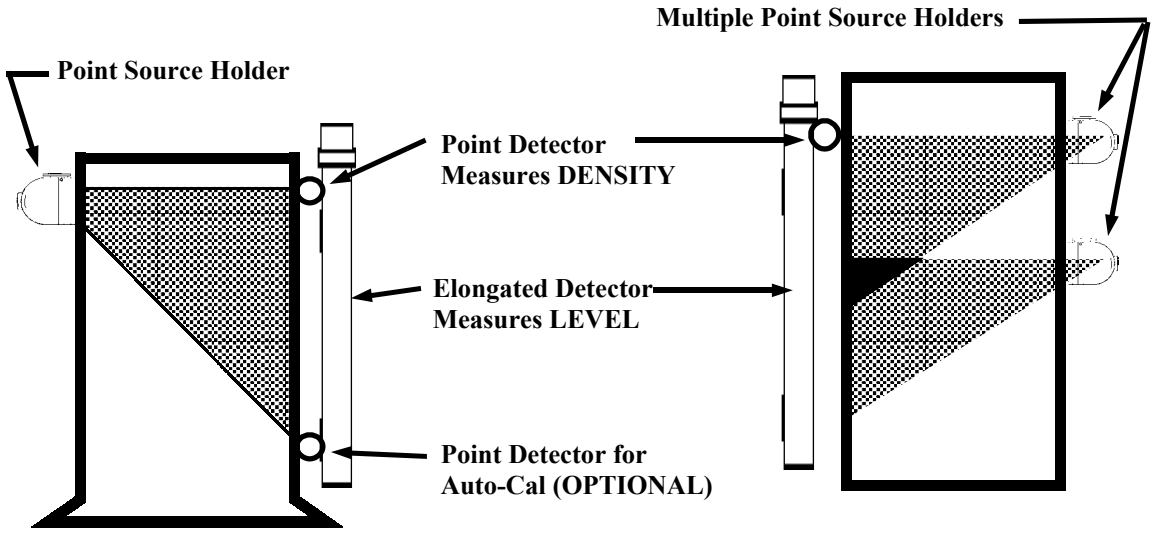
## System Configuration

The user's application determines the system configuration requirements.

Shown here are typical examples of two systems using Density Compensated Level Monitoring.




## System Components

Many system configurations are available for a number of different applications. However, in all cases there are at least four major components included with each Density Compensated Level Monitor System:

Source Holder with enclosed source capsule
Detector(s)
X96N Microprocessor(s)
Interconnect Cable(s)

### Source Capsule

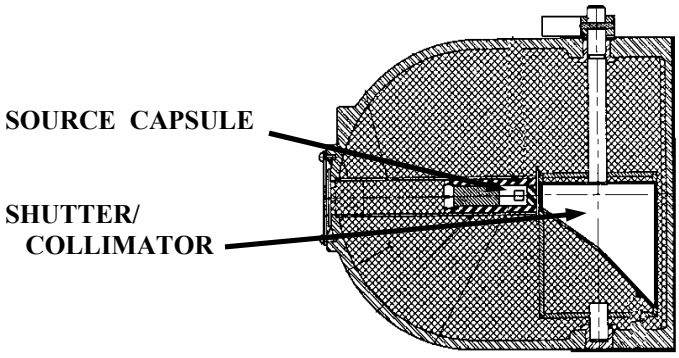
A radioactive cesium (Cs-137) source is sized to fit the needs of each application. The source material is encapsulated inside a welded stainless steel cylinder and shielded by a lead-filled source holder.

Cesium emits gamma radiation which has several advantages. Gamma radiation does not make material radioactive, nor does it change or affect the material as it is absorbed.

**Source Holder**

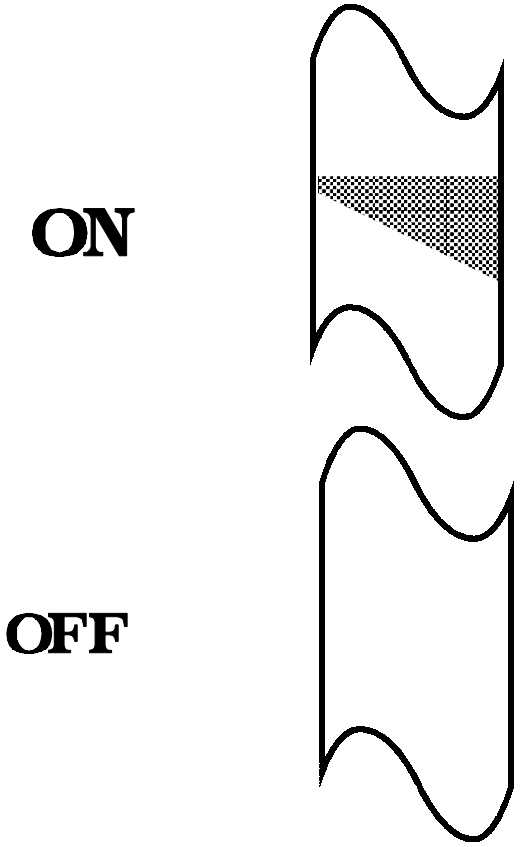
The point source holder is mounted to the external surface of the process vessel. A small slot in the lead shielding of the source holder focuses an active radiation beam through a collimated opening, into the process vessel, and toward the detector which is mounted on the opposite side of the vessel.

To ensure a safe way of closing off the active radiation beam during shipping, installation and servicing, a handle with a rotating shutter is provided.



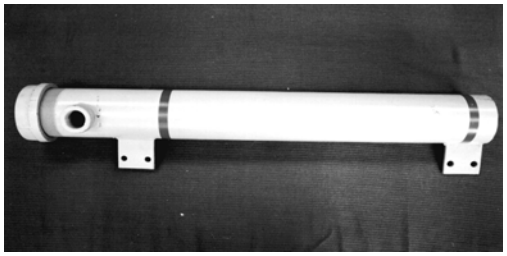

When OFF, or closed, the shutter rotates in place to cover the small opening and shield the radiation beam. The ON, or open, position removes the shielding from the small opening.

**ON/OFF Mechanism**

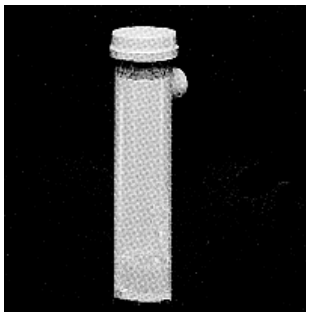


**Detectors**

The detectors are mounted in protective housings. When radiation from the source strikes the "active" length of the detector a signal is generated.



The level measurement is made using an elongated ion chamber or scintillation detector. The active length of the elongated detector corresponds to the full measurement range of interest, and is designated by bands of tape at the top and bottom of the detector housing.



The density measurement is made using a point scintillation detector.

I*on chamber* detectors produce a picoampere current that is converted into a voltage signal, amplified, and sent to the microprocessor.

S*cintillation* detectors produce a light pulse that is detected by a phototube, converted into an electrical pulse, amplified, and sent to the microprocessor.

Chapter 6 contains more information about the detectors.

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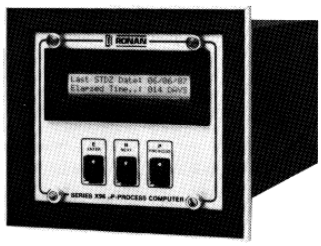
**X96N Microprocessor**

Ronan's X96N Microprocessor electronically manipulates the detector output signal and displays the results in a useful format.



With just three push buttons, a liquid crystal display screen, and pre-programmed menus, the process level is continuously monitored with minimal operator effort.

Chapter 7 contains details about the hardware used in the X96N, and Chapter 4 explains the software used for this application.

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**Interconnect Cable**

The interconnect cables provide a signal from each detector to the X96N Microprocessor. The cables are supplied with a pre-wired MS connector.

## Extended Features and Optional Accessories

Ronan's Density Compensated Level Monitor Systems offer a number of options and special features. Among the features available are:

Radiological Discrimination
Alarms
Auto-Cal
Auto-Cal Validate

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**Radiological Discrimination**

If there is a chance that on-site radiography devices will interfere with measurement output from the Ronan Density Compensated Level Monitor System, the radiological discrimination feature can be enabled. This feature protects the gage from interruptions caused by external energy sources.

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**Alarms**

High and low level alarm outputs are available.

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**Auto-Cal**

If interior walls of the vessel are prone to normal process build-up, the automatic calibration feature can be included. Auto-cal will maintain the accuracy and repeatability of the measurement with little or no effort on the part of the operator. This feature requires installation of one or more additional point detectors.

If this feature is included with your system, refer to Chapter 8 for details.

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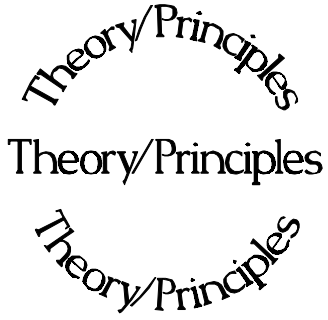
**Auto-Cal Validate**

The system's stability is monitored over a given time period. This "trend" is used to validate each Auto-Cal request - preventing and/or aborting those requests when unstable conditions arise.




**Chapter 2** gives a simplified explanation of how radiation gages work.

The "Theory of Radiation Gaging" Section reviews the concepts of radiation transmission and absorption.

The "Principles of Operation" Section explains signal processing, density compensation, referencing, calibration, and curve correct procedures.

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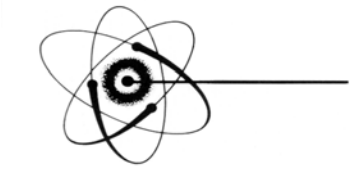
# Theory of Radiation Gaging

Radiation gages operate on the principle of radiation absorption and transmission.

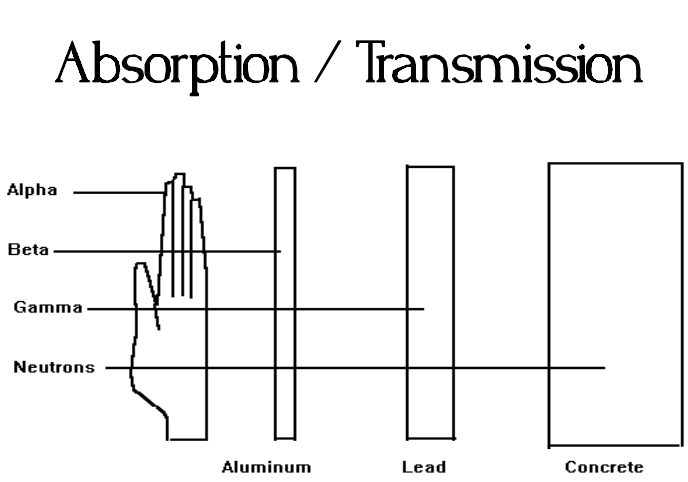
A beam of gamma radiation is directed from the source holder, through the vessel and its process material, and onto the surface of the detector.

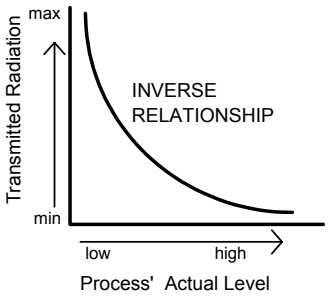
Some amount of radiation is *absorbed* by the material through which it passes, and some of the radiation is *transmitted* to the surface of the detector.



**Gamma's advantages:**

Passes through process material
Does not make material radioactive
Does not change the material
Can be shielded by lead



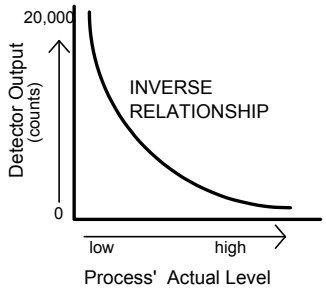




Process measurement is possible because the amount of radiation *absorbed and transmitted* is predictable.

The absorbed radiation is directly related to the level (or mass) of process in the vessel while the transmitted radiation is inversely related to the level (or mass) of process in the vessel.

Therefore, an **increased process level results in a decrease of transmitted radiation.**

# Principles of Operation



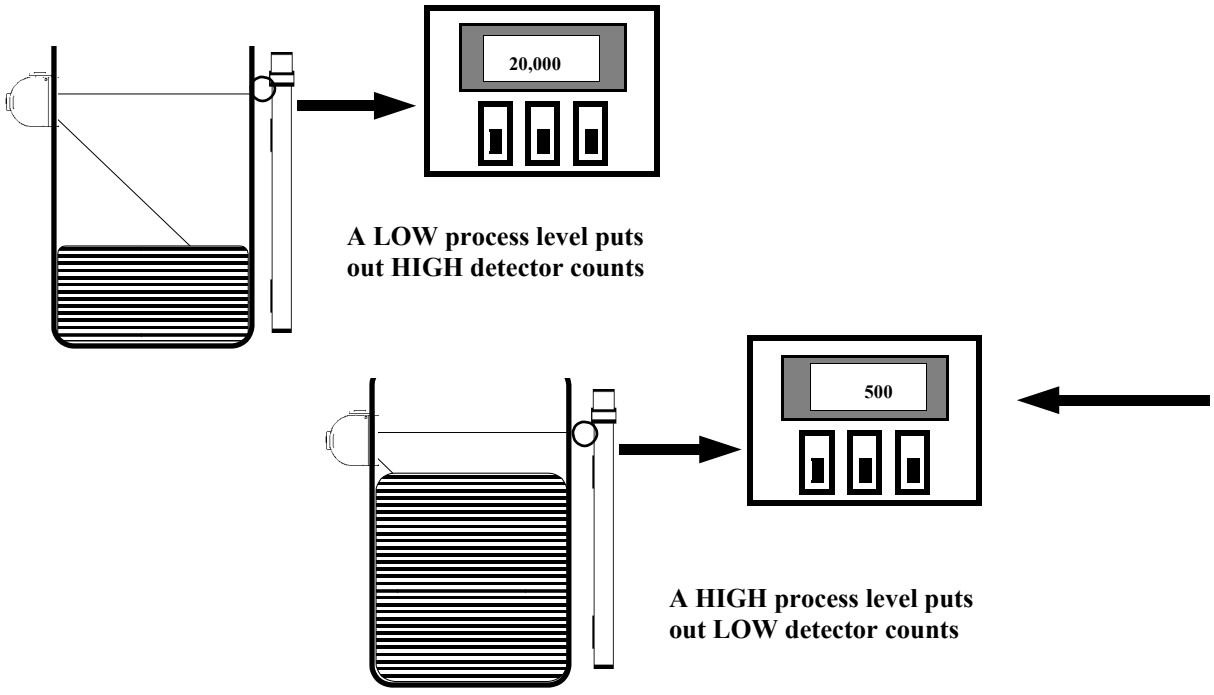

Since the radiation that's not being *absorbed* is being *transmitted*, the level (or mass) of process can be inferred by measuring the amount of radiation reaching the detector at any point in time.

The detector's output signal, in counts, also *varies inversely* to the process level (or mass). Shown here is a typical response curve for a continuous level application.

Fairly simple conditions exist when only one process density is involved. In that case, the variation in mass of material can only be caused by a variation in level of the process. In these cases, we can be assured that a change in the detector counts is a result of a change in the process level.

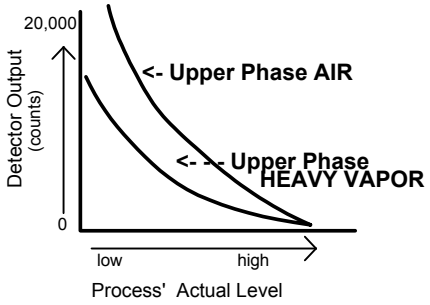
When the process level is absent (or low) the detector is exposed to a maximum amount of radiation which produces a HIGH output of counts.

When the process level is full (or high) the process material "shields" the detector which prevents radiation from reaching the detector, producing a LOW output of counts.



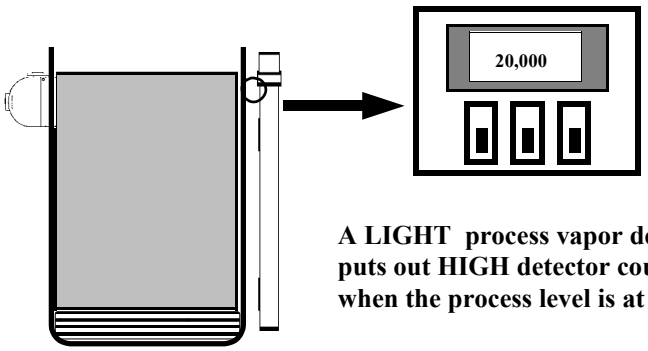
## Vapor/Foam Density Compensation

It is assumed that the density of the upper phase (the area above the process level) is at, or near, AIR. A major variable is encountered, however, when the density (mass) of the upper phase is greater than air.



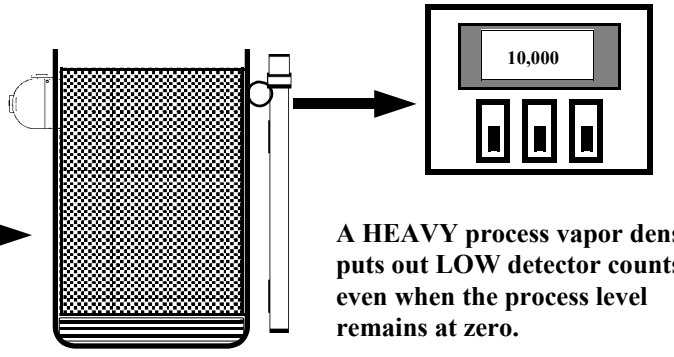

Shown below is a tank/vessel with an upper phase of foam or high-density gas/vapor. In this case, a change in detector counts may actually be a result of a change in the density of the upper phase of foam/vapor rather than a change in the process level.

In order to compensate, or correct, the continuous level gage for a heavy upper phase, a separate Point Detector is used.

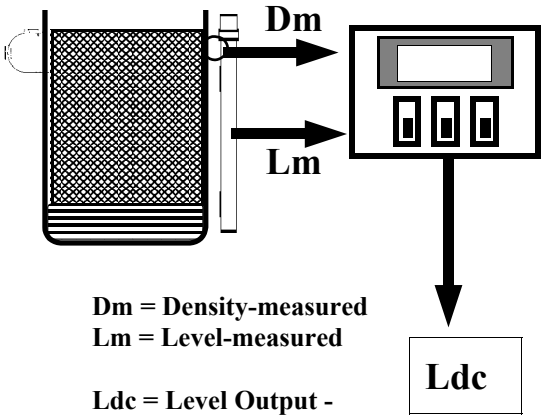



**A LIGHT process vapor density puts out HIGH detector counts when the process level is at zero.**

**Is the Change in Detector Counts due to a Change in Process Level OR Change in Vapor Density ?**




**A HEAVY process vapor density puts out LOW detector counts even when the process level remains at zero.**




**Dm = Density-measured**
**Lm = Level-measured**

**Ldc = Level Output - Density Compensated**

The Point Detector isolates and measures the density of the upper phase material (Dm). That ongoing measurement is "ratioed" against a known density (Dref).*

$$\text{Ratio (R)} = \frac{\text{Dm....}}{\text{Dref}}$$

That ratio is applied through software to the level measurement being received by the elongated detector (Lm). The resulting "density compensated" level output (Ldc) reflects an accurate indication of the process condition.

$$\text{Ldc} = (\text{Lm})\ (\text{R})$$

* See "Reference (Dref)" below

## Additional Signal Processing

In addition to Density Compensation, other stages of signal processing include:

Units Conversion
Measurement Range
Digital Filtering
Dynamic Tracking
Source Decay Compensation
* Reference (Dref)
Calibration
Curve Correction

## Units Conversion

The X96N Microprocessor converts the detector signal to user's measurement units of inches, feet, millimeters, centimeters, or meters.

## Measurement Range

The X96N displays the output measurement range in the user selected level units, and SpG density units. The level "range" is equivalent to the active length of the elongated detector, which corresponds to the full measurement range of interest.

## Digital Filtering

Reduction of the signal "noise" due to radiation statistics is handled in the stage of signal processing known as digital filtering. Digital filtering is a form of statistical averaging used to smooth, or dampen, random radiation as well as process-related noise. Increasing the digital filter's "time constant" results in decreased signal noise.

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## Dynamic Tracking

Dynamic tracking permits the gage response to temporarily by-pass the digital filter. This is helpful in some processes where sudden or drastic step changes in process must be observed in their true, or unfiltered, state.

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## Source Decay Compensation

Software also compensates for the decay of the radioactive source activity. On-going adjustments are made automatically for the rate of decay, or source half-life.

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## Reference (Dref)

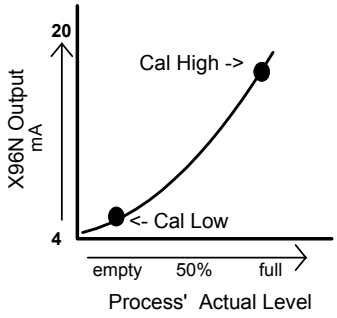
Density Reference (Dref) is the known condition used to calculate the density compensation ratio (R).

"Dref" is automatically measured at the same time the "Cal Low" level reading is obtained for the level calibration. (See "Calibration" which follow.)

Chapter 4 gives details on the "Density Reference," "Level Reference," and "Ratio" software modules.

Chapter 5 gives details on the Calibration/Compensation Procedure.

## Calibration

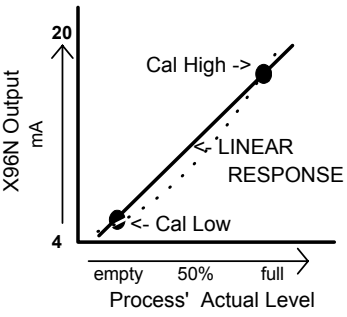



Calibration relates detector output (in counts) to numeric values that accurately represent the actual process level. The calibration procedure establishes reference points of known conditions against which the system can make ongoing comparisons. It requires at least two known points of reference - a low value and a high value. For best calibration results, the two reference points should cover as much of the full measurement range as possible.

As this example response curve shows, the calibration procedure also reverses the relationship between detector counts and actual process level. Now, a direct relationship exists, so that as the process level moves from empty to full, the X96N's display screen indicates an increase in user units from minimum to maximum - (example: 0 feet to 80 feet.).

**AND** the transmitter output signal also increases from minimum to maximum - (usually 4 to 20 mA).

## Curve Correction




Level measurement non-linearity can be caused by an irregular distribution of the radiation field over the full length of the detector. Vessel size and geometry, vessel wall construction, cross paths from multiple source fields, and other system configurations are among the potential causes of an irregular field distribution.

Because a linear output is desired, the adjustment is accomplished through another stage of software signal processing, curve correction.

The nature and form of the curve correction required for each application depends on a number of variables such as system configurations, detector geometry, process conditions, etc. Shown here is a typical response curve with curve correction applied.

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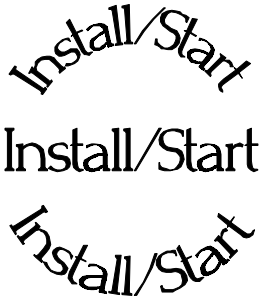


**Chapter 3** covers preliminary information that will help prepare for equipment installation and power-up.

Read the section on "Safety Precautions" before beginning to unpack or install the equipment.

The push-button guide and menu overview will familiarize you with how the X96N functions.

The specific and detailed installation instructions are provided on the Installation Drawings which are included in Chapter 10 of this manual.

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## Caution

Ronan's Monitor Systems use a sealed radioactive cesium (Cs-137) source which is safe if handled properly.

**Specfic License**

Most Level Monitors are mounted to large vessels. Installations on vessels that permit personnel access require a specific license. Your company's specific license will name a Radiation Safety Officer (RSO) or Radiation Protection Officer (RPO). The RSO for your company must be notified immediately upon receipt of the gage. DO NOT proceed with unpacking, storage, or installation without the RSO's authorization.

**General License**

Other monitor systems, such as Density Monitors, are mounted to small-diameter process pipes. Those applications do not require a specifically licensed person to unpack or mount the equipment, as long as the source holder remains padlocked in the OFF position. Only a specifically licensed individual is permitted to remove the padlock and turn the source holder to the ON position.

Ronan's field service personnel are available for advice or assistance. (606) 342-8500.

## Unpacking

All equipment manufactured by Ronan is carefully packaged to prevent shipping damage. Unpack the equipment in a clean, dry area.

Examine the contents and compare them to the packing list. Immediately report any discrepancy or damage to Ronan, the company's RSO, and the carrier. File a claim with the carrier.

## Storage

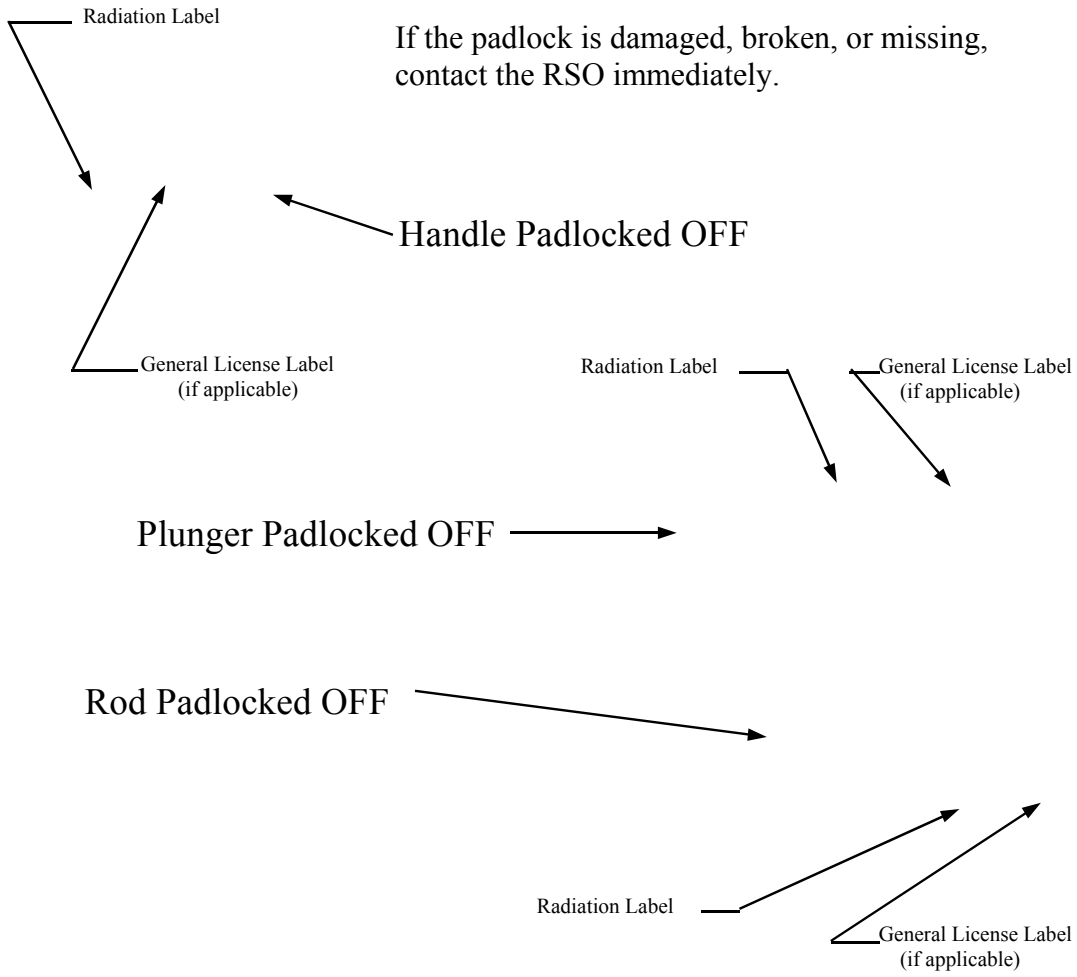
If it is necessary to store this equipment before mounting, the RSO will assign a safe and secure location with no personnel access.

During storage avoid temperatures below freezing, and areas with excessive humidity, moisture, or dirt.

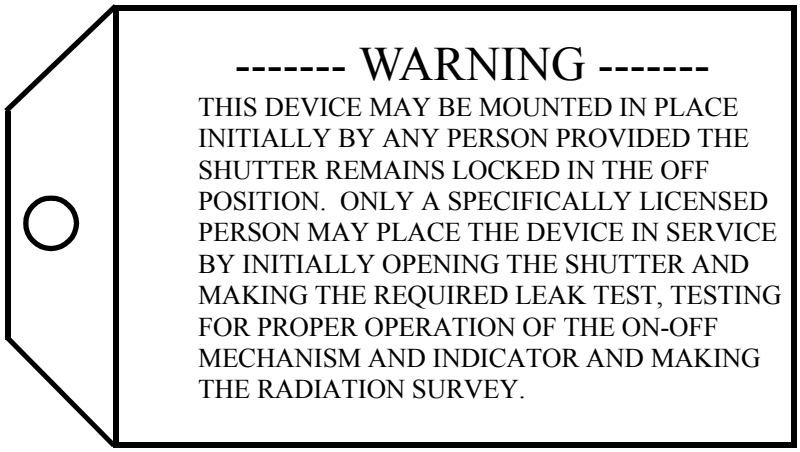
## Inspection

The source holder is equipped with an ON/OFF mechanism. During shipment and storage the mechanism MUST BE SECURED in the OFF position with a padlock.

If the padlock is damaged, broken, or missing, contact the RSO immediately.

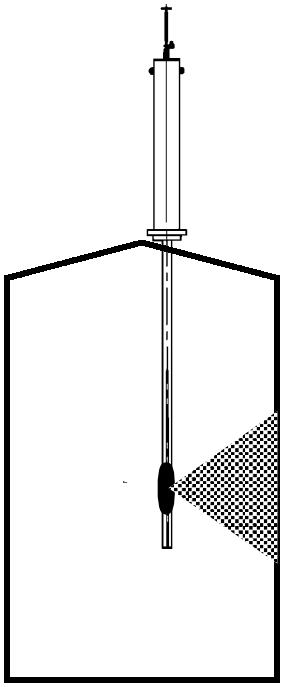



## Lock Tag



## Safety Precautions

During installation the RSO will provide guidelines to assure safety. Consider the information presented in the Regulation/Safety Chapter of this manual, as well as the following general guidelines:



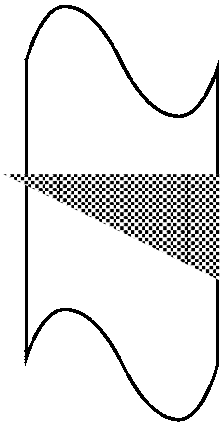
The source holder must remain padlocked in the OFF position until installation is complete.

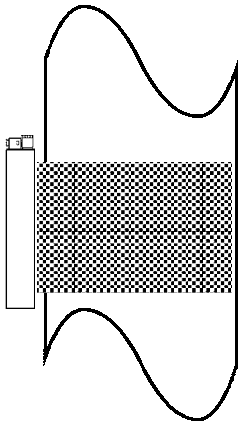
Take all necessary precautions to assure that the source holder is not dropped or damaged.

**A specifically licensed individual MUST inspect the installation** prior to placing the source holder in the ON position.

Always turn the source holder to the OFF position when working around it, the detector, or the area between these two components which is referred to as the "measuring gap."

When the source holder is placed in the ON position, avoid the "active beam."



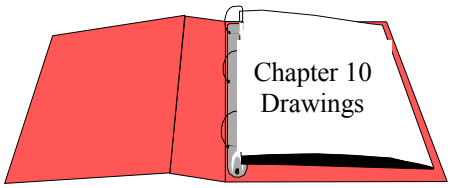


AVOID ACTIVE BEAM

## Mechanical Mounting

Review the Configuration Drawing which is included in the Drawing Chapter of this manual.

Please reference the dimensional drawings located in Chapter 10 when installing the equipment.



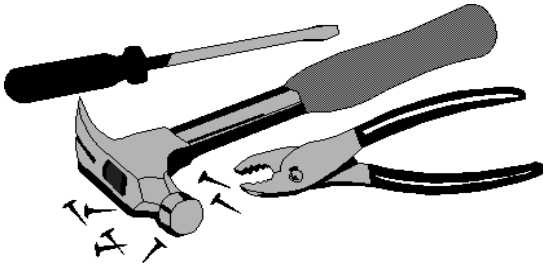

Consider the following general guidelines when mounting the sensor and detector:

Avoid internal vessel obstructions such as baffles, agitators, manways, heater/cooler tubes, etc. which could interfere with the transmission through the vessel of the radiation's "active beam."

Drawings:
Configuration
Installation

The source and detector must be rigidly mounted so they do not move with respect to each other. Such movement will destroy the system's calibration and/or its measurement.

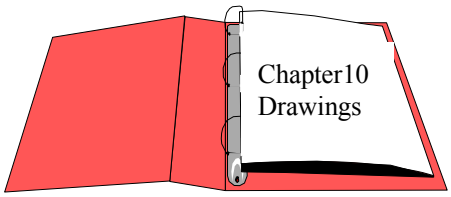
Insulation must be used at the point of installation IF:
- the temperature of the process pipe at that spot exceeds 131°F (55°C), or
- the voltage transmission through the pipe could interfer with the signal transmission from the source to the detector.



**Electrical Installation of Interconnect Wiring**

DO NOT APPLY POWER until wiring is carefully checked.

Wire the equipment according to the detailed interconnect drawing which is included in the Drawing Chapter of this manual.



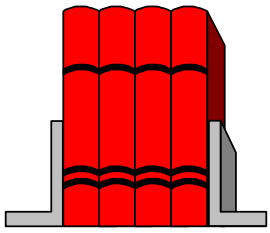

Drawings:
Interconnect

Follow local and national electrical codes for all interconnections.

Consider the following guidelines before making any electrical connections:

Use continuous conduit runs and protect housing junction boxes from dripping of condensed moisture off of conduit.

Plug unused conduit holes to prevent entry of dirt and moisture.



Run the interconnect cable in a separate conduit. Feed the cable through the conduit starting at the detector end and terminate at the microprocessor end.

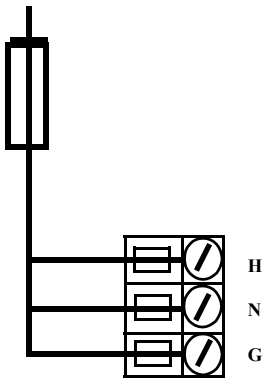
DO NOT run AC power cable in the same conduit with any of the low-level cables (signal, mV, mA, etc.)

LOCAL CODE
NATIONAL CODE

Maintain transient-free AC power sources between 105-130 VAC for the microprocessor. DO NOT use a line that is connected to a large motor, welding equipment, solenoids, etc.

WITH POWER OFF - - -
Connect cable pre-wired MS connector to detector.

Immediately replace lid of detector housing to keep out water and dirt.

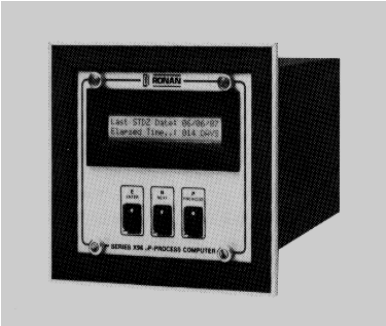



**POWER INPUT**

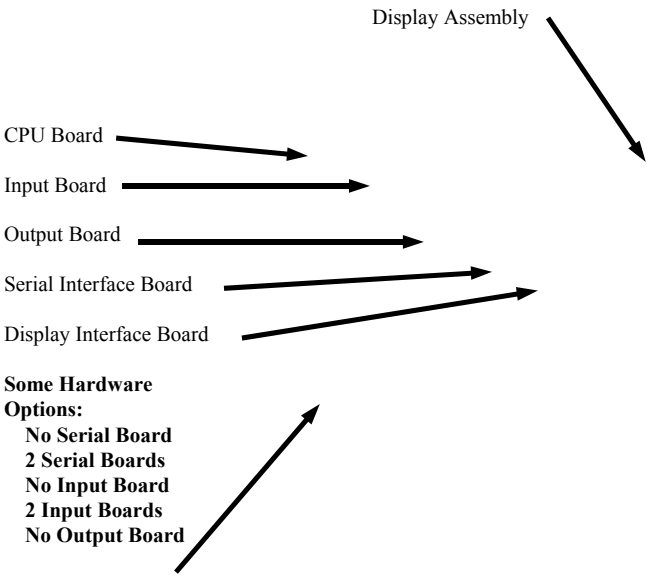
Check connections at microprocessor chassis terminals. Verify that all wires are fully inserted in terminal sockets and the screws firmly tightened.

## Microprocessor Verification

Loosen the four thumb screws to open the front cover and check the board and cable connections. Identify the CPU and other major boards from the drawing below. **Optional configurations are possible.**



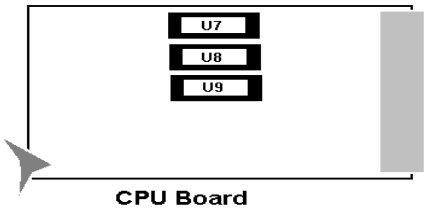
Press the push/pull latch to eject the CPU Board.



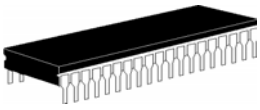

**NOTE:**
**These boards are interchangable in the frame's slots, but the ribbon cables MUST be connected to the correct boards.**

## Identification/ Documentation

The Ronan X96N Microprocessor can be programmed for a variety of applications and configurations. ***The specific application supplied with each system is determined by the combination of software EPROMS located on the CPU Board and the unique hardware configuration used to support these EPROMS***. See Chapter 7 for details about your specific hardware configuration.




Your own set of EPROMS (U7, U8, U9) will be labeled with a specific Software Version Number. This software identification number should be documented for future reference.



Replace the CPU Board back into the X96N's frame. Verify all boards are fully seated and cable connections fully inserted.

**CPU BOARD EPROMS:**

**U7** _____
**U8** _____
**U9** _____

**Power-up**

Before applying power, ensure all boards are fully seated in frame's slots and ribbon cables fully inserted. Close front door of the X96N and tighten the thumbscrews.

When power is applied the X96N runs a self-diagnostic program.

First the software version number is displayed.

```
RONAN (MONITOR SYSTEM)
VERSION XXXXXX
```

The LED's flash and the X96N scrolls through an operation guide.

```
RONAN (MONITOR SYSTEM)
SELF TEST OK
```

```
OPERATION GUIDE
N - DISPLAY NEXT FIELD
```

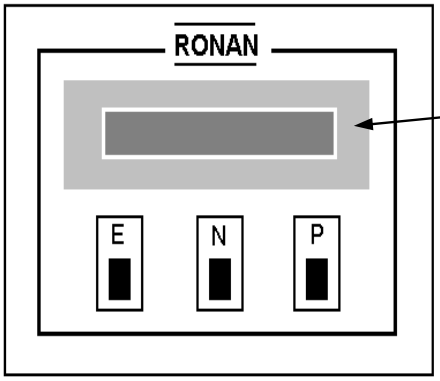
(P - PREVIOUS FIELD )
(E - ACCESS FIELD)

**Press <N>**

NOTE: If the operator does not Press <N> as instructed within one minute, X96N automatically goes to the first status display.

```
OPERATION GUIDE
TO START PRESS N
```

```
(Status Display #1)
```




LIQUID CRYSTAL DISPLAY SCREEN
STATUS DISPLAYS
PROGRAMMABLE FUNCTIONS (MENUS)

**Pushbutton Guide**

This list summarizes the functional uses for each of the three pushbutton.

**Press <E> to:**

- Access the programmable functions from the status displays (ACCESS CODE REQUIRED).
- Access the programmable function named on a menu.
- Exit from the last programmable function back to the status displays.
- Enter a choice (or number) from a menu (FLASHING LED).

**Press <N> to:**

- Advance to the NEXT status display.
- Advance to the NEXT programmable function .
- Answer "NO" to a question.
- Increase a given number (FLASHING LED).

**Press <P> to:**

- Return to the PREVIOUS status display.
- Return to the PREVIOUS programmable function.
- Answer "YES" to a question.
- Decrease a given number (FLASHING LED).

**Displays/Menus**

The programmed software, supplied to each system will determine the series of menus that are presented on the X96N display screen. Chapter 4 gives details about the software.


**Chapter 4 gives** details about the software used to program the microprocessor.

It includes an overview of the menus as well as detailed information about each of the status displays and the programmable functions.

| REV NO. | DATE | PAGE NO. | DESCRIPTION |
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## Getting Started

This chapter explains how to use the X96N Microprocessor's software.

### Menu Overview

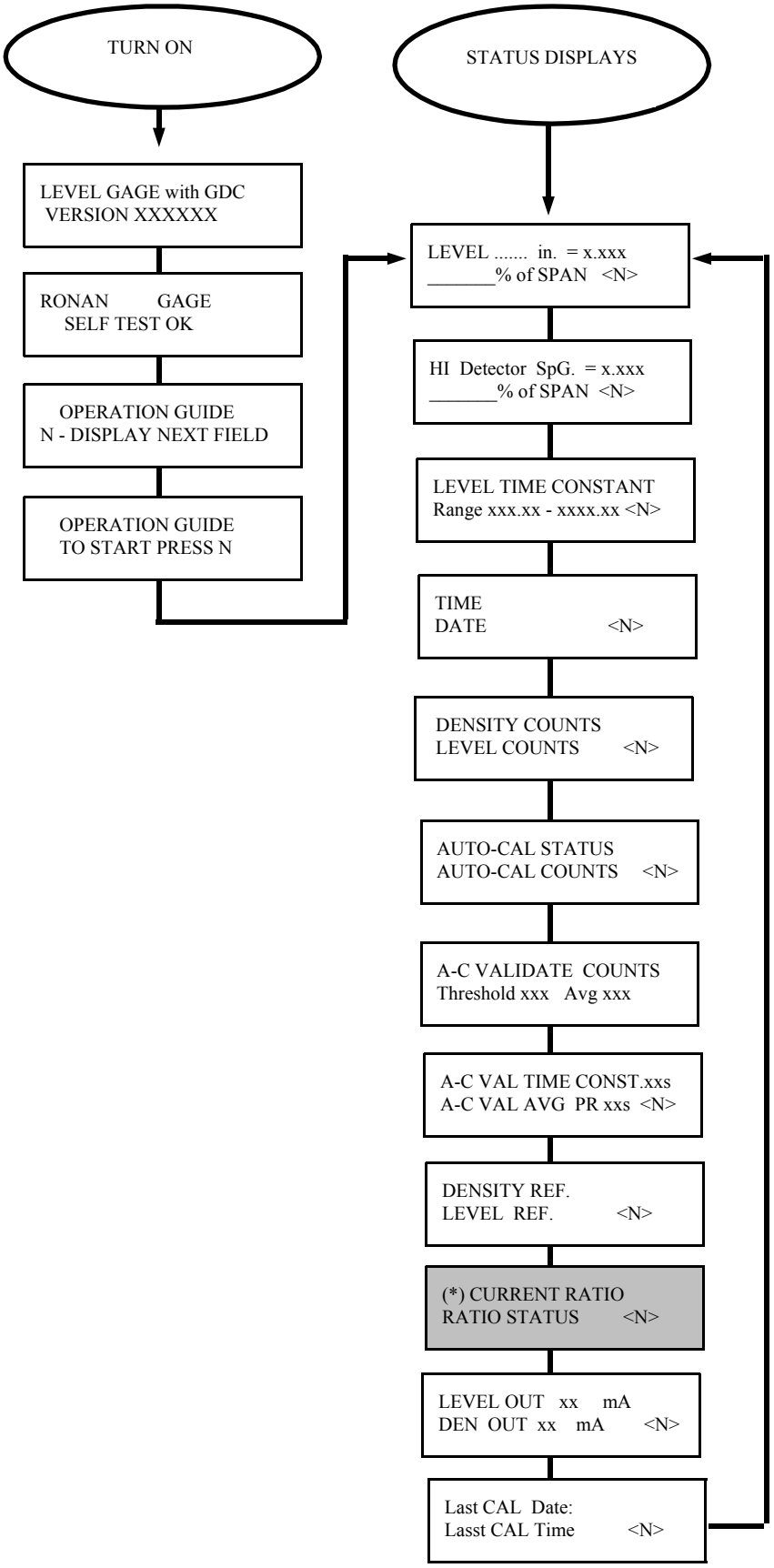
The programmed software supplied to each system will determine the series of menus that are presented on the X96N display screen. The menu overview on the next page shows all possible displays. Your own system may not require all of these displays and menus. Your series of screens may vary depending upon the hardware and software configurations required by your application. Details follow for the software displays which are included in your own system.

### Status Displays

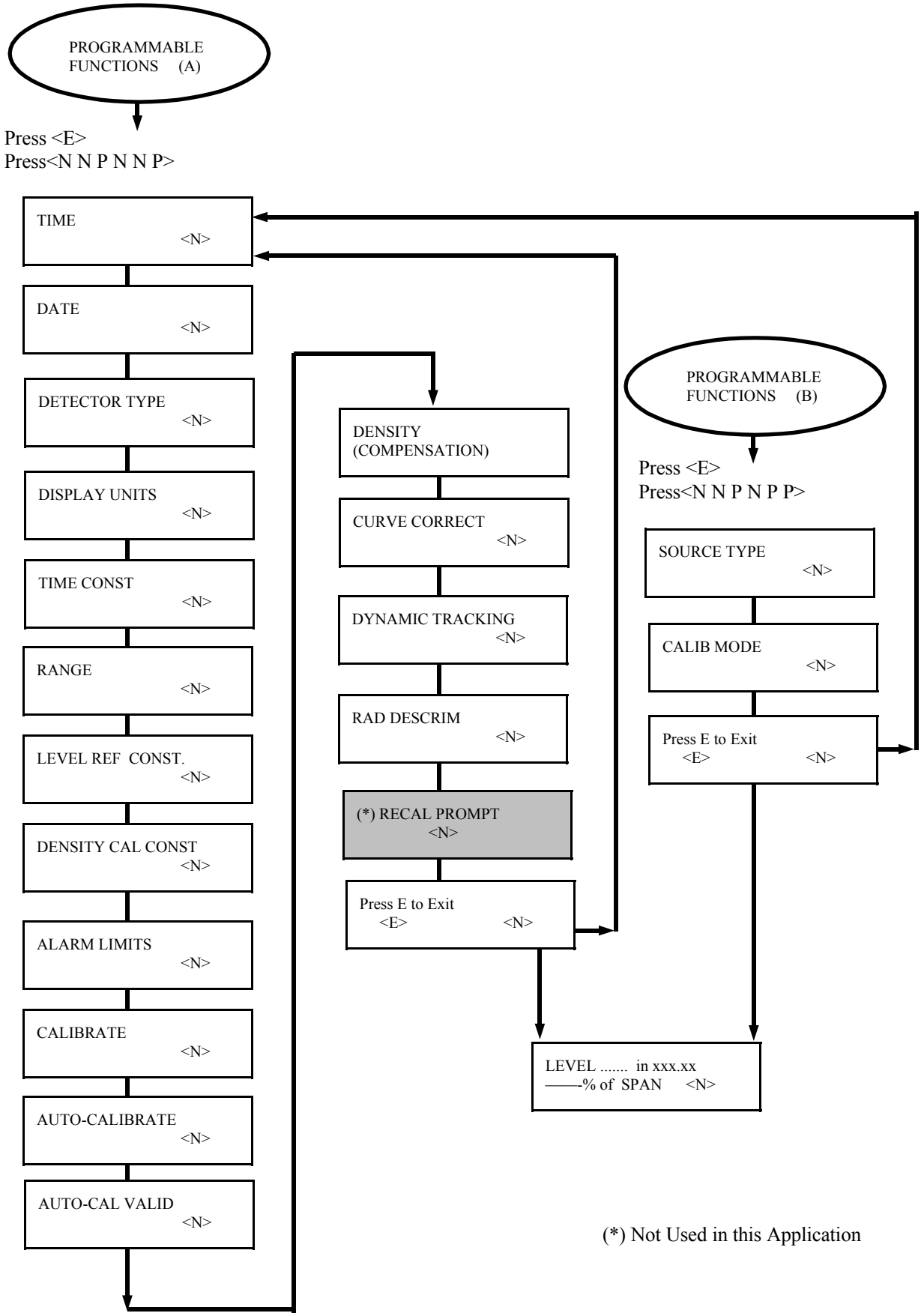
Status Displays are the system "reporters." Incoming measurements from the detector, settings used by the system, and output variables are among the information you can observe on the status displays.

### Programmable Functions

Programmable functions are more than "reporters." The programmable functions series of menus are used to enter and change information that's required to configure your system.




(*) If "Ratio" Enabled in Density Compensation




(*) Not Used in this Application

**Factory-Programmed**

Some of the programmable functions were set at the factory based on information provided at the time your Monitor System was ordered.

Oftentimes, these settings will be appropriate and will NOT require revision. However, if one or more of the parameters need to be re-configured, a code is required to access the menus.

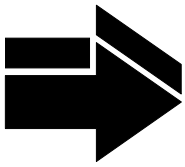
To *access* the factory-programmed functions, do this:

Press **<E>** LEDs flash

| Exam/Alter Functions |
|---|

Press **<N N P N P P>**

| Exam/Alter Functions |
|---|



---

**NOTE:**

To *exit* the factory-programmed functions, do this:

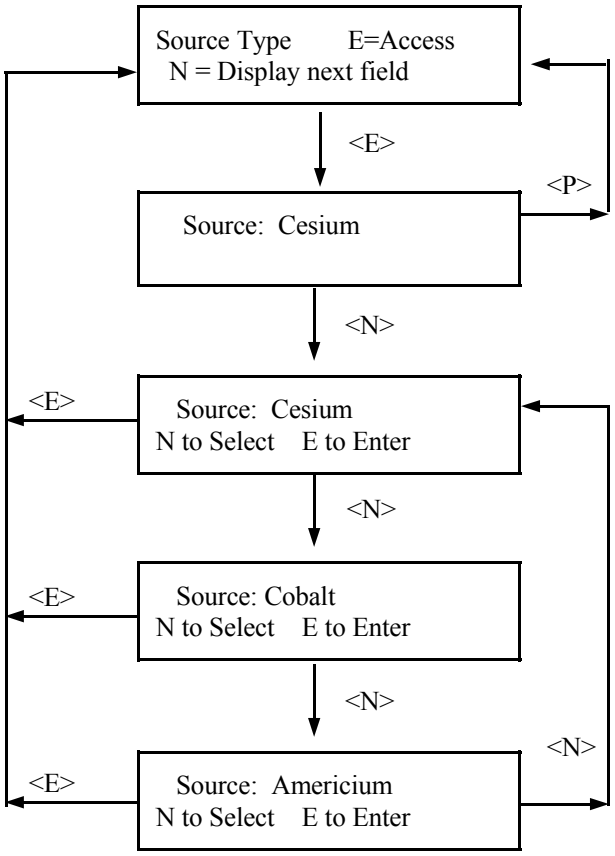
Press **<N> or <P>** until the display reads
"Press E to Exit"
Press **<E>** to return to Status Display #1.

SOURCE TYPE E = Access

Choose one of these source types:
CESIUM
COBALT
AMERICIUM

SOURCE TYPE:
Selects radioisotope being used. This permits the appropriate source decay factor to be applied through software signal processing.

**Press <N>**


Source Type E=Access
N = Display next field
<E>
<P>
Source: Cesium
<N>
<E>
Source: Cesium
N to Select E to Enter
<N>
<E>
Source: Cobalt
N to Select E to Enter
<N>
<N>
<E>
Source: Americium
N to Select E to Enter

CALIB MODE E = Access

Choose one of four calibration modes that represent the conditions that will be encountered EVERY TIME a calibration is done.

1) EMPTY - If vessel can be emptied each time.

2) WITH PROCESS (Z/F) - If vessel can be emptied and filled to 100% each time.

3) WITH PROCESS (L/H) - If vessel cannot be completely emptied and filled each time.

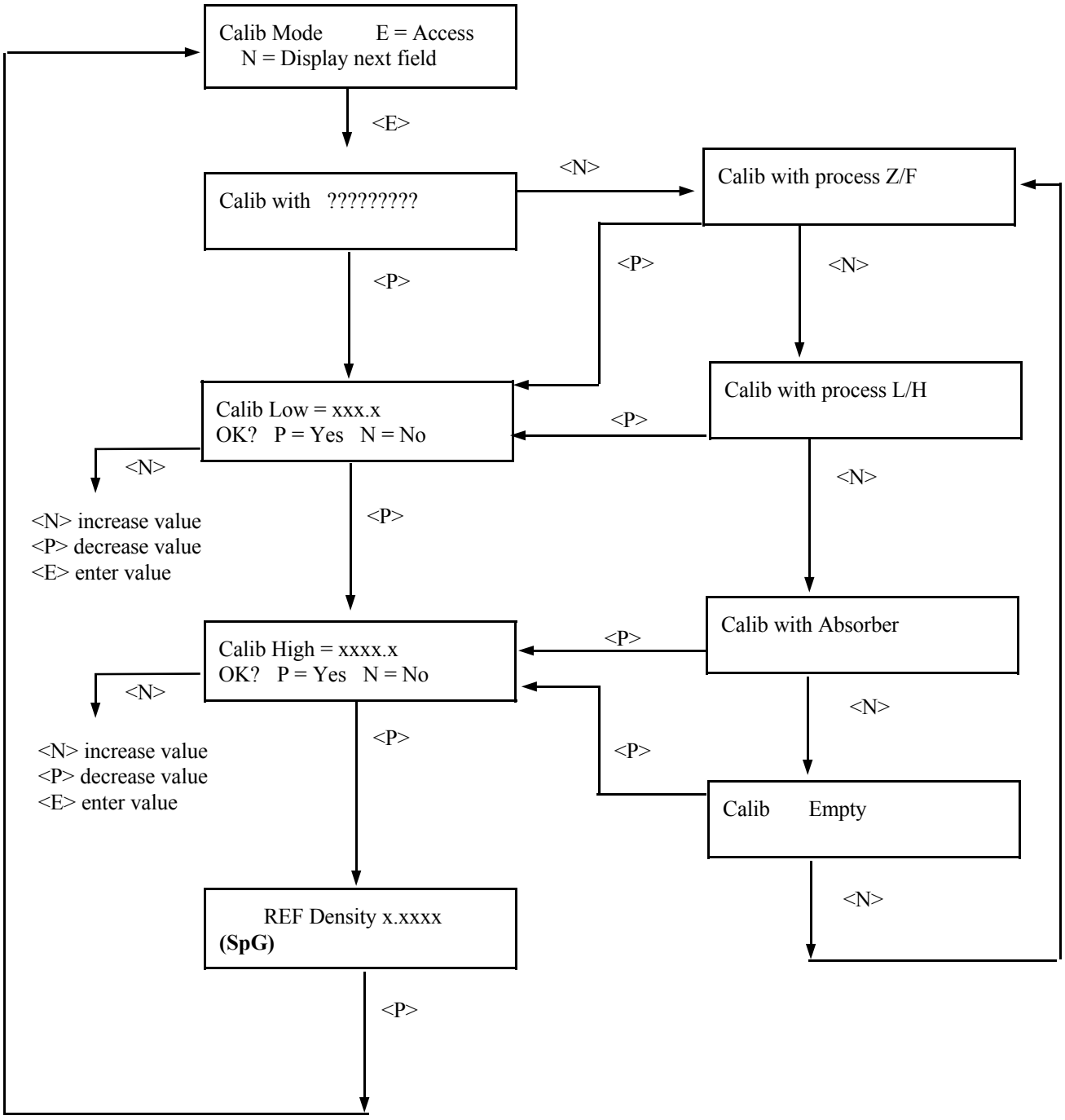
4) ABSORBER - If calibration cannot be done while process is running. Absorber plates will simulate required calibration conditions.

CALIBRATION MODE: Selects one of four modes to be used each time the system is calibrated.

**NOTE:** Reference Density entry in this module is in units of SpG.

**Press <N>**

**Press <E> to exit**


Calib Mode E = Access
N = Display next field
<E>
Calib with ?????????
<N>
Calib with process Z/F
<P>
<N>
<P>
Calib with process L/H
Calib Low = xxx.x
OK? P = Yes N = No
<P>
<N>
<N>
<N> increase value
<P> decrease value
<E> enter value
<P>
<N>
Calib with Absorber
Calib High = xxxx.x
OK? P = Yes N = No
<P>
<N>
<N>
<N> increase value
<P> decrease value
<E> enter value
<P>
<P>
Calib Empty
<N>
REF Density x.xxxx
(SpG)
<P>

## Programmable Functions

The programmable functions are more than information "reporters." The programmable function menus allow you to change the settings, limits, and parameters that govern your measurement system.

### Customer-Programmable

Ronan factory personnel tested the equipment using settings, limits, and parameters that closely resembled your circumstances. However, your specific equipment and process conditions will produce their own unique results.

The programmable functions permit you to re-configure the measurement output to accomodate your own specific process conditions and customized measurement needs.

A code is required to access the customer-programmable function menus.

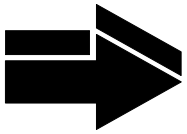
To *access* the customer programmable functions, do this:

Press **<E>** LEDs flash

| Exam/Alter Functions |
|---|

Press **<N N P N N P>**

| Exam/Alter Functions |
|---|



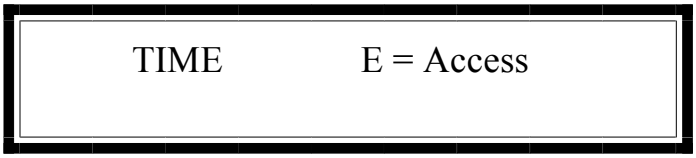
---

**NOTE:**

To *exit* the customer-programmable functions, do this:

Press **<N> or <P>** until the diplay reads "Press E to Exit"

Press **<E>** to return to Status Display #1




HH:MM:SS

TIME:
The X96N keeps the current time in 24-hour format. Use this module to change the time.

A small lithium battery maintains the time in the event of a power loss.

Hours:Minutes:Seconds

**Press <N>**


MM/DD/YY

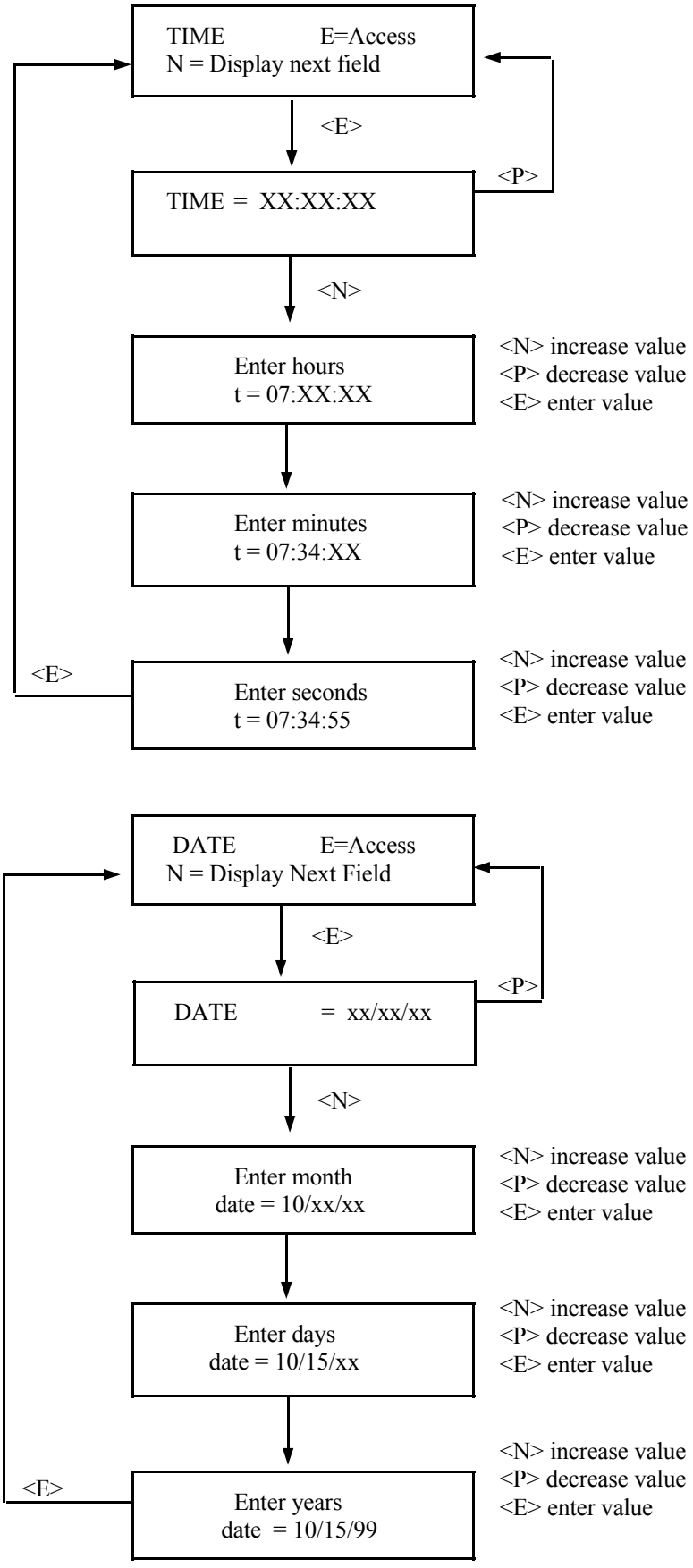
DATE:
The X96N increments the date each day at midnight. Use this module to change the date.

The date is stored as the "Last Cal Date" in the Status Display each time the system is calibrated.

Battery back-up maintains the date during power loss.

Month/Day/Year

**Press <N>**


TIME E=Access
N = Display next field
<E>
<P>
TIME = XX:XX:XX
<N>
Enter hours
t = 07:XX:XX
<N> increase value
<P> decrease value
<E> enter value
Enter minutes
t = 07:34:XX
<N> increase value
<P> decrease value
<E> enter value
<E>
Enter seconds
t = 07:34:55
<N> increase value
<P> decrease value
<E> enter value
DATE E=Access
N = Display Next Field
<E>
<P>
DATE = xx/xx/xx
<N>
Enter month
date = 10/xx/xx
<N> increase value
<P> decrease value
<E> enter value
Enter days
date = 10/15/xx
<N> increase value
<P> decrease value
<E> enter value
<E>
Enter years
date = 10/15/99
<N> increase value
<P> decrease value
<E> enter value

DETECTOR TYPE E = Access

Choose one of these elongated detectors for LEVEL input:

ION Chamber
Scintillation

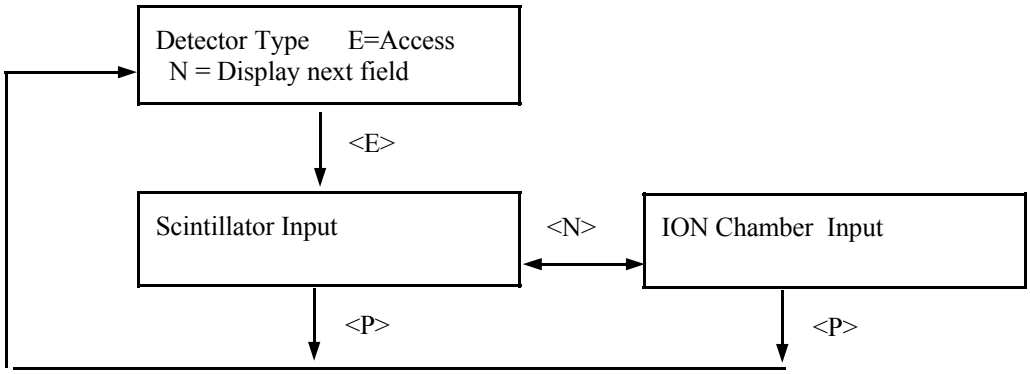
**NOTE:**

The Density point Detector is not selectable. Density is measured with a scintillation detector.

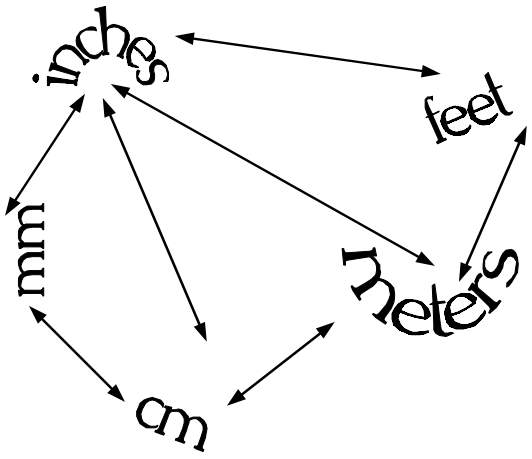
DETECTOR TYPE:
The choice of a level detector is a factory setting that should not have to be changed.

See Chapter 6 for technical information on the detectors that are included with your system.

**Press <N>**


Detector Type E=Access
N = Display next field
<E>
Scintillator Input
<N>
ION Chamber Input
<P>
<P>

DISPLAY UNITS E = Access

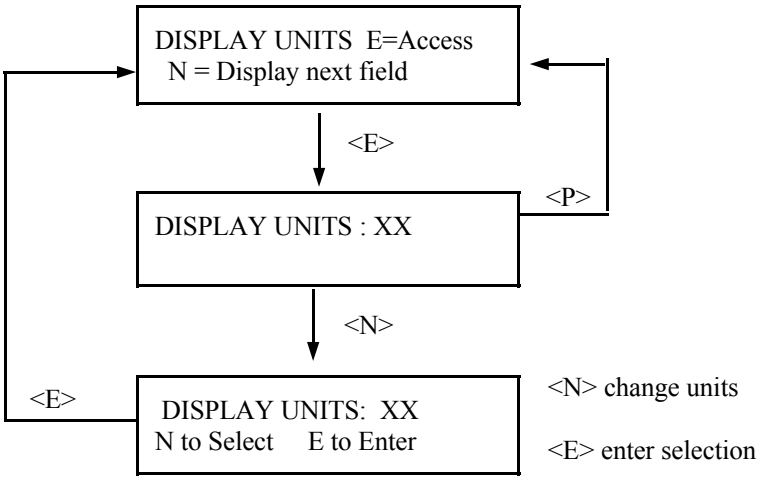



DISPLAY UNITS:
This menu determines the user's units being displayed for the process level measurement.

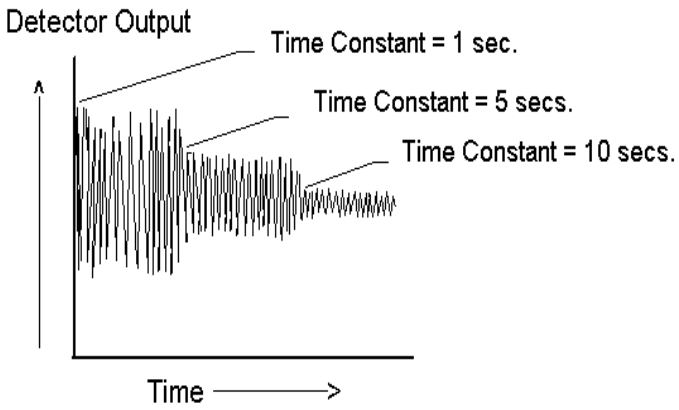
Level applications choose from inches, feet, millimeters, centimeters, and, meters.

If new units are selected, the system makes the necessary conversions.

**Press <N>**


DISPLAY UNITS E=Access
N = Display next field
<E>
<P>
DISPLAY UNITS : XX
<N>
<E>
DISPLAY UNITS: XX
N to Select E to Enter
<N> change units
<E> enter selection

TIME CONST E = Access




**NOTE:**

Values from 0.40 to 250.00 seconds can be used as the time constant entry.

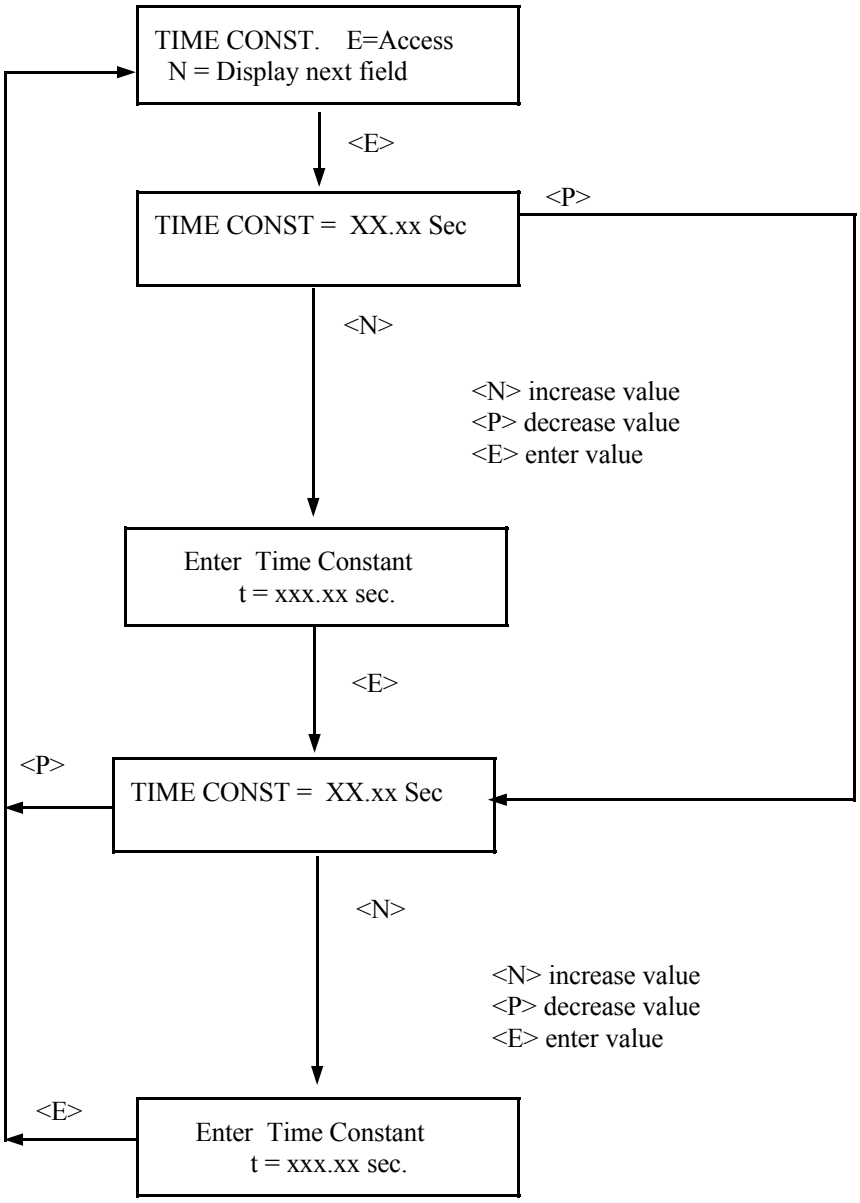
TIME CONSTANT: Counts received from the detector are fed into a digital filter module. This digital filter uses statistical averaging to smooth, or dampen, any random, radiation, and process related noise.

The statistical averaging is adjusted through a time constant setting in this module. Increasing the time constant will increase the filter time and decrease the noise.

The digital filter is by-passed during calibration (See CALIB. module) .

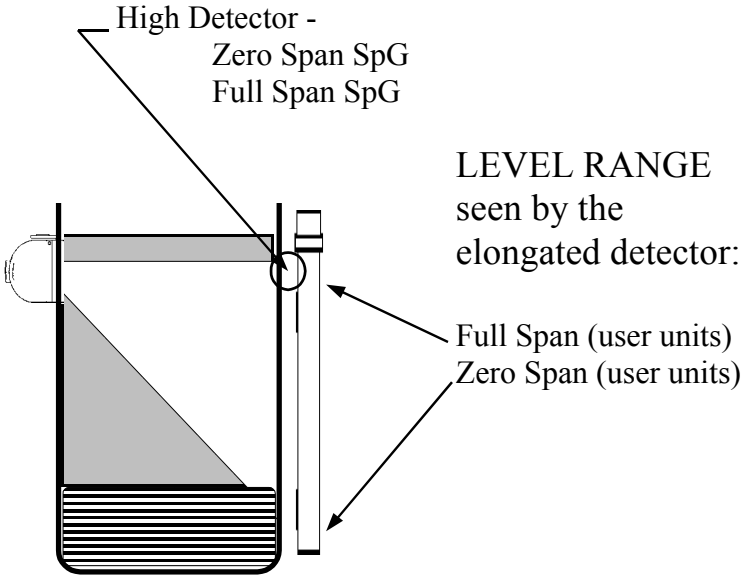
The digital filter is also by-passed if dynamic tracking is enabled and process interruptions occur that exceed the established threshold. (See DYN. TRACK. module).

**Press <N>**


TIME CONST. E=Access
N = Display next field
<E>
TIME CONST = XX.xx Sec
<P>
<N>
<N> increase value
<P> decrease value
<E> enter value
Enter Time Constant
t = xxx.xx sec.
<E>
<P>
TIME CONST = XX.xx Sec
<N>
<N> increase value
<P> decrease value
<E> enter value
<E>
Enter Time Constant
t = xxx.xx sec.

RANGE E = Access

DENSITY RANGE
seen by the point detector being used for density measurement:



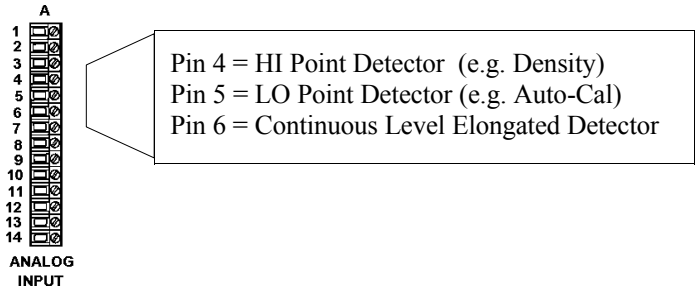

RANGE:
The measurement ranges are entered in user units. They cover the process level and density that are of interest.

This menu asks for the "zero span" which is the low end of the range, and the "full span" which is the high end of the range.

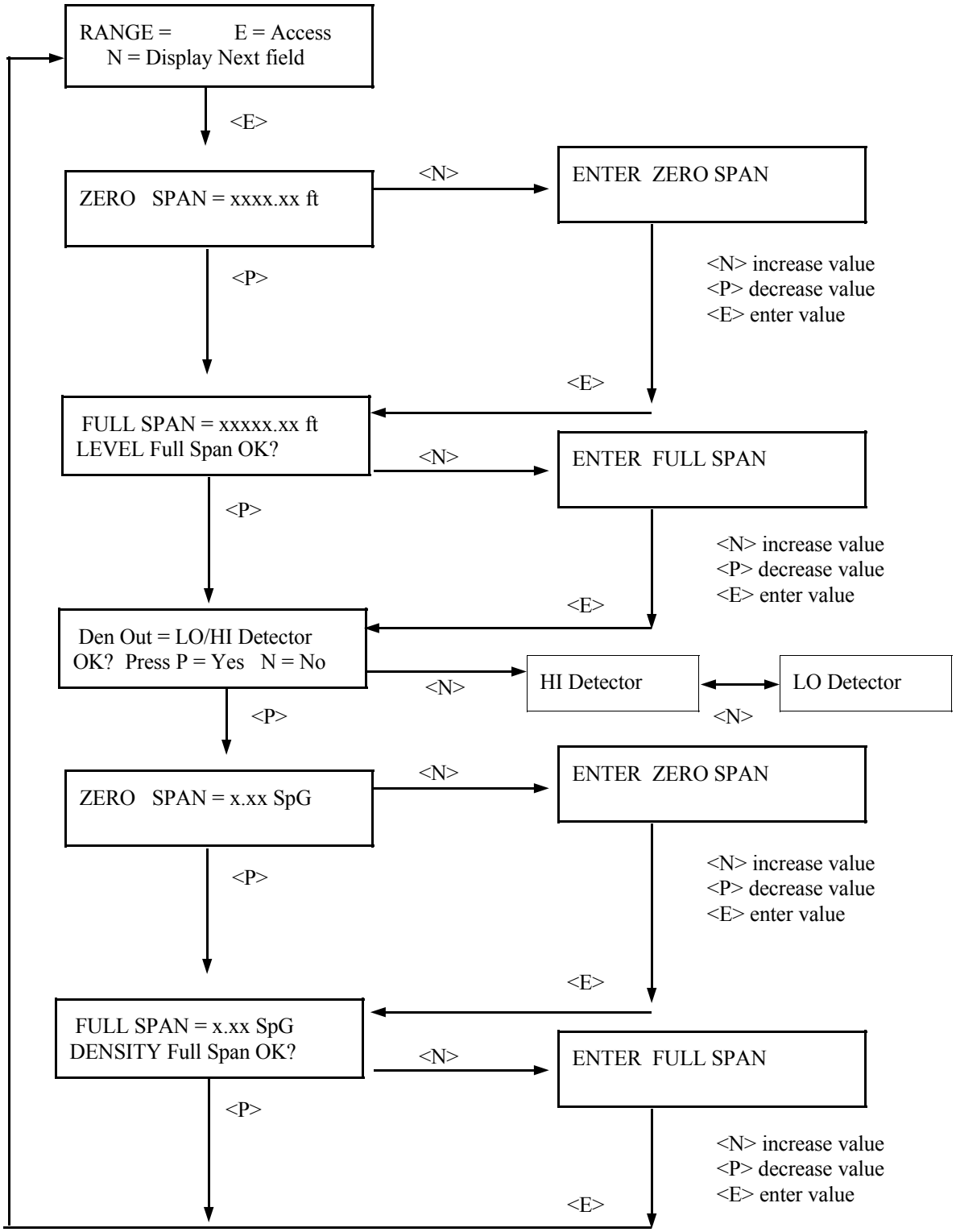
For best calibration results, the low calibration point should be as near as possible to the start of the range (zero span), and the high calibration point should be as near as possible to the high end of the range (full span).

The level measurement range can be no longer than the active length of the elongated detector.

The density measurement range should include the full range of SpG that the point detector will see.




**Press <N>**


RANGE = E = Access
N = Display Next field
<E>
ZERO SPAN = xxxx.xx ft
<N>
ENTER ZERO SPAN
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
FULL SPAN = xxxxx.xx ft
LEVEL Full Span OK?
<N>
ENTER FULL SPAN
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
Den Out = LO/HI Detector
OK? Press P = Yes N = No
<N>
HI Detector
LO Detector
<N>
<P>
ZERO SPAN = x.xx SpG
<N>
ENTER ZERO SPAN
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
FULL SPAN = x.xx SpG
DENSITY Full Span OK?
<N>
ENTER FULL SPAN
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>

LEV REF CONST. E = Access

LEVEL REFERENCE CONSTANTS:
This menu lets you make settings that are applied during the calibration procedure.

**Calibration Time** - the length of time (in seconds) spent by the system doing the calibration. This is the actual amount of time the gage will spend averaging counts from the detector.

CALIB. TIME

The signal noise band determines the value that should be entered here. Typically it is set at seven (7) times the digital filter time constant that was entered in the Time Constant Module. Values from 0 - 2500 can be used for this entry.

FAULT COUNT - LOW/HIGH

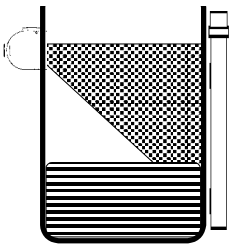
**Fault Count Low** - the minimum number of counts expected from the detector during calibration. This count should be set at a value no greater than half the background counts but not less than 1. Factory default setting is 10.

**Fault Count High** - the maximum number of counts expected from the detector during calibration. Set to a value no smaller than twice the background counts plus the highest normal operating counts. Factory default setting here is 20,000.

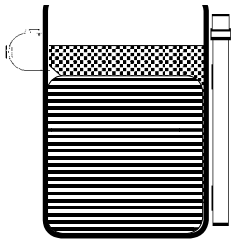
If Low or High Fault Count is exceeded during a calibration, the calibration will abort.

If you do not have the ability to determine the actual background and the normal operating counts, use the factory default setting of 10 for Fault Count Low and 20,000 for Fault Count High.

SPAN - ZERO/MAX

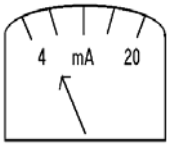


**A LOW process level puts out HIGH detector counts**



**A HIGH process level puts out LOW detector counts**

**NOTE:** The fault counts (LOW and HIGH) are used as threshold values for the RAD DISCRIM feature - if enabled. Values from 1 - 32767 can be used for these entries.



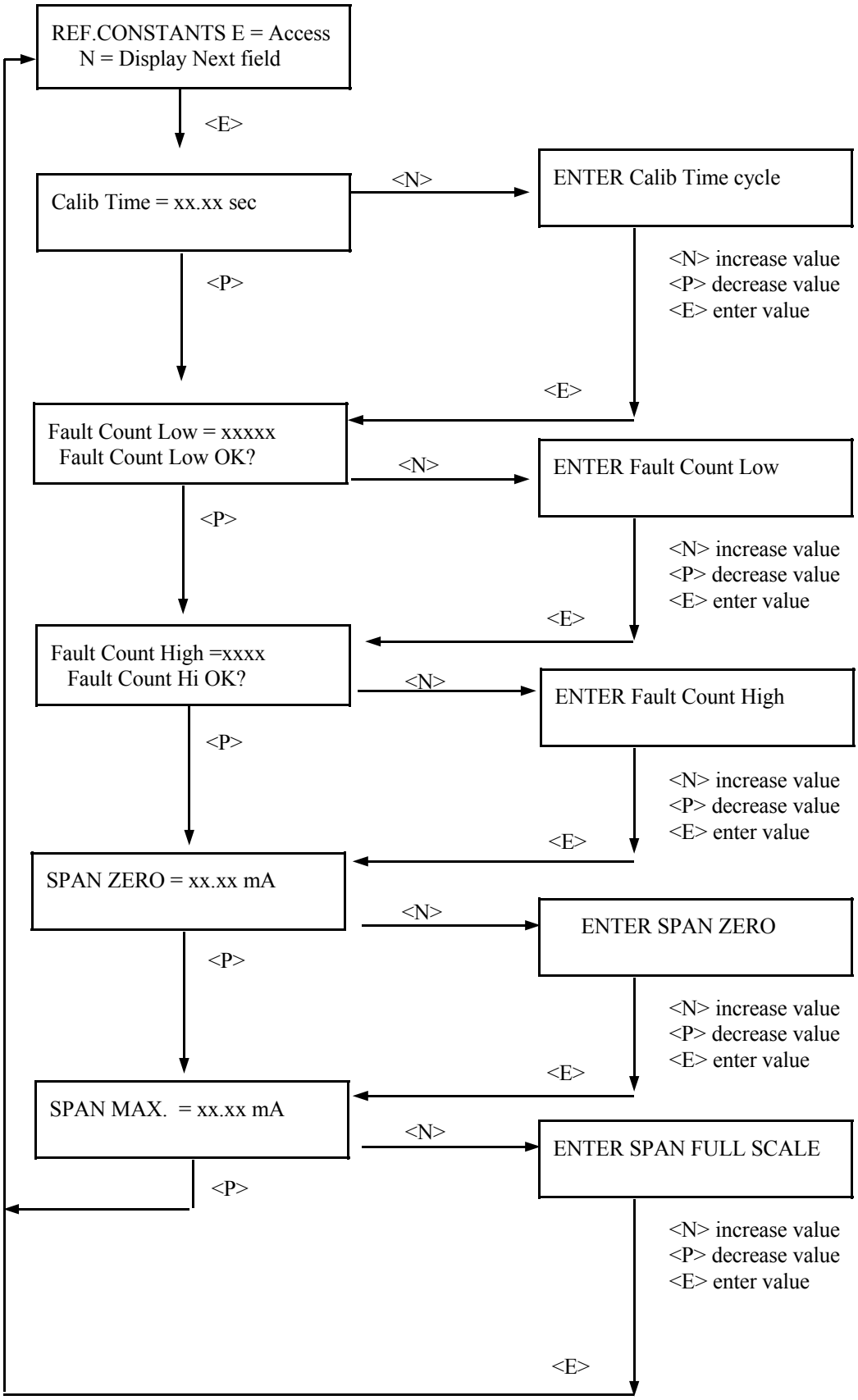

**Span Zero** - the transmitter output's low signal (in mA). This value should match the selection made during setup of the transmitter output board. Typically - 4mA.

**Span Max** - the transmitter output's high signal (in mA). This value should match the selection made during setup of the transmitter output board. Typically - 20mA.

Values from 0 - 50 can be used for these entries.

**Press <N>**

**NOTE:** All of these settings are stored for use during the calibration procedure.


REF.CONSTANTS E = Access
N = Display Next field
<E>
Calib Time = xx.xx sec
<N>
ENTER Calib Time cycle
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
Fault Count Low = xxxxx
Fault Count Low OK?
<N>
ENTER Fault Count Low
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
Fault Count High =xxxx
Fault Count Hi OK?
<N>
ENTER Fault Count High
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
SPAN ZERO = xx.xx mA
<N>
ENTER SPAN ZERO
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
SPAN MAX. = xx.xx mA
<N>
ENTER SPAN FULL SCALE
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>

DEN CAL CONST E = Access

Changing this value causes the computed density to change. IF the system computed 1/uT needs to be modified, it may require modification each time the gage is calibrated.

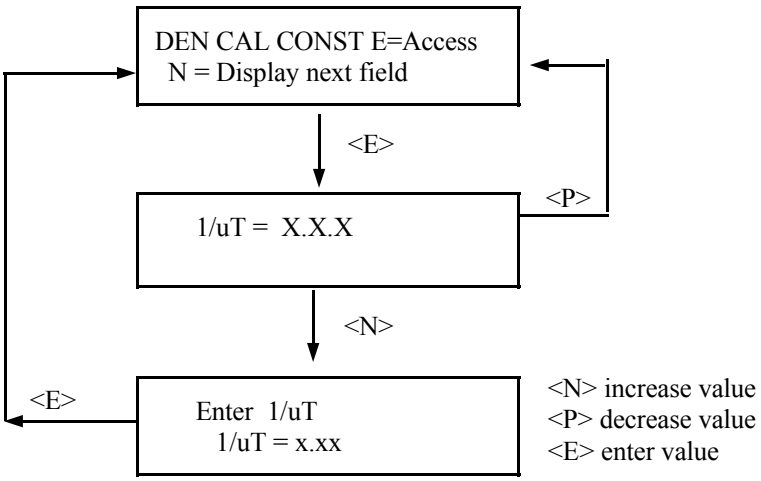
$$\frac{....1}{\mu T} = \frac{1}{0.2\ (\text{pipe ID"})}.$$

DENSITY CAL CONST: This module stores the Calibration Constant (1/uT) for your process/pipe diameter.

Using the <N> and <P> keys, you can input a new value to correct/change the value calculated by the system.

(See CALIBRATION Module.)

**Press <N>**


DEN CAL CONST E=Access
N = Display next field
<E>
<P>
1/uT = X.X.X
<N>
<E>
Enter 1/uT
1/uT = x.xx
<N> increase value
<P> decrease value
<E> enter value

ALARM LIMITS E = Access

ALARM LIMITS:
This function sets the relay trip points for the density and level alarms.

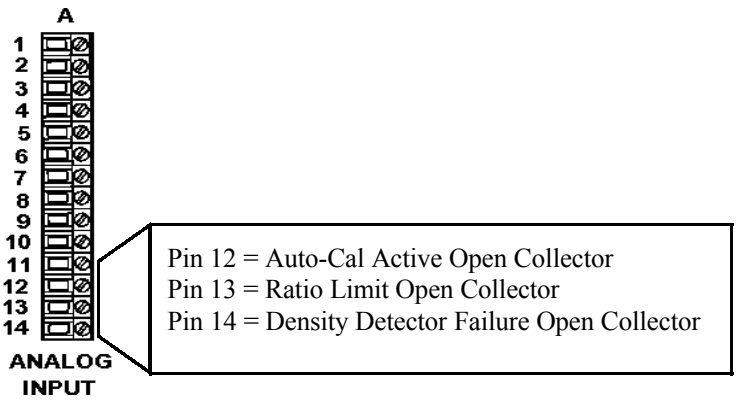
To help eliminate relay chatter, a trip point and reset point are both selected.

HI LEVEL TRIP = the density in detector counts where you want the relay to energize.

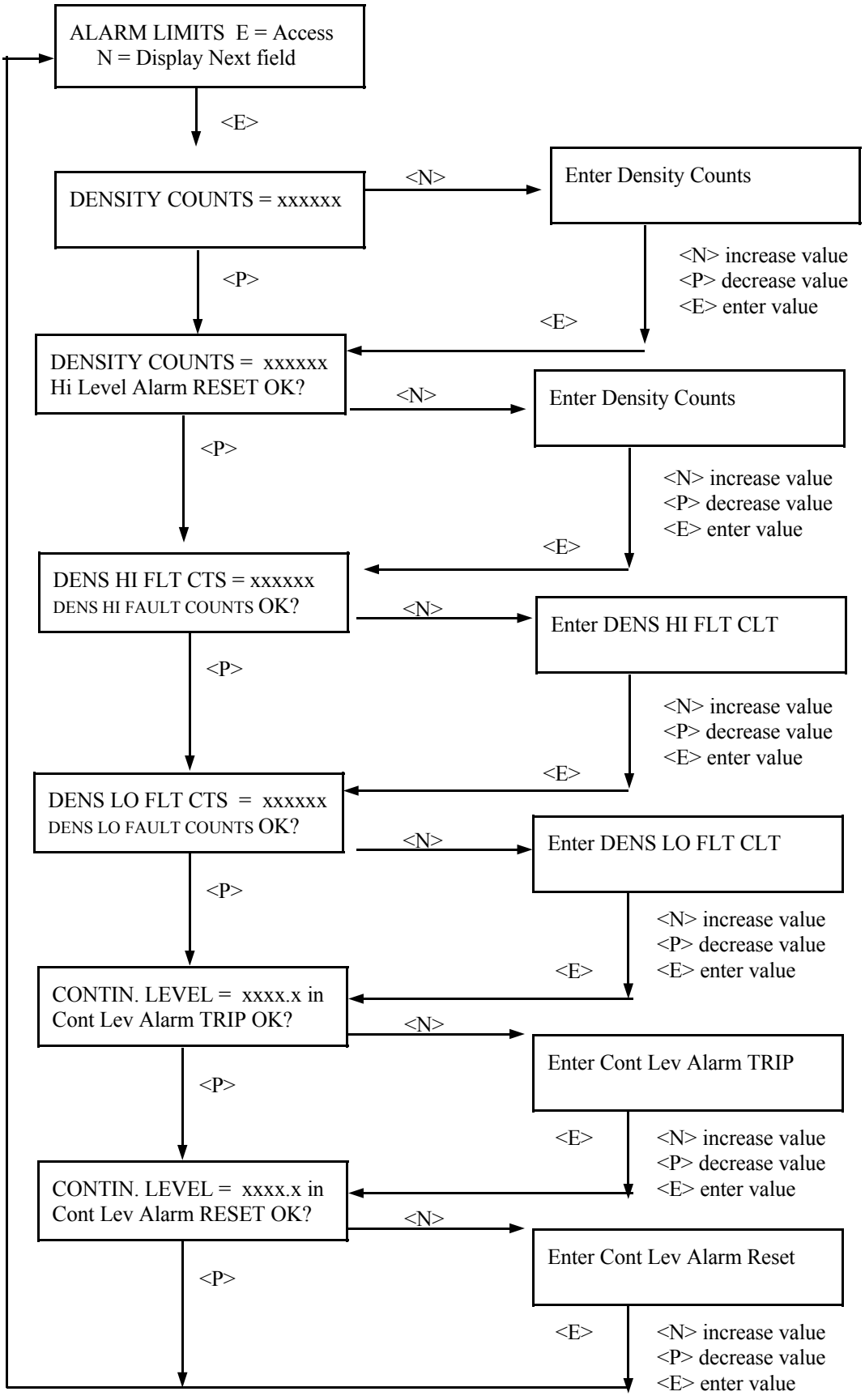
HI LEVEL RESET = the density in detector counts where you want the relay to de-energize.

CONTINUOUS LEVEL ALARM TRIP = the level in inches where you want the relay to energize.

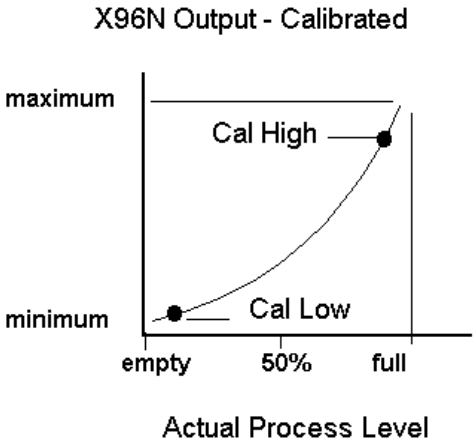
CONTINUOUS LEVEL RESET = the level in inches where you want the relay to de-energize.




**Press <N>**


ALARM LIMITS E = Access
N = Display Next field
<E>
DENSITY COUNTS = xxxxxx
<N>
Enter Density Counts
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
DENSITY COUNTS = xxxxxx
Hi Level Alarm RESET OK?
<N>
Enter Density Counts
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
DENS HI FLT CTS = xxxxxx
DENS HI FAULT COUNTS OK?
<N>
Enter DENS HI FLT CLT
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
DENS LO FLT CTS = xxxxxx
DENS LO FAULT COUNTS OK?
<N>
Enter DENS LO FLT CLT
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
CONTIN. LEVEL = xxxx.x in
Cont Lev Alarm TRIP OK?
<N>
Enter Cont Lev Alarm TRIP
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>
CONTIN. LEVEL = xxxx.x in
Cont Lev Alarm RESET OK?
<N>
Enter Cont Lev Alarm Reset
<N> increase value
<P> decrease value
<E> enter value
<P>
<E>

CALIBRATE E = Access




Chapter 5 gives details about the calibration procedure.

**NOTE:** Three things will cause the system to abort a calibration cycle:

1) The average counts received during Cal High is above the FAULT COUNT HIGH entered in CALIB.CONST. module.

2) The average counts received during Cal Low is below the FAULT COUNT LOW entered in the CALIB.CONST. module.

3) A key on the front panel of the X96N is pressed to manually abort the calibration.

CALIBRATE:
This menu initiates the calibration function.

The calibration procedure relates the counts from the detector to an actual level of process.

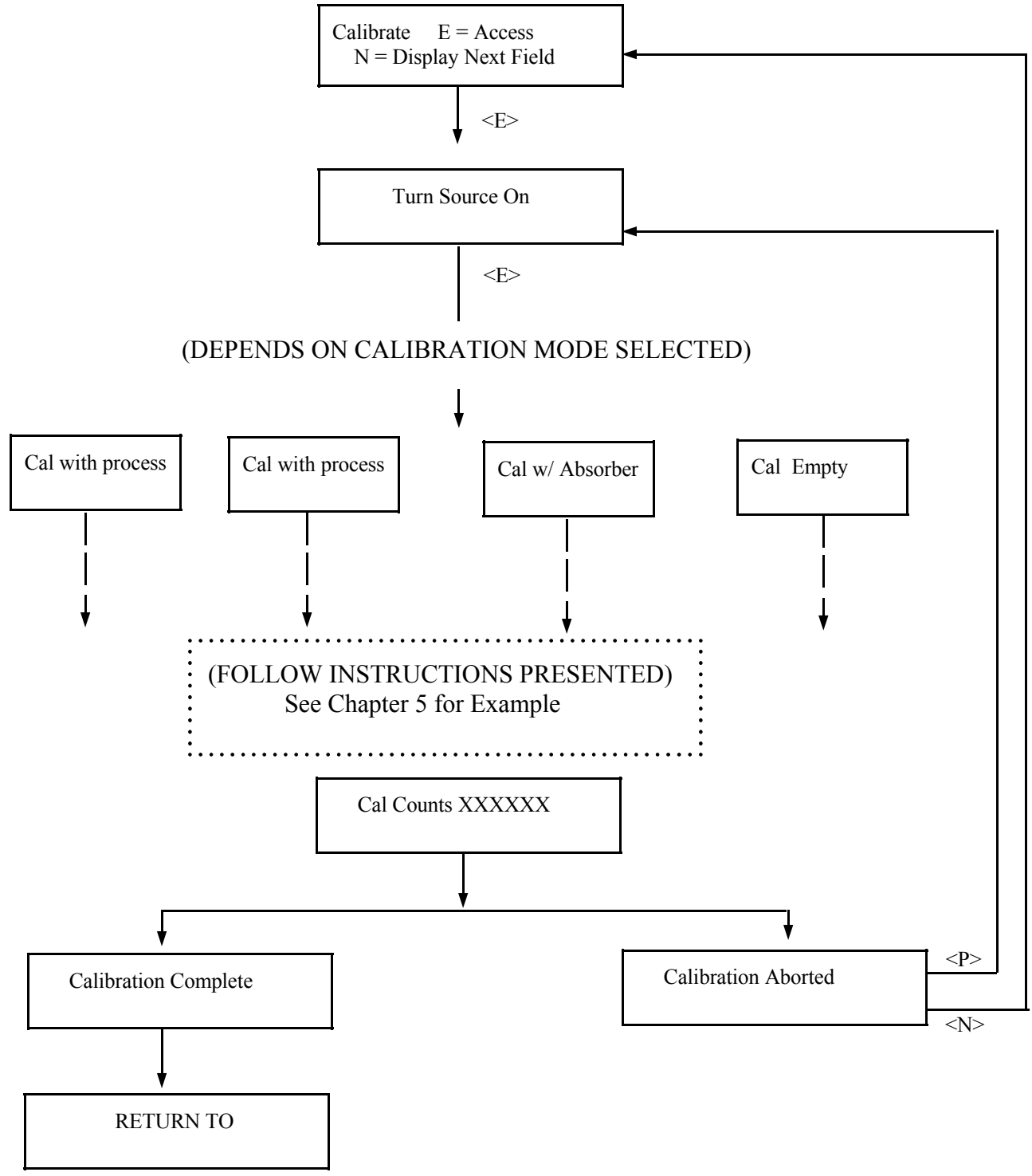
In all circumstances, the level gage requires at least two actual points of reference - a low value and a high value.

Intermediate values can be verified and corrected by using the Curve Correction function. (See CURVE CORRECT module).

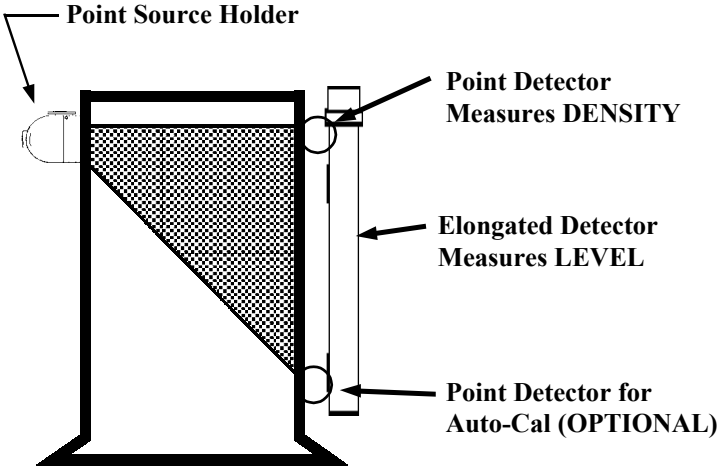
The series of screens presented during the calibration procedure will vary depending on which mode of calibration is selected. (See CALIB MODE module for more information).

During calibration the digital filter is by-passed so the system can use the actual counts received during the full calibratrion time period. After calibration, the counts are set to the averaged counts, and the digital filter is enabled again. (See TIME CONSTANT module).

**Press <N>**


Calibrate E = Access
N = Display Next Field
<E>
Turn Source On
<E>
(DEPENDS ON CALIBRATION MODE SELECTED)
Cal with process
Cal with process
Cal w/ Absorber
Cal Empty
(FOLLOW INSTRUCTIONS PRESENTED)
See Chapter 5 for Example
Cal Counts XXXXXX
Calibration Complete
Calibration Aborted
<P>
<N>
RETURN TO

AUTO CALIB E = Access




AUTO CALIBRATE: With a point detector installed, this module enables the system to automatically perform a calibration each time the process reaches the preassigned level.

Auto-cal maintains the gage calibration with virtually no operator interaction.

The Auto-Cal module asks for two values:

AUTO-ZERO TIME - the time, in seconds, the external contact should be closed.

AUTO-ZERO LOW - the actual level at which the Auto-Cal point detector is mounted.

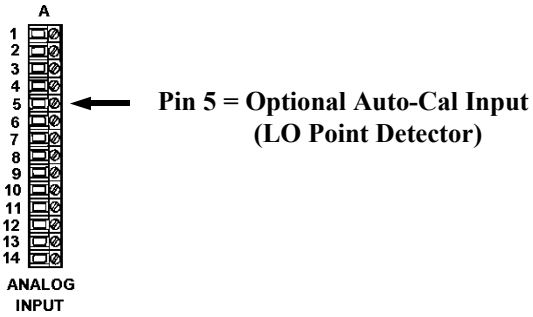
Auto-Cal will be temporarily disabled when:
- Gage is initially powered-up
- Auto-Cal abort is caused by a fault-count excess
- Radiological Discrimination event occurs

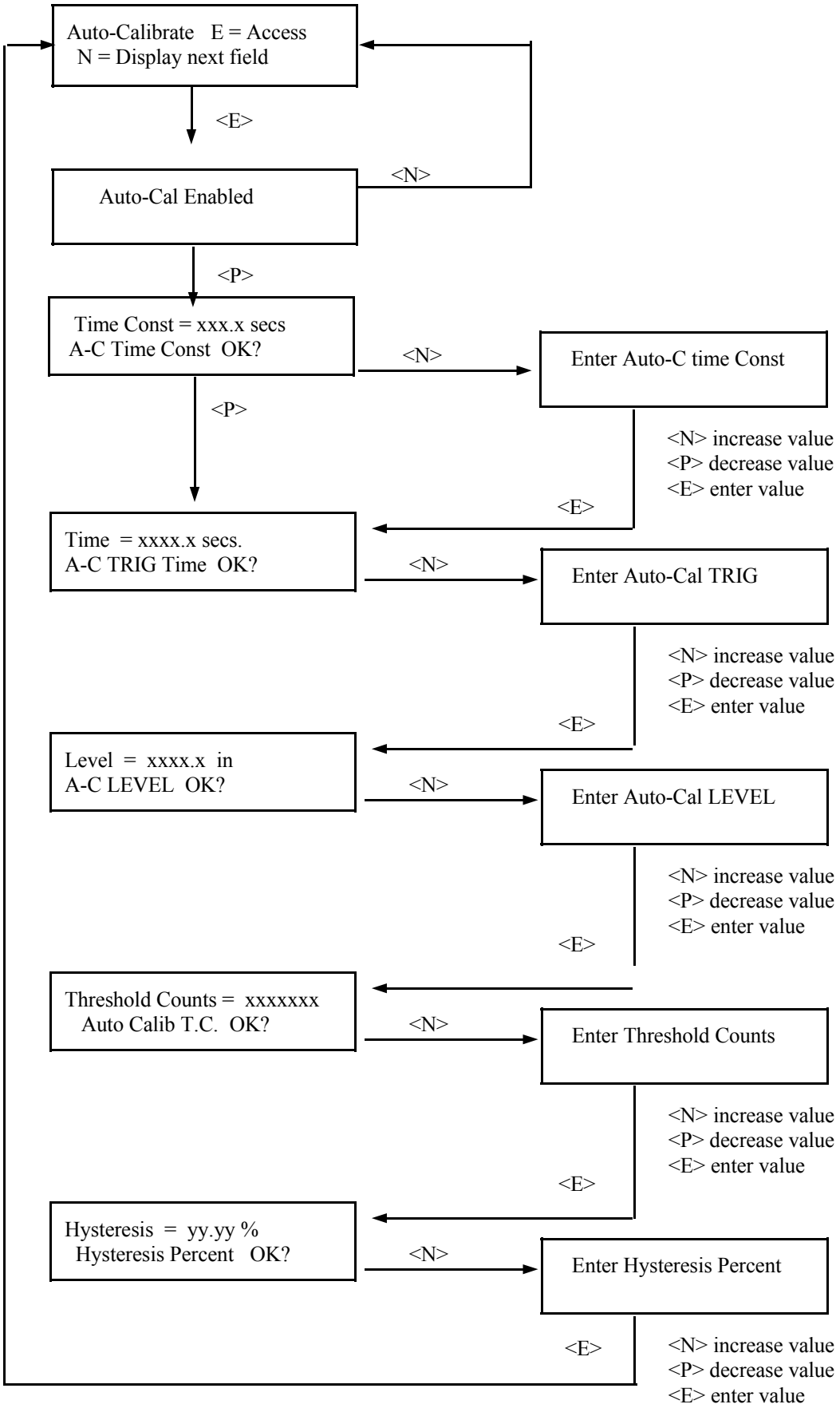
**NOTE:**

1) If the curve correct feature is enabled, always set register #01 in the Curve Correct Table to the auto-cal point detector's level.

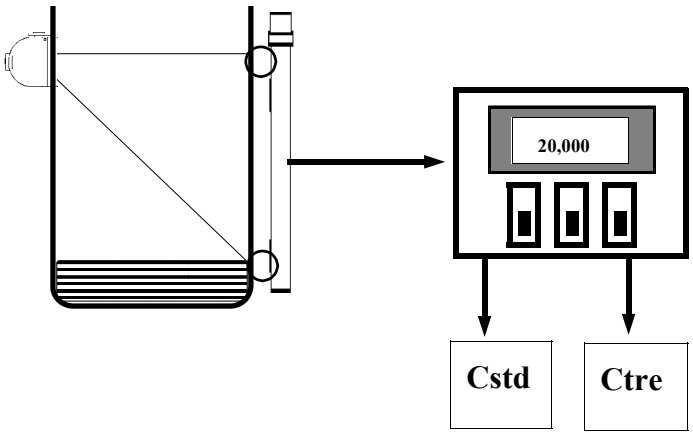
See Chapter 8 for details about this optional feature.

**Press <N>**




Auto-Calibrate E = Access
N = Display next field
<E>
<N>
Auto-Cal Enabled
<P>
Time Const = xxx.x secs
A-C Time Const OK?
<N>
Enter Auto-C time Const
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
Time = xxxx.x secs.
A-C TRIG Time OK?
<N>
Enter Auto-Cal TRIG
<N> increase value
<P> decrease value
<E> enter value
<E>
Level = xxxx.x in
A-C LEVEL OK?
<N>
Enter Auto-Cal LEVEL
<N> increase value
<P> decrease value
<E> enter value
<E>
Threshold Counts = xxxxxxx
Auto Calib T.C. OK?
<N>
Enter Threshold Counts
<N> increase value
<P> decrease value
<E> enter value
<E>
Hysteresis = yy.yy %
Hysteresis Percent OK?
<N>
Enter Hysteresis Percent
<E>
<N> increase value
<P> decrease value
<E> enter value

AUTO-CAL VALID E = Access




**Cstd = Standard Elongated Detector Counts**
**Ctre = Trended Elongated Detector Counts**
**Cval = Auto-Cal Validation Counts**
**Ct = Threshold Counts**

# Cstd - Ctre = Cval

**IF Cval < Ct, THEN Auto-Cal initiated**

**IF Cval > Ct, THEN Auto-Cal inhibited/aborted**

**NOTE:** The factory-entered default values in this function were selected based on what is known about the normal dynamics of your process. If a change is required to the values in this module, you may want to consult a Ronan factory or field service representative.

AUTO-CAL VALID:
Consistently monitors the counts from the Conitnuous Level input to determine if the system is stable.

This separate signal processing module provides a TREND of counts over the specified period of time. That TREND is compared to the instantaneous counts obtained through the standard signal processing module.

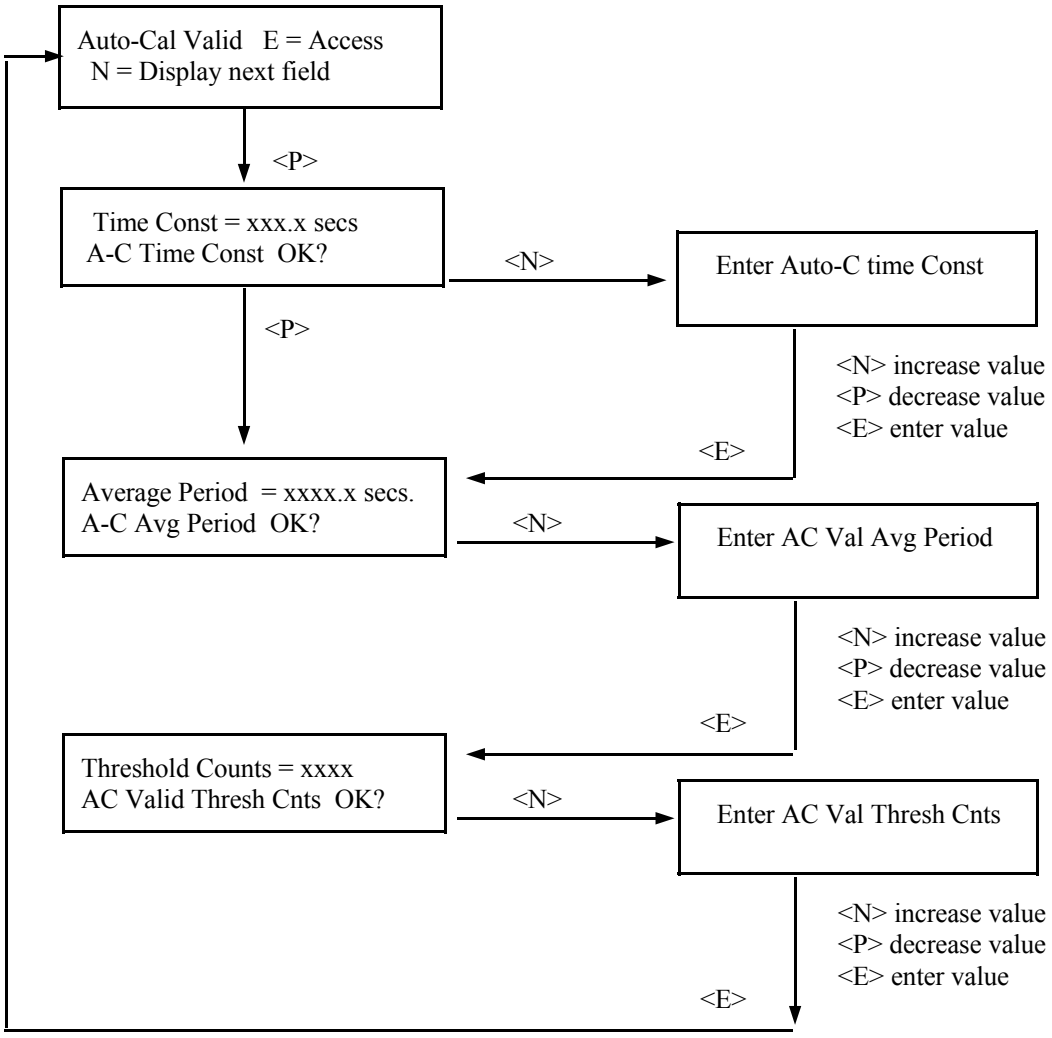
If the TREND reveals an unstable condition, the auto-cal is inhibited.

TIME CONSTANT:
A separate filter for processing continuous level detector counts that are used in this validation function.

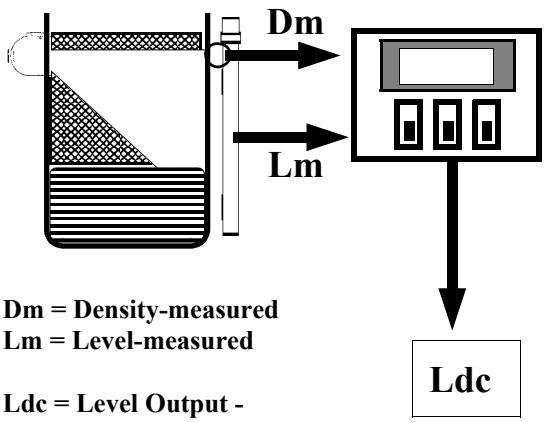
AVERAGING PERIOD:
Period of time used to average the filtered counts. (Max = 15 min)

THRESHOLD COUNTS:
Average detector counts, over the given TIME period, that must be exceeded to inhibit the Auto-Cal.

**Press <N>**


Auto-Cal Valid E = Access
N = Display next field
<P>
Time Const = xxx.x secs
A-C Time Const OK?
<N>
Enter Auto-C time Const
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
Average Period = xxxx.x secs.
A-C Avg Period OK?
<N>
Enter AC Val Avg Period
<N> increase value
<P> decrease value
<E> enter value
<E>
Threshold Counts = xxxx
AC Valid Thresh Cnts OK?
<N>
Enter AC Val Thresh Cnts
<N> increase value
<P> decrease value
<E> enter value
<E>

DENSITY E = Access




**Dm = Density-measured**
**Lm = Level-measured**

**Ldc = Level Output - Density Compensated**

When the gage is calibrated, a "reference density" is obtained and stored. Ongoing density measurements are compared to this "reference" to obtain a ratio value:

Ratio (R) = Dm/Dref

That ratio (R) is used to adjust the ongoing level measurement (Lm) and obtain the density compensated level (Ldc):

Ldc = (Lm) (R)

DENSITY COMPENSATION:
This function will modify, or adjust, the current level based on the counts received from the detector being used to measure density.

RATIO - MIN/MAX

CURRENT RATIO

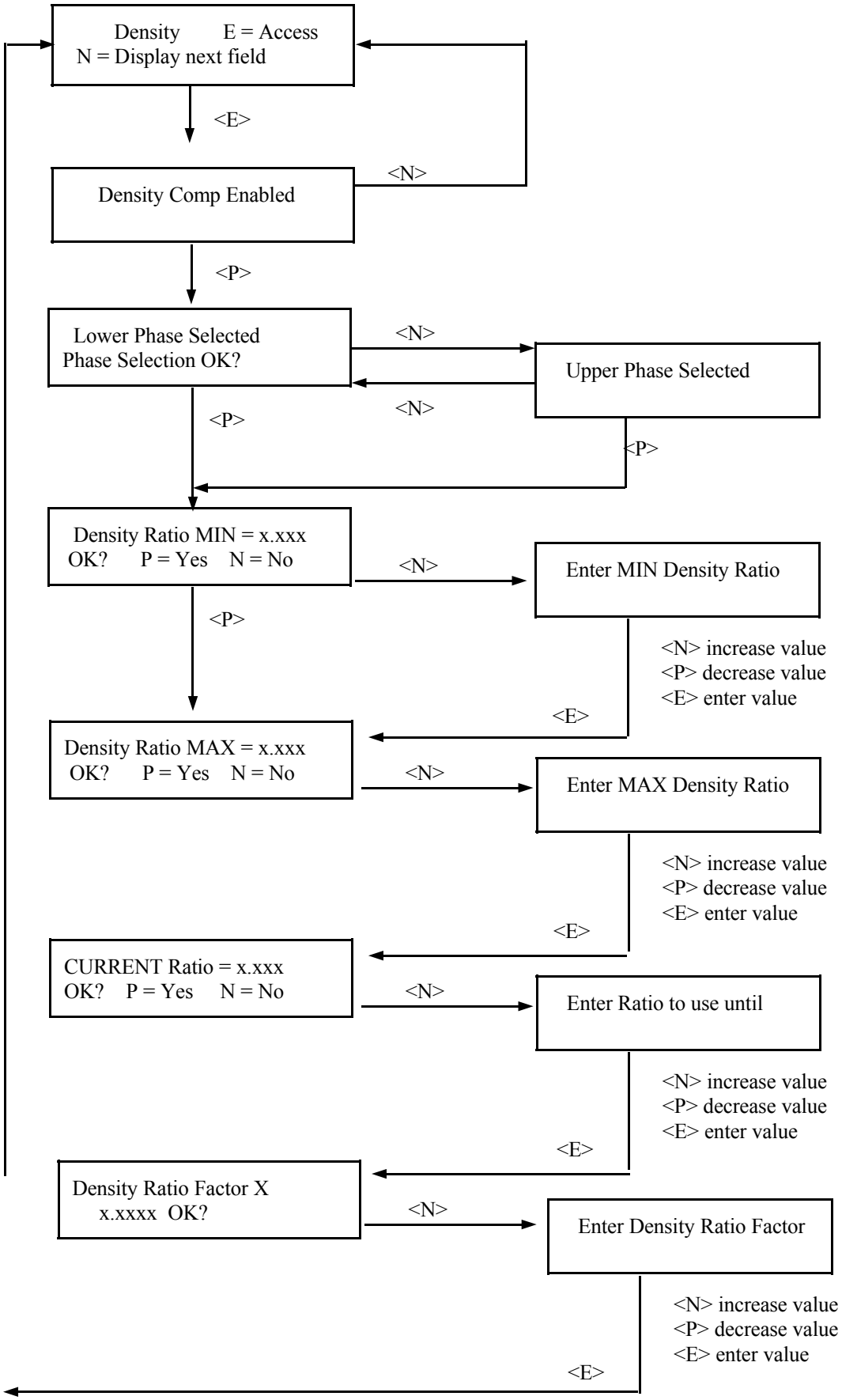
RATIO FACTOR

The "Current Ratio" is calculated by the system.

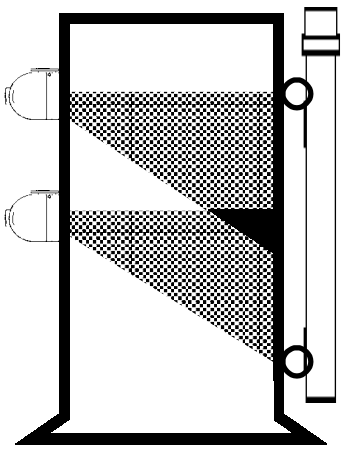
The ratio minimum and maximum are provided as safeguards. The system will flash the front panel LEDs if the "Current Ratio" exceeds either of these limits.

The Ratio Factor X is used to "fine tune" the gage calibration. If the level indication is too high, adjust the Ratio Factor X upward to give a larger Ratio (R) and therefore a lower level output.

**Press <N>**

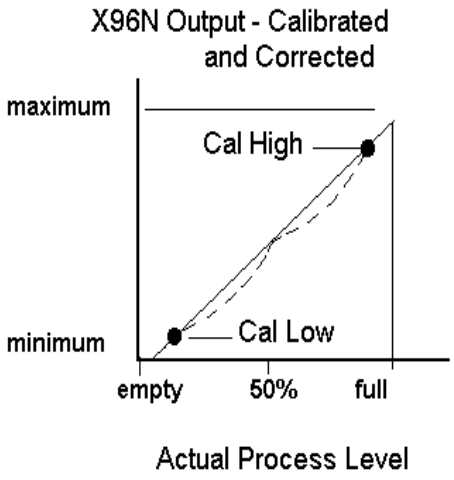

Density E = Access
N = Display next field
<E>
<N>
Density Comp Enabled
<P>
Lower Phase Selected
Phase Selection OK?
<N>
Upper Phase Selected
<N>
<P>
<P>
Density Ratio MIN = x.xxx
OK? P = Yes N = No
<N>
Enter MIN Density Ratio
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>
Density Ratio MAX = x.xxx
OK? P = Yes N = No
<N>
Enter MAX Density Ratio
<N> increase value
<P> decrease value
<E> enter value
<E>
CURRENT Ratio = x.xxx
OK? P = Yes N = No
<N>
Enter Ratio to use until
<N> increase value
<P> decrease value
<E> enter value
<E>
Density Ratio Factor X
x.xxxx OK?
<N>
Enter Density Ratio Factor
<N> increase value
<P> decrease value
<E> enter value
<E>

CURVE CORRECT E = Access



**EXAMPLE:**

Two point sources could create an irregular distribution of the radiation field.




Chapter 5 gives details about the Curve Correction procedure.

CURVE CORRECT:
The Curve Correct feature can be used in some system configurations to produce a more linear measurement.

In a level measurement, non-linearity is caused by an irregular distribution of the radiation field over the entire length of the detector.

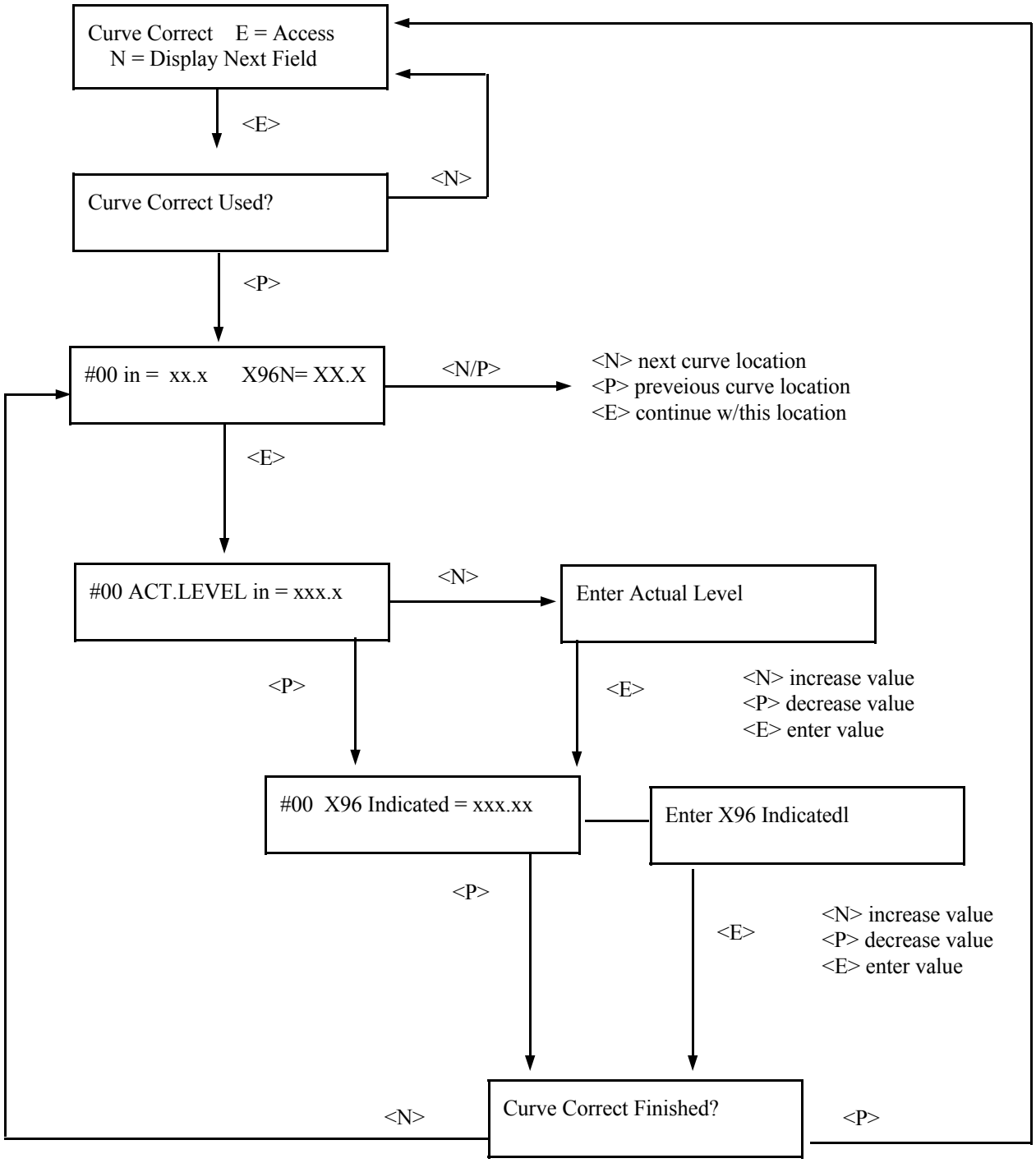
Among the circumstances that can cause this non-linearity are:

- Vessel size
- Vessel geometry
- Multiple point sources
- Vessel wall construction

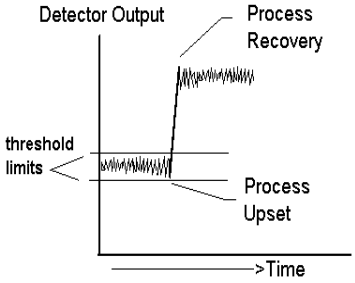
This menu permits entry of up to ten increments that can be used to linearize the output. The first increment (#00) and the last increment (#09) must match the values you entered as "zero" and "span" in the RANGE module.

**NOTE**: When Auto-Cal is enabled, position #01 of the Curve Correct Table must be set to the level of the Auto-Cal detector.

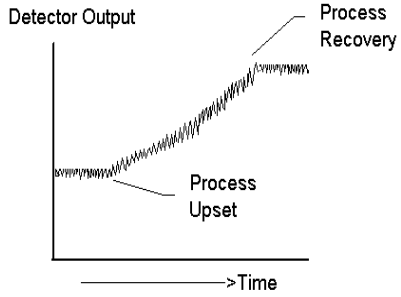
**Press <N>**


Curve Correct E = Access
N = Display Next Field
<E>
<N>
Curve Correct Used?
<P>
#00 in = xx.x X96N= XX.X
<N/P>
<N> next curve location
<P> preveious curve location
<E> continue w/this location
<E>
#00 ACT.LEVEL in = xxx.x
<N>
Enter Actual Level
<P>
<E>
<N> increase value
<P> decrease value
<E> enter value
#00 X96 Indicated = xxx.xx
Enter X96 Indicatedl
<P>
<E>
<N> increase value
<P> decrease value
<E> enter value
<N>
Curve Correct Finished?
<P>

DYN TRACK E = Access




Time Constant = 10 secs.
Dynamic Tracking Enabled




Time Constant = 10 secs.
Dynamic Tracking Disabled

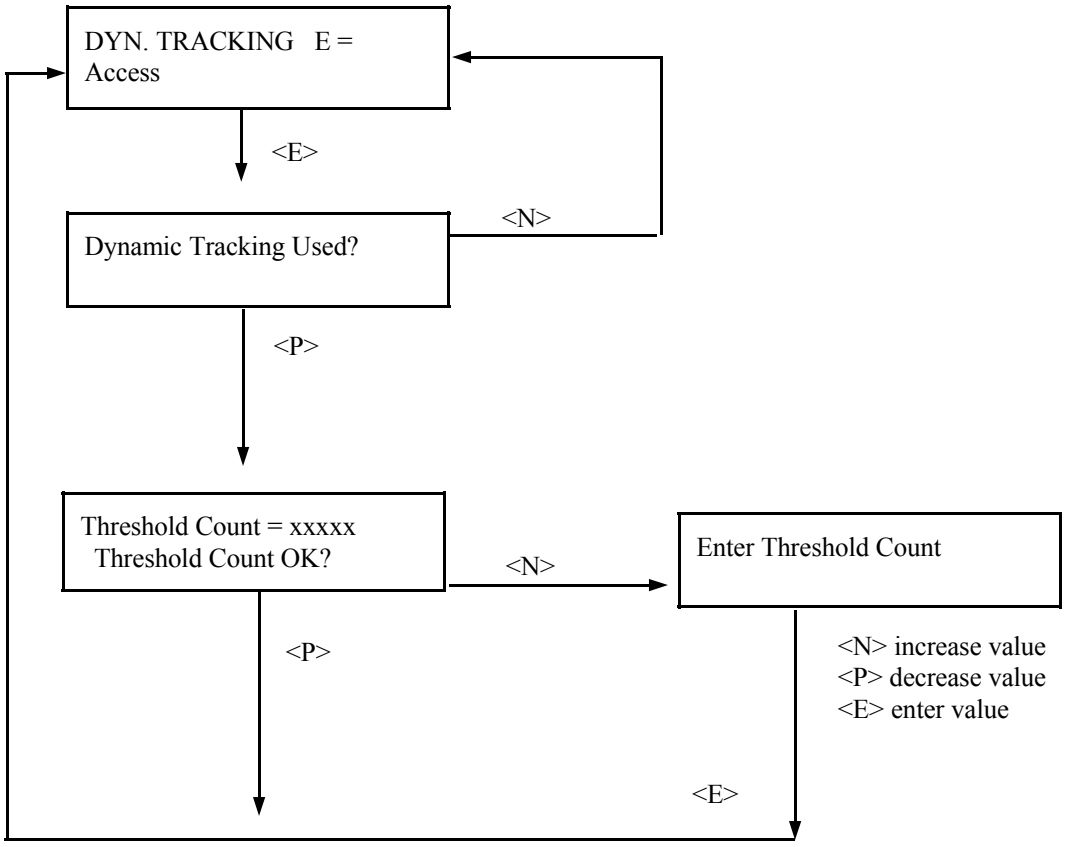
DYNAMIC TRACKING: This feature permits sudden process step changes to by-pass the digital filter so they can be observed in their "unfiltered" state.

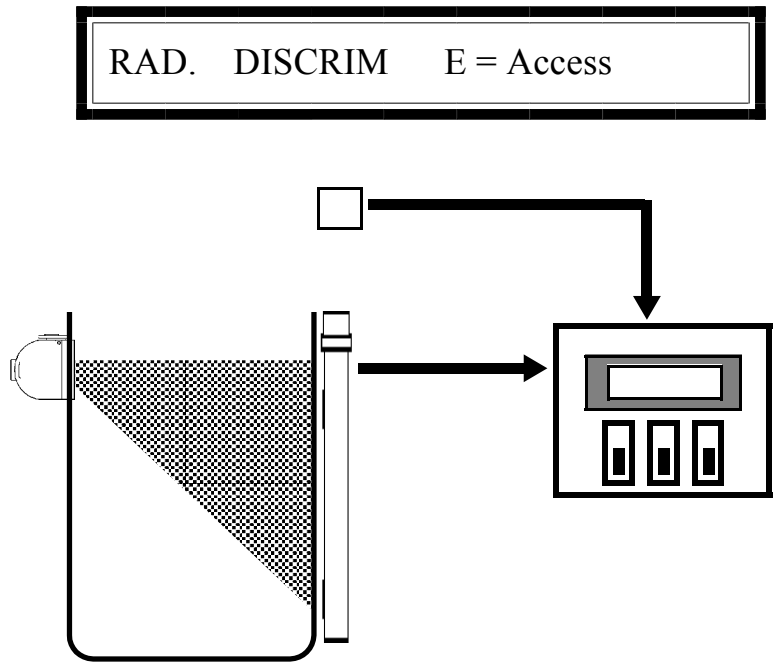
This menu requests if dynamic tracking is desired. If enabled, a response threshold value is entered in "detector counts" and is adjustable so that the normal process fluctuations can be considered.

If a sudden process change occurs that exceeds the set threshold, the filter is by-passed and the actual response is displayed.

Upon process recovery, the time constant filter is resumed.

**Press <N>**


DYN. TRACKING E =
Access
<E>
Dynamic Tracking Used?
<N>
<P>
Threshold Count = xxxxx
Threshold Count OK?
<N>
Enter Threshold Count
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>




PRINCIPLES OF OPERATION:

If there is radiation introduced from a source other than the measuring source, the measuring detector will experience an increase in count rate resulting in a low level offset. The level controller would normally open the inlet valve and add process to meet the level set point, resulting in an over-fill. However, Ronan uses a radiation monitoring detector mounted in line with the measuring detector, but outside the measurement beam width. When this detector senses the presence of an extraneous source of radiation, the rad-disc software clamps the output of the measuring circuit before any level off-set can occur. As soon as the external radiation disappears, the measuring detector is then allowed to respond and indicate true level. If the process level drifted off set point during the clamping interval, the measuring detector will respond according to its time constant setting. If dynamic tracking is used, the response can be shortened.

Most processes are quite slow so the offset should not be far from target during the radiography interval. For processes whose levels can vary rapidly, dynamic tracking or short time constants are definitely recommended.

GENERAL:

Assumptions are made that the external radiation influence is only temporary (order of minutes) and does not last for an extended period.

The level gage is essentially inoperative, but will immediately function when the x-ray/ radiography source is removed. The advantage of this feature is that catastrophic over-fills should not occur as a result of a large level offset error.

The level gage need not be disabled during radiography. Switching control to manual is not advised since the level indication is "clamped" during the radiation period. As long as the radiography interval is relatively short (minutes) the process should not drift away from the control set-point. The operator should be made aware of this condition by interfacing the rad disc solid state alarm to an annunciator or the DCS.

WHAT TYPE OF RADIATION TRIGGERS THE RAD-DISC?

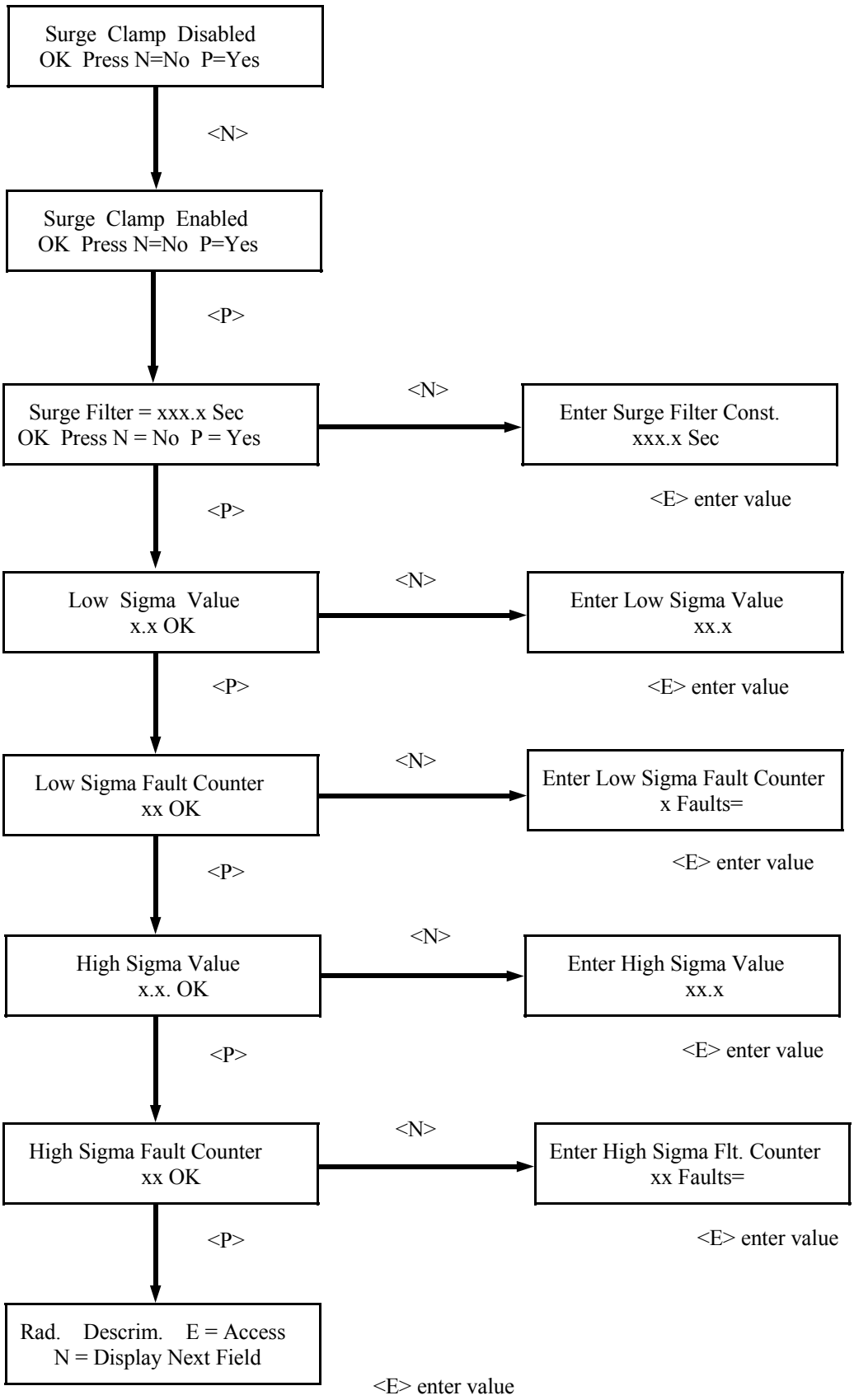
The presence of a very low level background, e.g. only 0.02 to 0.05 mR/h will be detected in approximately two (2) seconds and any large level (> 0.05 mR/h) will be detected immediately.

When the output is clamped there will be a visual flashing on the X96 display, along with a solid state alarm which is available to alarm the operator of the fact that the gage is not responding to level. The operator should be advised of procedures to keep the vessel from over or under filling while the radiography is taking place.

Once the radiation is removed, the clamping of the gage is removed, the alarms are cleared, then the operator knows the gage is responding to true level.

SOLID STATE ALARM CIRCUITRY:

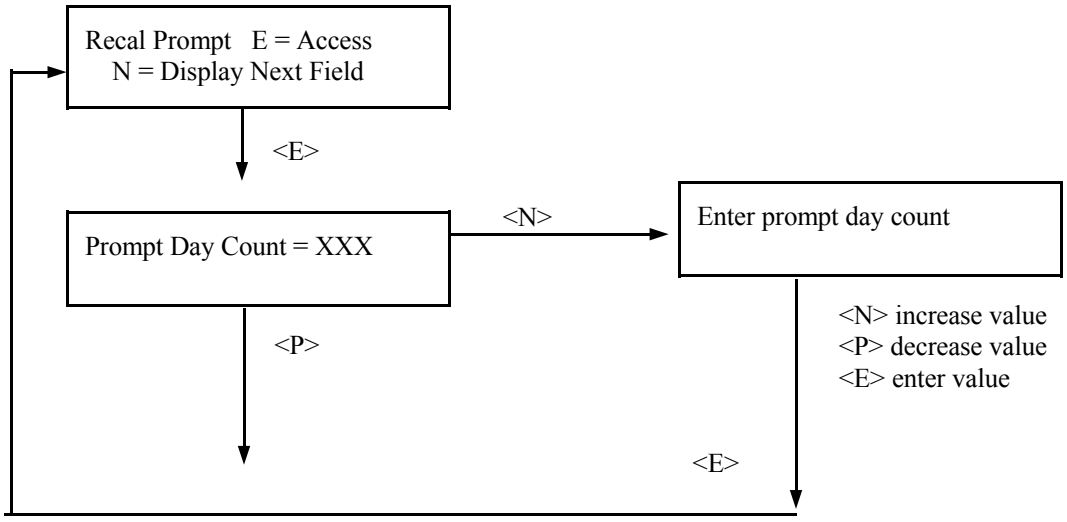
Open collector output X96 terminal A-12.


Surge Clamp Disabled
OK Press N=No P=Yes
<N>
Surge Clamp Enabled
OK Press N=No P=Yes
<P>
Surge Filter = xxx.x Sec
OK Press N = No P = Yes
<N>
Enter Surge Filter Const.
xxx.x Sec
<E> enter value
<P>
Low Sigma Value
x.x OK
<N>
Enter Low Sigma Value
xx.x
<E> enter value
<P>
Low Sigma Fault Counter
xx OK
<N>
Enter Low Sigma Fault Counter
x Faults=
<E> enter value
<P>
High Sigma Value
x.x. OK
<N>
Enter High Sigma Value
xx.x
<E> enter value
<P>
High Sigma Fault Counter
xx OK
<N>
Enter High Sigma Flt. Counter
xx Faults=
<E> enter value
<P>
Rad. Descrim. E = Access
N = Display Next Field
<E> enter value


RECAL PROMPT:

Not used in this application.

**Press <N>**


Recal Prompt E = Access
N = Display Next Field
<E>
Prompt Day Count = XXX
<N>
Enter prompt day count
<P>
<N> increase value
<P> decrease value
<E> enter value
<E>

| LEVEL .....in = xxxxx.x |
|---|

LEVEL.....:
Current process level in user units.

____% OF SPAN:
Percent of the total output range represented by the current level measurement being received from the elongated detector.

**EXAMPLE:**

**IF** Level Range = 0.0 to 100.0 in
**AND** Present level = 25 in
**THEN** Status Display #1 reads:

| LEVEL .....in = 25.0 |
|---|

If the current level falls below the value set as the low end of the measurement range, the bottom line message reads:

"UNDERRANGE of span"

If the current level rises above the value set as the high end of the measurement range, the bottom line message reads:

"OVERRANGE of span"

**IF** level goes to 103 in
**THEN** Status Display #1 reads:

| LEVEL .....in =103.0 |
|---|

**Press <N>**

| HI DETECTOR SpG = xxxxx.x |
|---|

HIGH DETECTOR (Density) .....:
Current density in user units of the high point detector being used for density input.

____% OF SPAN:
Percent of the total density output range represented by the current measurement.

**EXAMPLE:**

**IF** Range = 1.00 to 1.40 SpG
**AND** Present density = 1.230 SpG
**THEN** Status Display #1 reads:

| HI DETECTOR SpG = 1.230 |
|---|

If the current density falls below the value set as the low end of the measurement range, the bottom line message reads:

"UNDERRANGE of span"

**IF** density goes to 1.45 SpG
**THEN** Status Display #1 reads:

If the current level rises above the value set as the high end of the measurement range, the bottom line message reads:

"OVERRANGE of span"

| HI DETECTOR SpG = 1.45 |
|---|

**Press <N>**

**NOTE:**

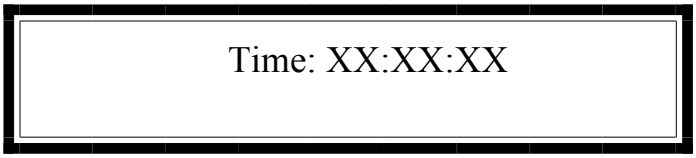
Detector choice (high or low) for density input is made through "RANGE" Programmable Function Module.

Level Time Constant = xxx.xx sec

TIME CONSTANT:
Filter Time Constant (in seconds) that is being applied to the level measurement.

RANGE:
Output Range (in user units) that is set as the high and low points of the level measurement.

**Press <N>**




TIME:
Current time of day in 24-hour format

DATE:
Current date in MM-DD-YY format.

**Press <N>**


DENSITY COUNTS:
The density detector 's unfiltered output in counts currently being used in measurement calculations.

LEVEL COUNTS:
The level detector's unfiltered output in counts currently being used in measurement calculations.

**Press <N>**

Auto-Cal Status

AUTO-CAL STATUS:
Enabled/Disabled

AUTO-CAL COUNTS:
Counts from the point detector being used for Auto-Cal

Auto-Cal Validate Counts

AUTO-CAL VALIDATE COUNTS:
Parameters used to validate or confirm that conditions are OK for doing the automatic calibration.

THRESHOLD: Average detector counts that must be exceeded in order to inhibit the auto-cal.

AVERAGE: Detector counts averaged over the PERIOD of time given below.

Auto-Cal Validate Time Constant xxx s

TIME CONSTANT: An independent time constant for the moving window averaging of the level detector.

AVERAGE PERIOD:
Length of time the system holds the values entered into a register at the end of each TIME CONSTANT.

**Press <N>**

| Density REF XXXXX |
|---|

DENSITY REFERENCE: Counts from Density Detector recorded and stored at the time of the last Reference procedure.

This value is used for ongoing internal calculation of the RATIO (R) that's used for Density Compensation.

LEVEL REFERENCE: Counts from Level Detector recorded and stored at the time of the last Reference procedure.

This value is used for ongoing internal calculation of the Level Calibration/Curve Correct.

**Press <N>**

Current Ratio = X.XXX

CURRENT RATIO:
If Density Compensation is enabled, the last system-calculated Ratio value is displayed here.

The system calculates the Ratio based on the:
Measured Density
Reference Density
AND the
Ratio Factor X

The "Factor X" can be adjusted (through the Density Compensation Programmable Function module) to fine-tune the amount of Density Compensation that's being applied to the level measurement.

RATIO STATUS:
Below/Above -
Reports where current Detector Counts are relative to the Threshold.

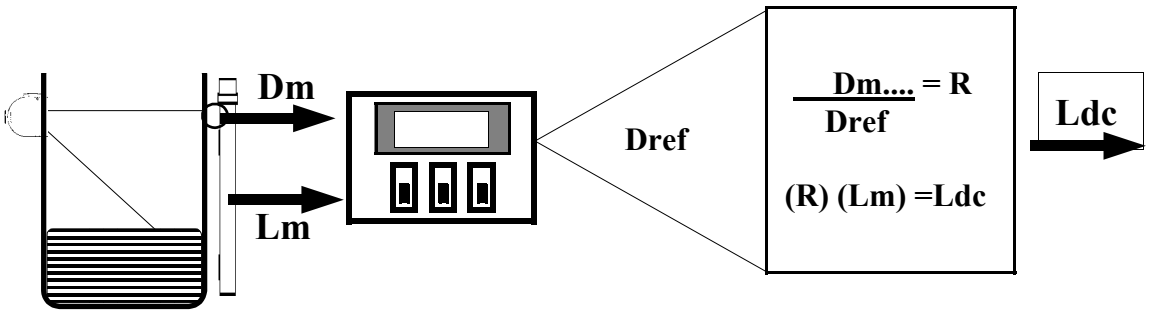
**Press <N>**

**Dm = Density measured**
**Lm = Level measured**

**Ldc = Level Output -**
**Density Compensated**

**Dref = Density Reference**
**(Value captured at the time of Calibration/Reference procedure)**

**R = Ratio**



| Level Output | xx.xx mA |
|---|---|

LEVEL OUTPUT:
X96N output board's present reading (normally between 4-20mA)

DENSITY OUTPUT:
X96N output board's present reading (normally between 4-20mA)

**Press <N>**

Last Cal Date: XX/XX/XX

LAST CAL DATE:
Date the system was last calibrated.

LAST CAL TIME:
Time of day the system was last calibrated.

**Press <N>**


**Chapter 5** gives step-by-step instructions for calibrating the Density Compensated Level Monitor System.

The curve correction procedure is also detailed.

An accurate calibration and curve correction will produce the optimal measurement results from Ronan's Density Compensated Level Monitor System.

Document all changes you make to the factory-default settings* that are active in your system.



* See "Factory Configuration and Inspection Sheets" filed in Chapter 10 with drawings.

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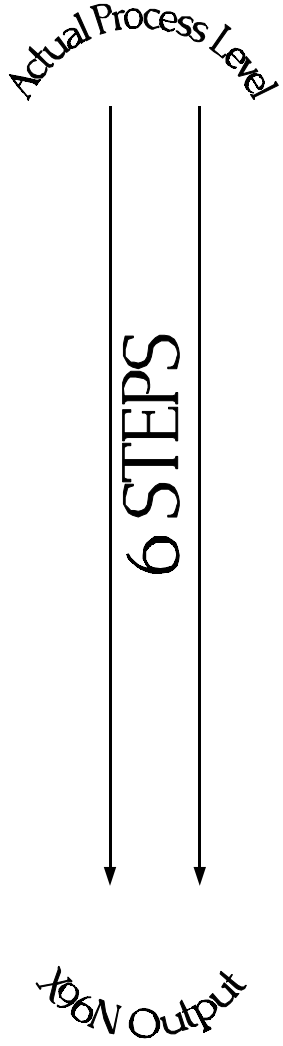
## Reconfiguring the System




**----CALIBRATION GOAL---**
**To correlate the X96N output to the actual process level**

Ronan ships the Density Compensated Continuous Level Monitor System with factory-default software settings. Those settings are responsible for the information that initially appears on the status displays.

After installation at your site, you will want to customize the system to fit your own application and process variables. The goal is to correlate the X96N output with your own process level, thus producing an accurate level measurement. The list below summarizes the activities that are detailed in the remainder of this chapter:

1. Check the factory-default settings to be sure they are appropriate for your circumstances. If NOT, make necessary changes and document those changes for future reference.

2. Perform an initial calibration. This procedure relates the actual process level to the system's output.

3. Verify the density compensation feature is producing enough "correction" for your conditions. If NOT, adjust the density default settings to "fine tune" the compensation feature.

4. Use the curve correction procedure to further refine the output, producing a more accurate measurement, if required.

If desired, enable the Auto-Cal optional feature and set

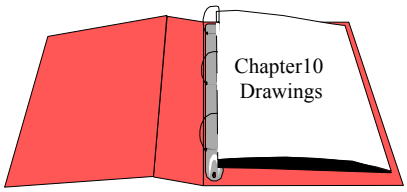
5. up working parameters.

6. Document some critical readings for future diagnostics and troubleshooting. Also, record any changes you made to the factory-default settings. Keep this information for future reference.

# 1 Factory Default Settings

Locate the "Factory Configuration and Inspection Sheets" which are filed with drawings in Chapter 10 of this manual. That information will indicate how the system operated under factory conditions.

The factory-default settings were selected based on information provided at the time your System was ordered. In most cases these settings should be appropriate for your circumstances. If you change any of the factory-default settings, be sure to document the changes for future reference.




Reference: :
Factory Configuration Sheet

**DOCUMENT ALL CHANGES**

Check these settings through the X96N programmable functions.

Press **<E>** LEDs flash
Press **<N N P N N P>**
Press **<N>** to reach these functions:

CAL MODE
TIME CONSTANT(S)
RANGE(S)-of 4-20 mA outputs:
- Channel 1 - Elongated Level Detector (zero/full)
- Channel 2 - HI Density Comp Point Detector **OR** LO Auto-Cal Point Detector

LEVEL REF CONSTANTS -
- Calibration Time
- Fault Counts (high/low)
- Output Span (zero/max.)

ALARM LIMITS
- High Level (Point Detector) = Density counts
- Continuous Level (Elongated Detector) = Height units (ft, in, etc)

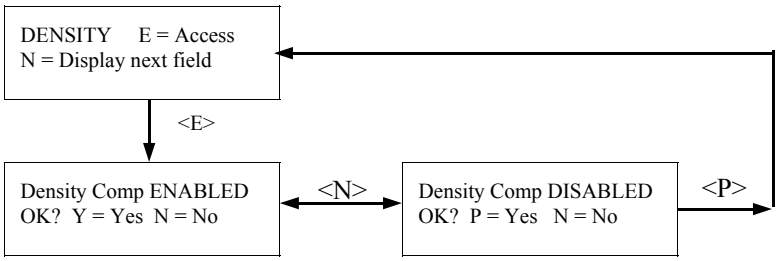
DENSITY COMPENSATION
- Temporarily “Disable” this function -

(see next page)

## Temporarily Disable the DENSITY COMP Function

One of your first tasks will be to calibrate the system. Before beginning the calibration procedure, however, you should temporarily disable the DENSITY COMPENSATION function.

Continue Pressing **<N>OR <P>** to reach DENSITY
Press **<E>** to access




Press **<N>** to choose "Disable"
Press **<P>** for "Yes"

---

## Calibration MODE

One of your first tasks will be to calibrate the system. The steps involved in the calibration will vary slightly depending upon the *mode* of calibration selected as the constant.

One of these four CALIBRATION MODES will be active on your system:

Cal on EMPTY
Cal with PROCESS - Zero/Full
Cal with PROCESS - Low/High
Cal with ABSORBER

**NOTE:** Instructions which follow are for a "Calibration with Process - Zero/Full" mode. Y*our own mode* may be different, in which case your own screens may vary slightly from the example shown on the following pages. In that case, follow the prompts on your screen and enter the information requested for your own circumstances.

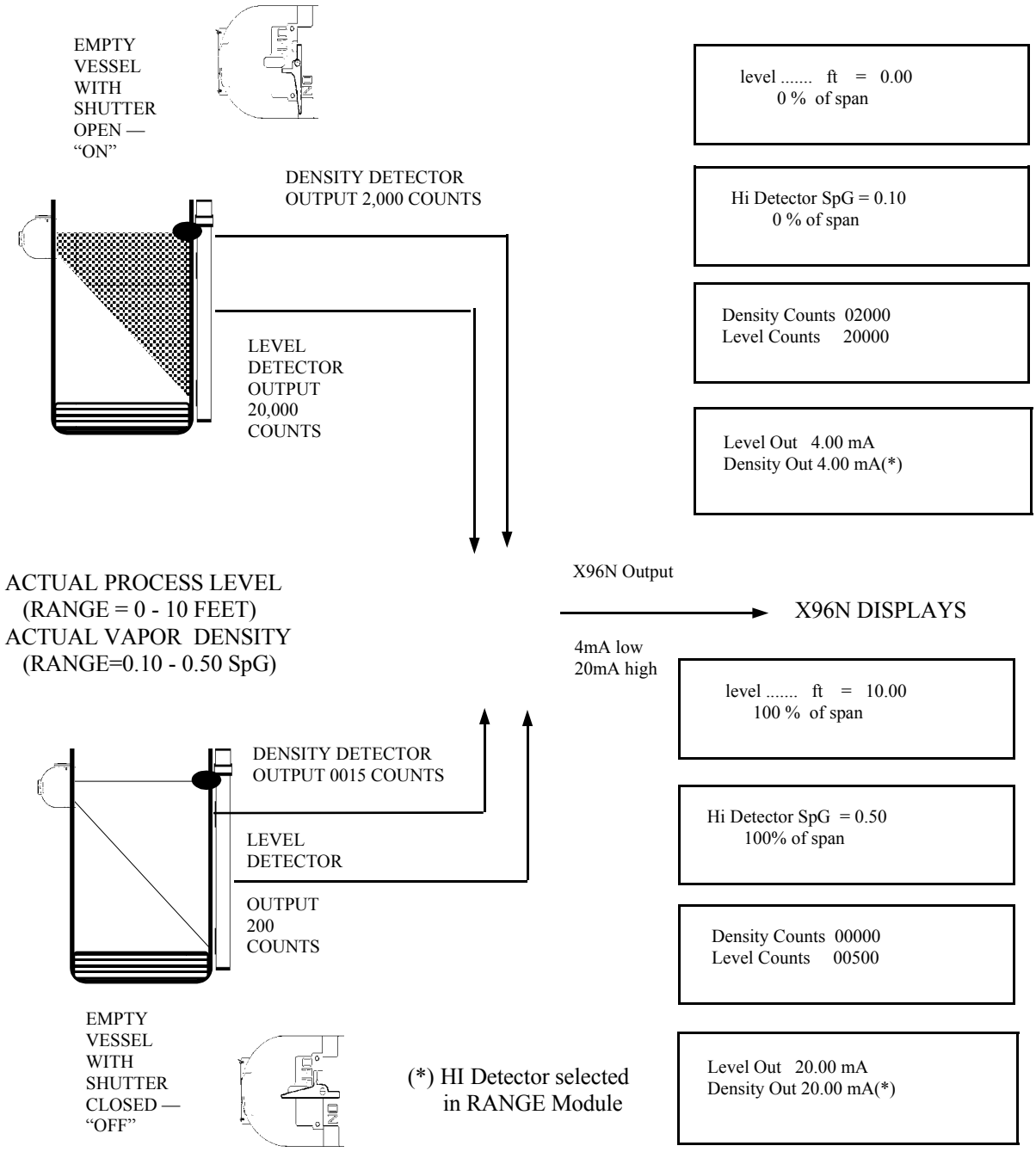
**Most applications use the "Calibration with Process" Mode.** Changing the CALIBRATION MODE requires access to the Factory-Programmable Functions.

**NOTE:** The "Density Reference" value given in these modules is in units of SpG and should represent the expected SpG of the upper phase vapor under LOW LEVEL conditions.

# 2 Initial Calibration

The initial calibration procedure relates the X96N's output to your actual process conditions. It instructs the microprocessor to read and store the detector counts for a low and high process level at a minimum vapor density.

Next, the density compensation feature is enabled and configured. Once the system is conditioned to recognize the low and high levels, and to compensate for the minimum and maximum densities, it will provide a 4-20 mA output over the entire range of interest.



**Calibration Procedure**

The CALIBRATION module is located in the customer-programmable functions.

**YOU MUST KNOW THE ACTUAL LOW AND HIGH LEVEL/ DENSITY OF YOUR PROCESS VESSEL FOR THIS PROCEDURE.**

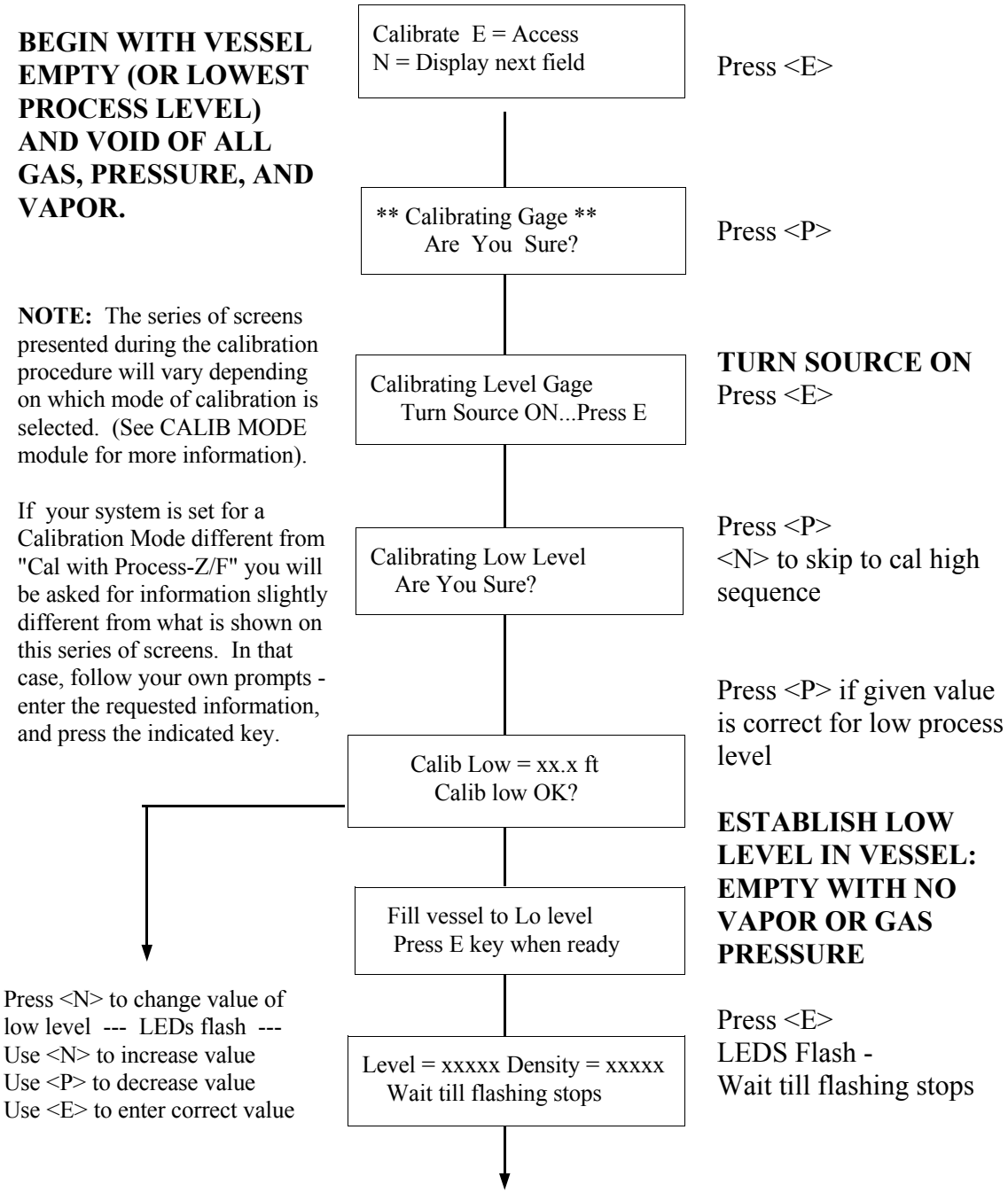
Begin by entering the access code:

Press **<E>** LEDs flash
Press **<N N P N N P>**
Press **<N>** to reach CALIBRATE

**BEGIN WITH VESSEL EMPTY (OR LOWEST PROCESS LEVEL) AND VOID OF ALL GAS, PRESSURE, AND VAPOR.**

**NOTE:** The series of screens presented during the calibration procedure will vary depending on which mode of calibration is selected. (See CALIB MODE module for more information).

If your system is set for a Calibration Mode different from "Cal with Process-Z/F" you will be asked for information slightly different from what is shown on this series of screens. In that case, follow your own prompts - enter the requested information, and press the indicated key.




Next Page

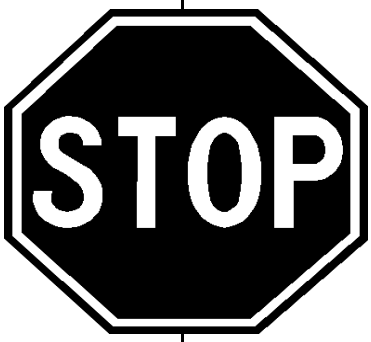
Calibration Hi Level
Are Your Sure?

Press <P>
<E> to escape sequence

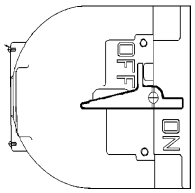
Calib High = XX.XX ft
Calib High OK?

Press <P> if the given value is correct for high process level.

Press <N> to change value of high level --- LEDs flash ---
Use <N> to increase value
Use <P> to decrease value
Use <E> to enter correct value




**DO NOT FILL THE VESSEL - INSTEAD, CLOSE THE SOURCE HOLDER SHUTTER TO SIMULATE YOUR HIGH PROCESS LEVEL (i.e. LOW COUNTS)**




Fill Vessel to Hi Level
Press E key when ready

**CLOSE SHUTTER TO SIMULATE HIGH PROCESS LEVEL IN VESSEL**
Press <E>

**NOTE:** If you get a CAL ABORT message the"fault count high" or "fault count low" may have been exceeded. Check the detector count setting for these parameters in the CALIB. CONSTANT module.

Level= xxxxx Density =xxxxx

LEDs Flash - - -
Wait till flashing stops

Press <E> to return to Status Display #1

Calibration Complete
Start Process

Go to the status display where the Reference counts are stored and document these two values for future reference:

| | |
|---|---|
| **Density Ref** | **xxxxx** |
| **Level Ref** | **xxxxx** |

Den Ref _____ ←

Lev Ref _____ ←

Move on to Density Compensation →

# 3 Density Compensation

The calibration procedure detailed on the previous page conditioned the system to recognize the low and high process levels under minimum influence from an upper phase of gas or foam. Now we must adjust or modify that initial calibration to compensate for the additional mass (density) that is encountered when process conditions create an upper phase vapor that has a SpG greater than air.

## Compensation Procedure

The DENSITY module is located in the customer-programmable functions.

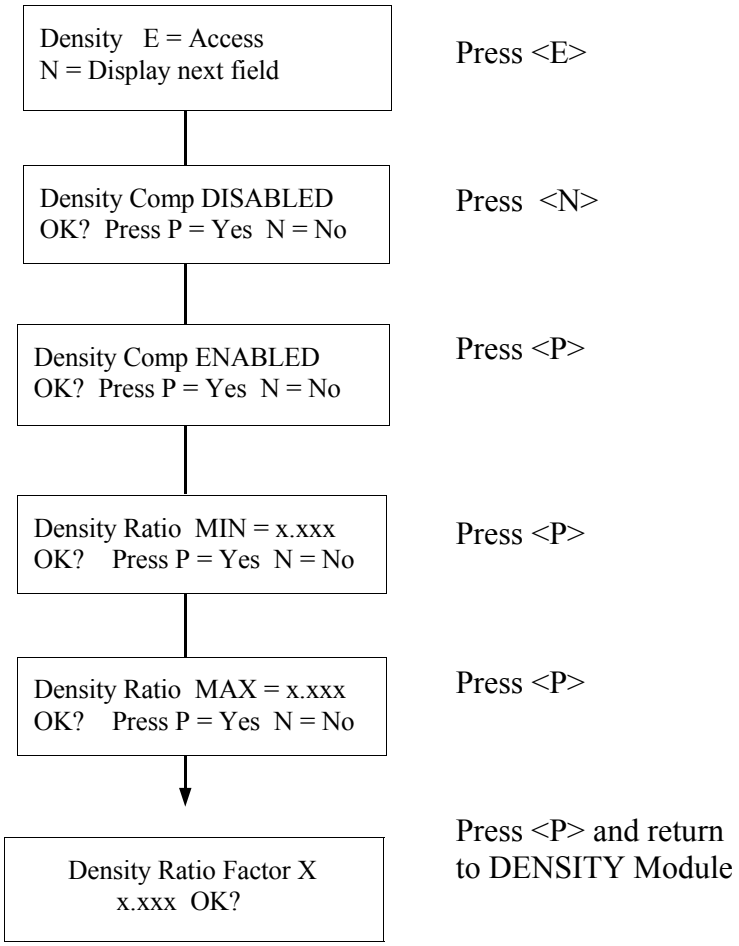
Begin by entering the access code:

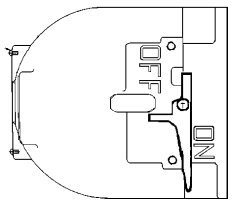
Press **<E>**
Press **<N N P N N P>**
Press **<N>** to reach DENSITY

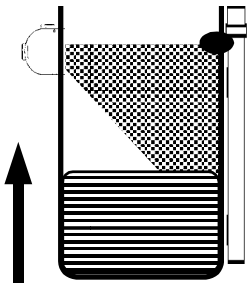
**ACCEPT ALL OF THE DEFAULT VALUES IN THESE MENUS.**

**AFTER DENSITY COMPENSATION IS TESTED, IT MAY BE NECESSARY TO ADJUST ONE OR MORE OF THESE VALUES.**

**DO NOT MAKE ANY CHANGES AT THIS TIME.**





Once Density Compensation has been enabled, open the source holder shutter and begin to fill the vessel with process, pressure and whatever else constitutes normal operation environmental conditions.

Your objective now is to bring the process up to a KNOWN LEVEL AND TO ESTABLISH NORMAL PROCESS CONDITIONS in the upper phase of gas/ vapor so you can determine if the default Density Compensation parameters are appropriate for your specific conditions.

LEVEL ..... in = xxx
_____ % of span

For example, if you KNOW you have introduced process to a level of 10% of span, this status display should correctly indicate that level and percentage.

IF NOT, the "density compensation RATIO factor" may need to be adjusted.

Return to the DENSITY module, shown on the previous page, and make the necessary adjustments.
.

Chaper 4 gives more details about the DENSITY COMPENSATION software module.

**NOTE:**

*Increasing* the "Ratio Factor X" will *increase* the Ratio (R) which will, in turn, *decrease* the indicated level.

X=↑
R=↑
LEVEL=↓

Move on to Curve Correction

# 4 Curve Correction

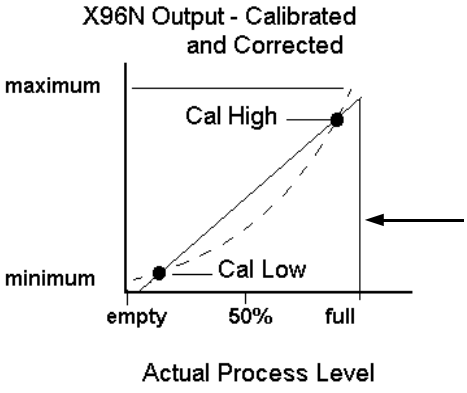
The calibration procedure detailed on the previous page instructed the system to recognize two known points - an actual low level and an actual high level.

The intermediate levels were computed based on a linear (straight line) relationship between the two actual points. (See Chapter 2). This linear relationship assumes the radiation field is distributed evenly over the entire range of the vessel.

Unfortunately, however, the system's configuration does not always produce an evenly distributed radiation field. That is to say, things like the size and shape of the vessel, the dynamics of process movement, the geometry and placement of the system components can all interact to produce an uneven distribution of radiation which, in turn, produces a non-linear response.

By applying a curve correction through software, a linear relationship can be simulated.

**Examples:**
**Non-linear responses due to uneven distribution of radiation field**

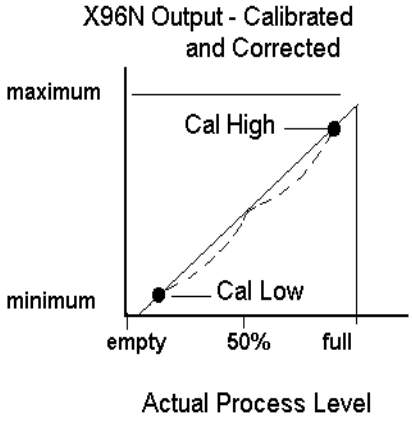



1) Vessel walls with uneven insulation

OR

2) Vessel with internal supports and piping

3) Cross radiation fields from two point sources on vessel



**Curve Correction Procedure**

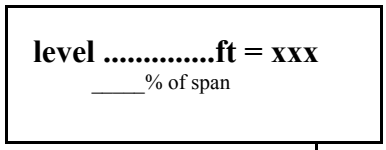
The curve correction procedure entails giving the system a number of additional intermediate points of actual process levels.

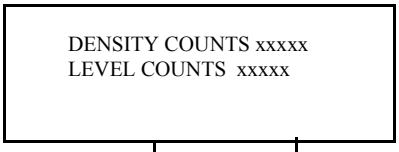
The X96N software permits entry of up to eight additional intermediate points.This procedure involves varying the process level to cover as much of the full range as possible.

You must first collect the data by observing the status displays for each increment to see the X96N's reading, and compare it to what you know to be the actual level at that increment.

**Data Collection for Curve Correction**

As you observe the X96N reading, record the results in the TABLE below. The first increment (#00) and the last increment (#09) MUST match the values you entered as "zero" and "full" span in the RANGE module.




**YOU MUST KNOW THE ACTUAL PROCESS LEVEL OF EACH INCREMENT**

| | Actual Level (units) | X96N Output (units) | Detector Output/ (counts) LEVEL | Detector Output/ (counts) DENSITY |
|---|---|---|---|---|
| #00 | _____ | _____ | _____ | _____ |
| "zero " span ----> #01 | **(*)** | _____ | _____ | _____ |
| #02 | _____ | _____ | _____ | _____ |
| #03 | _____ | _____ | _____ | _____ |
| #04 | _____ | _____ | _____ | _____ |
| #05 | _____ | _____ | _____ | _____ |
| #06 | _____ | _____ | _____ | _____ |
| #07 | _____ | _____ | _____ | _____ |
| #08 | _____ | _____ | _____ | _____ |
| #09 | _____ | _____ | _____ | _____ |

**NOTE:** Not all curve locations have to be used, however, covering as much of the entire range as possible will produce the best results.

"full" span ---->

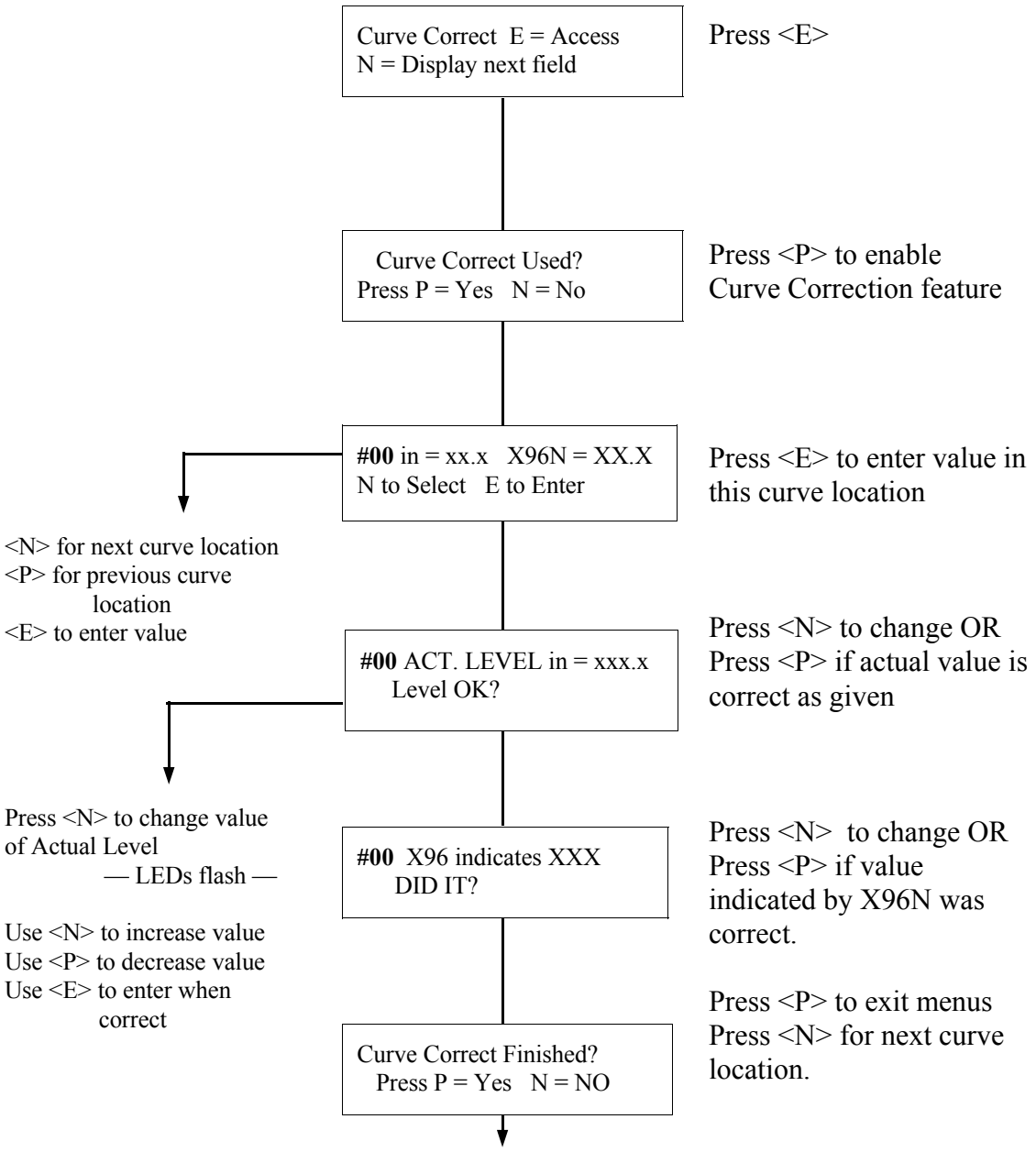
**(*)** If Auto-Cal enabled, #01 MUST be set to value of Auto-Cal detector.

## Applying Curve Correction

The CURVE CORRECT module is located in the customer-programmable functions.

Begin by entering the access code:

Press **<E>** LEDs flash
Press **<N N P N N P>**
Press **<N>** to reach CURVE CORRECT




Next Page

**#01** in = xx.x X96N = XX.X
N to Select E to Enter

Press <E> to enter value in this curve location

<N> for next curve location
<P> for previous curve location
<E> to enter value

**#01** ACT. LEVEL in = xxx.x
Level OK?

Press <N> to change OR
Press <P> if Acutal Level is correct as given

**#01** X96 indicates XXX
DID IT?

Press <N> to change OR
Press <P> if Indicated Value from X96N is correct.

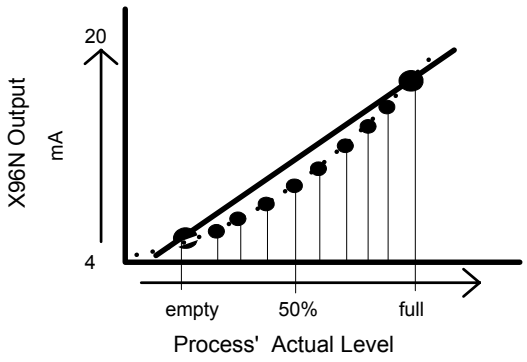
Press <N> to change value of Actual Level
— LEDs flash —

Use <N> to increase value
Use <P> to decrease value
Use <E> to enter when correct

Continue through the curve locations entering collected data from the TABLE.

**Continue through all curve locations. Enter zero (0) in all unused registers.**

**All locations (#00 —#09) that do not have data from the TABLE, MUST have zeros (0) entered in the "Actual Level" register and the "X96N Indicated" registers.**




**Example:**
**Intermediate Points Plotted and Curve Correct Applied**

Move on to Auto-Calibration

## 5 Auto-Calibration/ Validation

If you are using the Auto-Calibration option, you will want to enable that feature and check those default parameter setups with the Factory Configuration Sheets in Chapter 10.

Auto-Cal Validate should also be enabled if the Auto-Cal option is used.

Chapters 4 and 8 give details about these two software features. The factory-recommended settings in these modules should produce the best results. You may want to consult Ronan before making any changes here.

## 6 Documentation

For future reference, document these items:

(a) All conditions that are present during the calibration and curve correct procedures. That is, any information that will be needed to reproduce these exact circumstances the next time a calibration is performed. For example, note if agitators are running, vessel is at normal operating temperature, process is flowing from top of vessel through "active radiation beam," etc.

(b) All changes made to factory-default settings such as time constant, calibration constants, gain, etc.

(c) The Level and Density REFERENCE COUNTS as they appear on the Status Display at the time of the initial calibration.

(d) The Linearizer Curve entries made during the Curve Correction procedure.

TB-A pin 6+ to 2-_____ ←

TB-A pin 7+ to 2-_____ ←

Also, for Ion Chamber detectors (analog input) with the source turned "ON" and the process at, or near LOW LEVEL, use a voltmeter to measure and record these two voltage readings from the Input Terminal (TB-A). This information may also assist with future troubleshooting efforts.


**Chapter 6** contains technical information and reference drawings for the detector.

The Scintillation Detector is NOT field servicable.

Instructions are given for replacing the detector.

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## Scintillator Detector Description

The Ronan scintillation detector consists of three main components: The plastic scintillation crystal, the photomultiplier tube (PMT), and the associated electronics.

### Scintillation Crystal

The crystal (3) used for the Continuous Level Monitor System is polyvinyltoluene (PVT) plastic. The crystal produces light pulses which are proportional to the incident radiation events striking it.

Typically mounted in a stainless steel shell the entire crystal assembly is sealed against moisture and dirt and is non-repairable. An integral flange serves to mount the crystal to the PMT. A special silicone membrane serves as an optical coupling (19) medium between the crystal and the PMT.

---

### Photomultiplier Tube

The PMT (6) is a light sensitive vacuum tube with a photosensitive layer that converts the light pulses to an electrical current. Light pulses from the crystal strike the photosensitive layer and release electrons. A high voltage power supply connected to the photosensitive layer accelerates the electrons through stages of current amplification.

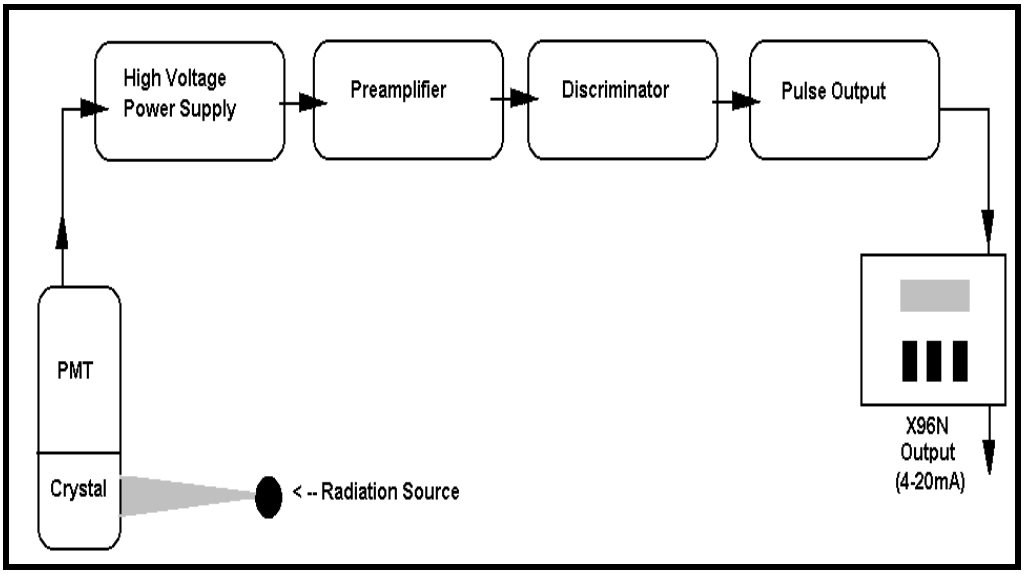
The PMT and its associated components are housed in a special magnetic shield. The tube is shock-mounted internally, with an interface plate at the top which also mounts the electronics and the outer shell (7).

---

### Electronics

Four boards, housed in a stainless steel shell, comprise the electronics and their functions.

* High Voltage Power Supply
* Preamplifier
* Discriminator
* Pulse Output

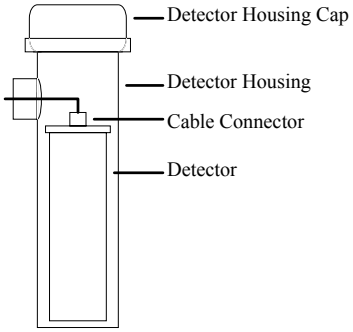



**Detector Service**

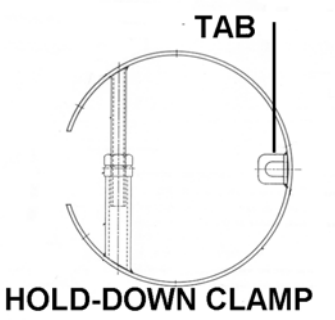
The critical components of the electronic circuit and the PMT/Crystal Assembly are aligned before leaving the factory. (See Factory Configuration and Check Out Sheets, Chapter 10). If any component of the Scintillation Detector is adjusted or replaced, the performance of the entire system will be adversely affected and will require realignment before continued use is possible.

Therefore, the **scintillation detector IS NOT field servicable.** Should a problem arise with the detector, the entire Detector Assembly should be returned to Ronan for repair/replacement.

**Detector Removal/ Replacement**



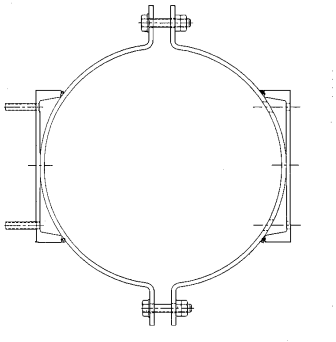

1) Check NOTES below for illustrations and cautions that apply to your specific equipment.
2) Unscrew cap on detector housing.
3) Unscrew connector on top of detector.
4) Remove detector from housing.
5) Carefully install replacement detector in housing.
6) Screw connector back onto detector.
7) Immediately replace detector housing cap.
8) Follow instruction to REFERENCE or CALIBRATE new detector.




**ELONGATED DETECTOR NOTES:**

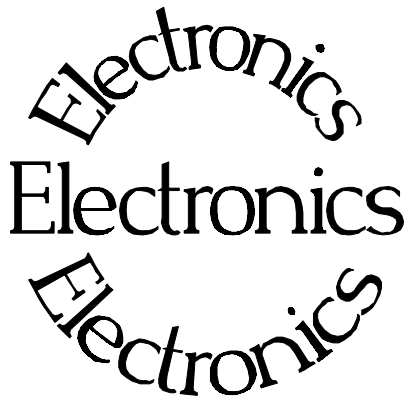
To avoid damage in shipment or installation, the elongated detectors are packaged separate from the housing. Avoid subjecting detectors to mechanical shock. Avoid supporting detector by its chain handle, or other lifting devices, for prolonged periods of time.

When detector is properly seated on the bottom of the housing, the hold-down clamp "tab" will engage and the extension rod screw can be adjusted to tighten detector assembly into housing.



**DETECTOR HOUSING/ BRACKET ASSEMBLY NOTES:**

Many detectors are shipped inside the housing/bracket assembly. Bolts at the top and bottom of the C-Clamp are used to adjust the assembly around a pipe.




B-9742-K

**Chapter 7** contains information about the Electronics used in your Density Compensated Level Monitor System.

Troubleshooting tips are also included.

Most measurement problems can be isolated to one of four areas:

* Accessory related
* Installation related
* Process related
* Monitor System Equipment

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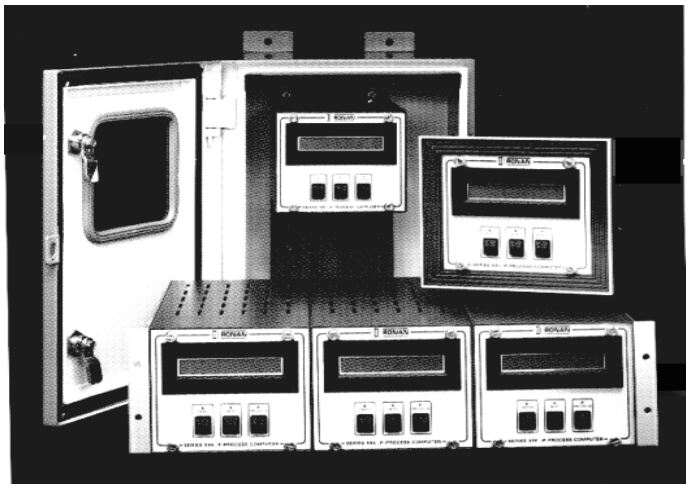
# X96N Microprocessor



## Power Supply Assembly

**Input: 24VDC**
**110VAC +/-15% 50/60Hz**
**220VAC +/-15% 50/60Hz**

**Output: +/-15VDC**
**+5VDC**

Test the power supply with a voltmeter by temporarily disconnecting all input wiring from TB-A. Do not allow the wires to touch other terminals or chassis. Suspect power supply problems if:

+15V, -15V or +5V LEDs are NOT illuminated.
+15V is NOT measured across pins 1and 2 of TB-A.
-15V is NOT measured across pins 2 and 3 of TB-A.

If necessary, access the power supply assembly by removing the four screws around the OUTSIDE edge of the panel.

To remove fuse for inspection, **PUSH IN** and **TWIST** COUNTERCLOCKWISE:

Four screws around outside edge of panel will access Power Supply Assembly.

Temporarily disconnect TB-A input wiring.

Check LEDs

## X96N Microprocessor Boards

Most troubleshooting of the X96N can be done to the board level. Loosen the four thumbscrews from the front cover of the display/keypad. Open the front cover and refer to Drawing B-9742-K for board identification.

Reference:
B-9742-K

Each board can be easily removed and replaced. Replacement part numbers are given on the Factory Checkout and Test Sheets in Chapter 10.

---

**NOTICE:**

The boards are interchangable in the chassis slots, however each ribbon cable MUST be plugged into the correct board.

---

## CPU Board

The central processor unit (CPU) consists of the Intel 8088 Microprocessor, clock generator, the RAM, ROM and $E^2$ROM memory devices and the buffers providing the interface to the input and output busses.

Suspect CPU board problems if readings on the display screen are incorrect or erratic.

Before replacing the entire board, check to be sure the EPROMS are positioned correctly. Also, try replacing EPROMS on U7, U8, and U9.

---

## Input Board

The input board provides analog-to-digital conversion to condition the detector output and signal(s) for processing by the CPU.

Suspect problems with input board if any of the following conditions arise:

-15/+5V LEDs on back panel are not illuminated.

Detector input (analog or pulse) is not being converted to counts on the display screen.

The open collector outputs from TB-A do not function properly. (Measured at TB-A pins 12,13,14).

**Output Board**

The output board converts digital values of active units to two transmitter outputs (4-20 mA or 10-50 mA.) Also, two alarm trips with single setpoints providing two SPST contact outputs each. A fail-safe relay, supervised by the system watchdog, transfers if the unit fails or if it loses power.

The output board may need to be replaced if a problem arises with either one of the output signals, or if the alarm trips are not initiating properly.

---

**Display Interface Board**

The display interface board connects the main bus to the display board. It contains decoder/buffers, power failure battery back-up, and the real-time clock.

This board may need replaced if the Time and Date on the X96N do not work correctly.

---

**Display Assembly**

The display assembly is comprised of the Display Board, LCD Board , and Switch board. This assembly contains the operator display screen and three pushbuttons.

Suspect problems here if the pushbutton inputs send errant signals to the microprocessor.

---

**Serial Interface Board**

The *optional* serial interface module provides output facilities to a hard-copy printer or a computer.

Suspect problems here if devices external to the X96N are setup with correct system parameters, but are still not receiving a communication signal.

## X96N Transmitter Output Board Setup

Reference:
B-9742-K

The output range (normally 4-20 mA) is entered in the LEV REF. CONST. menu of the X96N and should match the selection on the output board.

Two methods for setting up the transmitter output are given on the following pages:

Setup Using a Calibrator and
Setup Using the Gage Signal

---

## Transmitter Output Board Setup Using a Calibrator

Reference:
B-9742-K

1. Temporarily disconnect the yellow wire from input terminal (TB-A) at pin6. DO NOT allow it to touch other terminals or chassis.

2. Connect the calibrator to TB-A at pin6 (+V) and pin2 (-V).

3. Select Status Display #1.

4. Set the calibrator until Status Display #1 indicates UNDERRNG (around 3.00V)

5. Refer to drawing B-9742-K for ZERO control.
COUNTER-CLOCKWISE INCREASES ZERO SPAN

6. Adjust the transmitter zero control (Z1) for channel 1and (Z2) for channel 2 to obtain an output current/voltage corresponding to ZERO of range. (eg. 4 mA)

pin 2 (-)

7. Set the calibrator until Status Display #1 indicates OVERRANGE (around 0.00V)

pin 6 (+)

8. Refer to drawing B-9742-K for SPAN control.
CLOCKWISE INCREASES FULL SPAN

9. Adjust the transmitter span control (SP1) for channel 1 and (SP2) for channel 2 to obtain an output current/voltage corresponding to SPAN of range. (eg. 20 mA)

10. Disconnect the calibrator and replace yellow wire input terminal TB-A at pin6. RESUME NORMAL OPERATION!

## Transmitter Output Board Setup Using the Gage Signal

Reference:
B-9742-K

1 (-) Ch 1
2 (+) Ch 1
3 (-) Ch 2
4 (+) Ch 2

1. Calibrate the gage.

2. Empty the process or establish a "Cal LO" condition.

3. Turn source ON.

4. Using a millimeter for current output or a voltmeter for voltage output, monitor the gage signal in series directly across the output terminal (TB-B) for channel(s):
Channel 1: pin 1(-), pin 2(+)
Channel 2: pin 3(-), pin 4(+)

5. Select Status Display #1 and record the reading(s) in units and %.

6. Access the RANGE module and record the ZERO SPAN value (s) for Channel(s). Temporarily reset this value to some number higher than what was recorded in Step #5.

7. Return to Status Display #1 and verify it now indicates "UNDERRNG"

8. Refer to drawing B-9742-K for ZERO control.
COUNTER-CLOCKWISE INCREASES ZERO SPAN.

9. Adjust the output zero control (Z1) for channel 1 and (Z2) for channel 2 to obtain an output current/voltage corresponding to the zero span of range (eg. 4mA).

10. Turn the source OFF.

11. Select Status Display #1 and record the reading(s) in units and %.

RECORD FOR REFERENCE:

Step # 5 (Ch1)_____ ←

(If Used-Ch2)_____ ←

Step # 11(Ch1)_____ ←

(If Used-Ch2)_____ ←

12. Again access the RANGE module and record the FULL SPAN value(s) for Channel(s). Temporarily reset this value to some number lower than the reading in Step # 11.

13. Return to Status Display #1 and verify it now indicates "OVERRNG"

14. Refer to drawing B-9742-K for SPAN control.
CLOCKWISE INCREASES FULL SPAN

15. Adjust the output span control (SP1) for channel 1 and (S2) for channel 2 to obtain an output current/voltage corresponding to the full span of range (eg. 20 mA).

16. Turn the source ON.

17. Access the RANGE module a third time and reset channel(s) ZERO and FULL SPAN to the original values as recorded in Steps #5 and Step #11. RESUME NORMAL OPERATION!

## Alarm Trip Setup Using a Calibrator

Reference:
B-9742-K

1. The alarm trip set-points are normally field-calibrated after the system's process measurement calibration is completed. Periodic re-calibration of these modules in NOT normally required.

2. The alarm output controls two relays. Each relay has normally open and normally closed contacts. Output terminal (TB-B)
Channel 1: alarm pin7 (C), pin8 (NC) and pin9 (NO)
Channel 2: alarm pin10 (C), pin11 (NC) and pin12 (NO)

3. Temporarily remove the yellow wire from TB-A, pin 6. Do not allow it to touch other terminals or the chassis.

4. Connect the calibrator to TB-A pin 6(+) and pin 2 (-).

Ch 1: 7 = C
8 = NC
9 = NO
Ch 2: 10 = C
11 = NC
12 = CO

5. Select Status Display #1.

6. Set the calibrator until Status Display #1 indicates the desired setpoint value (3.00 to 0.00V = 0-100% of gage measurement output.)

7. Refer to drawing B-9742-K.
COUNTER-CLOCKWISE DECREASES SETPOINT

8. Adjust the SETPOINT control (TP1) for Channel 1 on the alarm trip until the alarm just occurs indicated by the red LED on keypad.

9. Set the hysteresis (HS1) to the desired value.
COUNTER-CLOCKWISE INCREASES HYSTERESIS.

pin 2 (-)

The hysteresis starts at 5% of input span and adds about 1.5% of span each turn.

pin 6 (+)

10. Repeat Steps 6-9 for Channel 2 using (TP2) and (HS2).

11. Disconnect calibrator and replace yellow wire input terminal TB-A at pin 6. RESUME NORMAL OPERATION!

---

## ION Chamber Detector Signal Gain

Reference:
B-9742-K

If Low Reference LEVEL counts are below 10,000 or above 20,000 counts, the signal gain may need adjusted. Follow this procedure:

1. Obtain empty vessel or low level condition.

Density REF. XXXXX
LEVEL REF. XXXXX

2. Turn source ON.

3. Observe the "Density/Level Counts" status display.

4. Refer to drawing B-9742-K.

Density Counts XXXXX
LEVEL Counts XXXXX

5. Adjust (R2) control on Input Board until the display reads between 10,000 and 20,000 counts for LEVEL.

## Isolate Problem

Most problems can be isolated to one of four overall causes. Eliminate each, one at a time, until the cause is determined.

### Accessories

Begin by disconnecting potentiometers, records, and controllers from the system. Accessories, when operating properly, should have NO effect on the X96N display.

---

### Configuration/ Installation

If the problem is not affected by the accessories, look for configuration changes that may have occurred since the Measurement System was installed.

When troubleshooting, it is important to consider the "Theory and Principles of Operation" information in Chapter 2. Process measurement is possible due to the principles of radiation transmission and absorption. The total mass of material between the radiation source and the detector (i.e. "measuring gap") will affect the final measurement. You must eliminate possible configuration/installation type of changes as the cause of your problem.

For example, consider these possibilities:

- Did the vessel insulation expand due to absorbed moisture during a wash down or absorbed process during a spill? This condition would increase the total mass of material in the "measuring gap" and would therefore indicate a higher level.

- Did something happen to compress the vessel insulation and therefore change the total mass of material.

- Could dust from process material or surrounding environment be collecting in "dead space" between the radiation source and detector? This would also indicate a higher level.

- Are changes taking place inside cooling or heating coils that carry liquid or vapor through the "active beam" of radiation?

---

### Process Conditions

If configuration causes are eliminated, consider the process conditions themselves.

For example, entrained air or gas bubbles in the process material present pockets of minimum mass (i.e. low vessel conditions). If the amount of entrained gas remains constant, the system's calibration procedure will automatically allow for its effect. However, if the amount of entrained gas increases or decreases, the system will indicate lower or higher process levels.

**Measurement Equipment**

After eliminating the accessories, installation/ configuration, and process conditions as possible causes of the problem, you will want to consider the measurement equipment. The X96N Microprocessor itself will be of great help in this troubleshooting procedure.

* If the problem is traced to the Detector, Chapter 6 contains technical information that may help to further isolate the problem.

* If the problem is traced to the Optional Accessories the information in Chapter 8 may assist you.

## Using the X96N Status Displays to Troubleshoot

The X96N continuously monitors system operation. The following Status Displays may help to uncover the cause of system malfunctions.

**ALL STATUS DISPLAYS:**

(blank display)

Begin by ensuring the displays are operational. If all of the **display screens are blank** consider these possible causes:

- Power off - Check AC power line or fuses.
- Total system failure - Check for faulty power supply
  Check for faulty CPU board.
- Faulty display board - Check for shorts at X96N:
  TB-A pins 1-2 and 2-3
  TB-B pins 1-2 or 3-4

(flashing display)

If all display screens begin flashing:

- Radiological Discrimination may have detected outside source of radiation. Check Calibration Constant for Fault Count.
- Density Compensation Ratio Limits exceeded.

## STATUS DISPLAY #1:

Detector signal below calibration range (UNDERRANGE):

```
level ..... in = xxxxx.x
   UNDERRANGE
```

- Process condition
- Empty vessel
- Calibration error
- Faulty input board

Detector signal above calibration range (OVERRANGE):

```
level ..... in = xxxxx.x
   OVERRANGE
```

- Process condition
- Source OFF
- Calibration error
- Faulty input board

Detector signal erratic**:**

```
level ..... in = ??????
      ???????
```

- Response time too fast - increase time constant.
- Dynamic tracking threshold too low - increase threshold.
- Radiation field varying independent of process - check to ensure source holder handle in secured in the ON position.

## OTHER STATUS DISPLAYS:

Density counts equal 0

```
Density Counts 00000
Level Counts xxxxx
```

- Density detector failure

Detector counts greater than Reference (low) counts:

```
Density REF < Counts
Level REF < Counts
```

- Level measurement below limits - check for calibration error.
- IF Ion Chamber Detector, check detector signal adjustments.

## CURRENT RATIO DISPLAY

```
Current Ratio - - - - -
Ratio Status
```

Current Ratio Counts FROZEN

- Ratio Limits were exceeded. Display Frozen at last valid ratio before exceeding the limits.

## OUTPUT STATUS DISPLAY:

Level OUT 04.00 mA
Density OUT 04.00 mA

**Output always 4.0** - Detector signal is below the calibration range:

- Process condition
- Calibration error
- Empty vessel/pipe

Level OUT 20.00 mA
Density OUT 20.00 mA

**Output always 20.00** - Detector signal is above the calibration range:

- Process Conditions
- Calibration error
- Source OFF

Level Out ..: ?????
Density OUT ... xxxxx

**Erratic output:**

- Response time too fast: increase time constant.
- Dynamic tracking threshold too low - increase threshold.
- Radiation field varying independent of process - check to ensure source holder handle in secored in the ON position.

## COUNTS DISPLAY:
## (Second Value)

Density Counts 0000
Level Counts 00000

No detector signal:

- Faulty detector
- Faulty detector amplifier
- Faulty +/- 15V power
- Faulty cabling
- Source OFF

Density Counts 10000
Level Counts 32767

Detector signal above range:

- Calibration error
- Faulty detector/detector amplifier

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**Chapter 8** includes details about optional features, accessory equipment, and other special items that may be included with your gage.

The information in this chapter applies only to the Density Compensated Level Monitor Systems that use these options.

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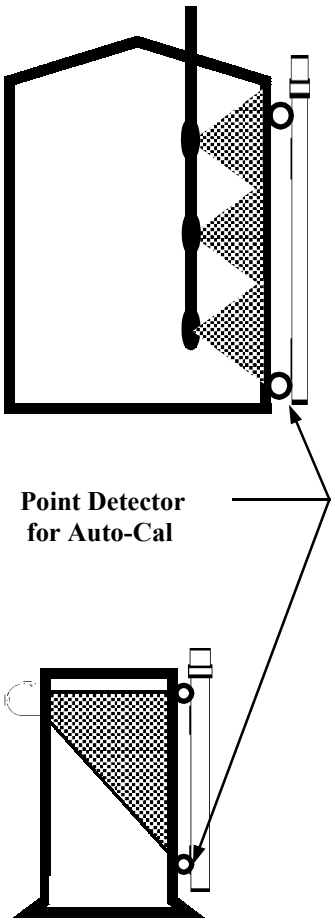
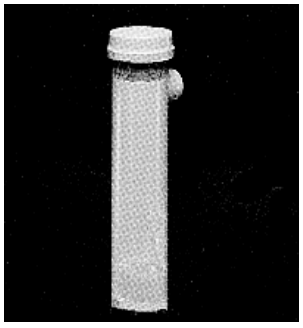
## Auto-Calibration Set-up



The auto-cal feature maintains the accuracy and repeatability of your measurement with little or no effort on the part of the operator.

**When is Auto-Cal needed?**

If interior walls of the vessel are prone to normal process build-up, the auto-cal feature is especially useful.

**What does Auto-Cal do?**

Auto-Cal provides a "shortcut" method of calibrating the Density Compensated Level Monitor by causing the X96N to go directly to the CALIBRATE LOW function. This eliminates the need for an operator to manually access the "calibrate" sequence of menus and keystrokes.

**What 's required to use Auto-Cal?**

Auto-Cal is initiated by a signal from a point detector, strategically installed on the process vessel.

**What is a "Point Detector?"**

Much like the "elongated" detector that is included in your Density Compensated Level Monitor, the "point" detector also senses the change in radiation field as the level of process changes.

Ronan's Scintillation Point Detector is used for this purpose. If the Auto-Cal Option is part of your System, the Outline and Interconnect Drawings are included in Chapter 10.

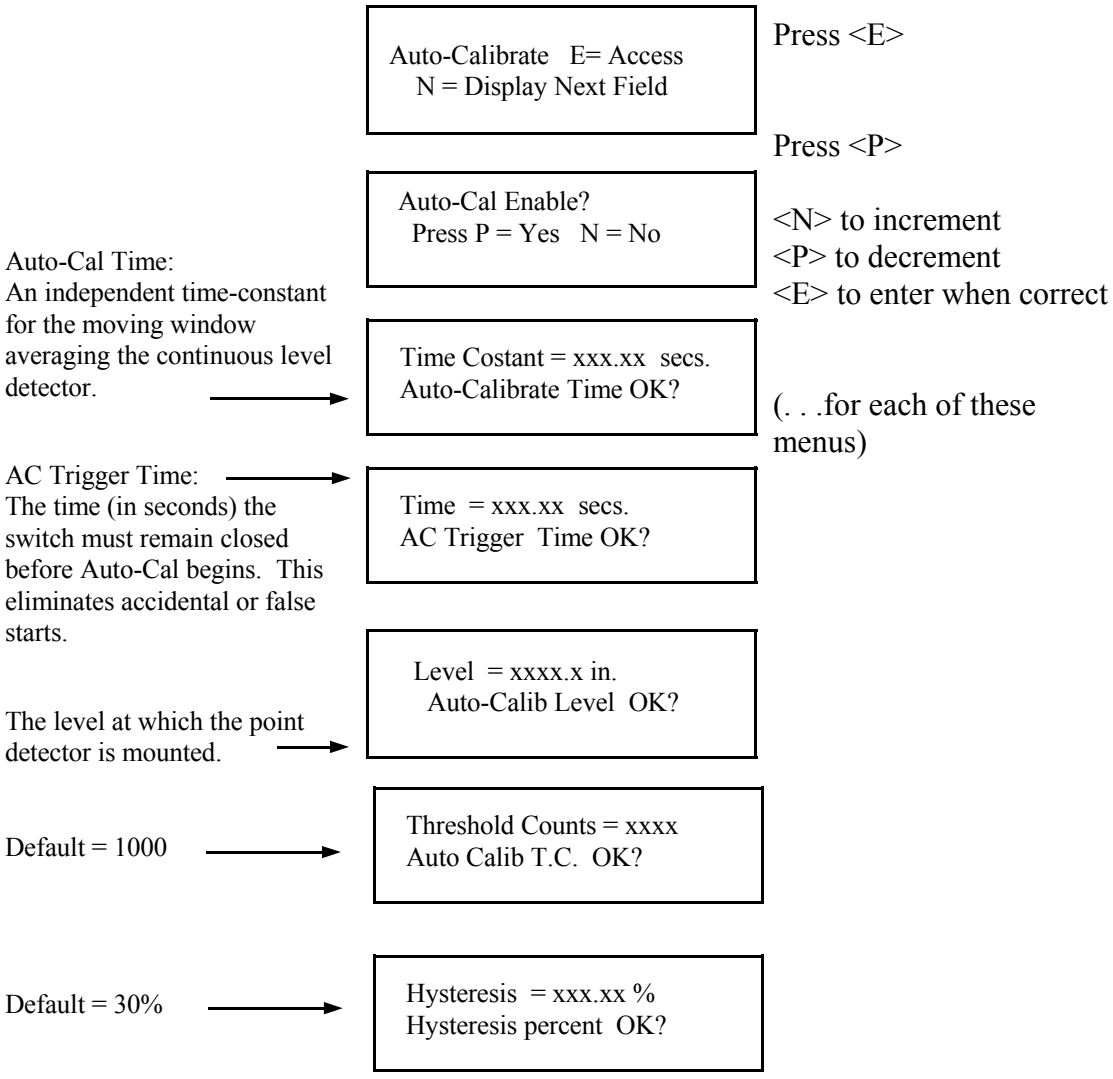
**How is Auto-Cal Set-up?**

**Auto-Cal can be used ONLY AFTER the initial LOW and HIGH calibration is done.** (See Chapter 5)

The AUTO CALIBRATION module is located in the customer-programmable functions.

Begin by entering the access code:

Begin by entering the access code:
Press **<E>** LEDs flash
Press **<N N P N N P>**
Press **<N>** to reach AUTO CAL.



Once Auto-Cal is set-up, and the calibration is initiated the X96N display will inform you when an auto-cal is taking place.

---

**Messages:**

| | |
|---|---|
| Auto-Calibrating<br>Low Level | TO ABORT: Press <N> |
| Auto Calibrate Aborted<br>Retry Auto Calibrate? | Press <N> to return to Status Display #1<br>OR<br>Press <P> to continue auto-calibrating |

---

| | |
|---|---|
| Open External Contact or<br>Disable Auto-Cal | This message indicates the pushbutton is stuck, or the external electronic switch has failed.<br><br>Release the pushbutton OR disable the external switch to return to Status Display #1. |

---

| | |
|---|---|
| Auto-Cal Fault Counts -<br>Retry Auto-Calibrate? | This message indicates an Auto-Cal was attempted with a full vessel or with the source turned OFF.<br><br>Press <N> to return to Status Display #1. |

## Auto-Cal Validation Set-up

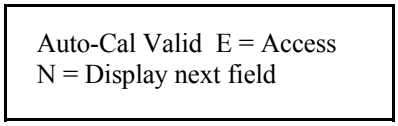
**Why use Auto-Validate?** Calibrations should only be done under NORMAL and stable operating conditions. Calibration results obtained during ABNORMAL process conditions (eg. rapidly changing levels) will produce invalid results.

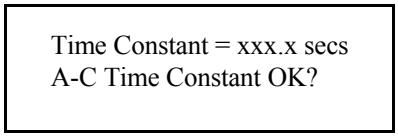
**What is Auto-Cal Validation?** Auto-Validation examines each request for Auto-Calibration to insure process conditions are within normal operating limits.

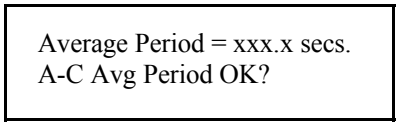
Auto-Validation will inhibit, or abort, any Auto-Calibration request if unstable process conditions are detected.

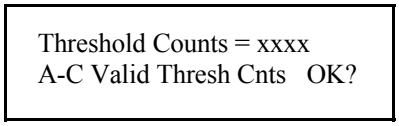
**When should I use Auto-Cal Validation?** Auto Validation should always be used when the Auto-Cal Option is enabled.

**How is Auto-Cal Validation Set-up?** Ronan's factory personnel analyze the information provided at the time your Monitor System was ordered, and make recommendations based on the dynamics of your process. These factory-programmed parameters should produce the best results. If you suspect a problem, you may want to consult Ronan field service for technical assistance before making changes.




**Chapter 9** contains a summary of NRC regulations and personnel safety requirements that pertain to radiation gages.

An example is provided for determining radiation field intensity, with Dose Rate, RAD, and REM calculated.

Source holder shutter and leak testing is explained.

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## Leak Test/ Shutter Test Requirements

The integrity of the containment and shielding around a radioactive source must be verified at periodic intervals specified by the NRC or agreement state.

Testing the containment and shielding involves verifying two conditions: (1) the integrity of the source capsule and (2) the function of the ON/OFF mechanism (shutter).

Ronan provides leak test training and a leak testing service to assist in meeting these requirements. The service can be purchased on a contract basis for each individual source. After the source holder is wiped by the customer, the kit is returned to Ronan for analysis. Ronan issues a report and maintains a record of the results.

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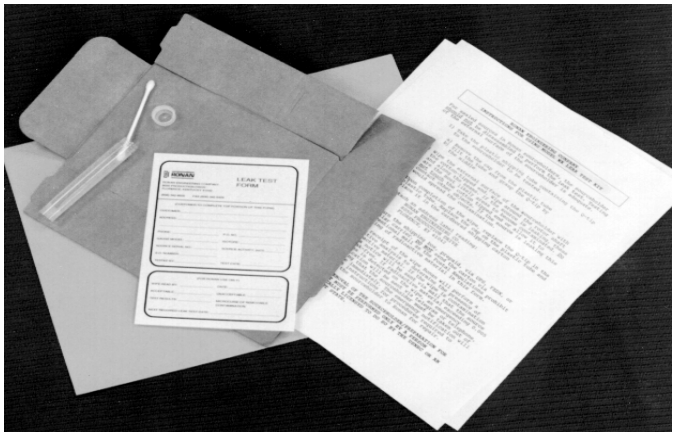
## Leak Test Kit

The leak test procedure described here applies only to the Leak Testing Kit (WPTST) purchased from Ronan. As part of the service Ronan provides a leak test kit consisting of these items:



A small plastic tube containing a cotton swab (Q-tip).

A Leak Test Form for processing the leak test.

Instructions for using the cotton swab and completing the form.

A cardboard shipping container for returning the plastic tube, Q-tip, and Leak Test Form to Ronan for processing. (The cardboard shipping container requires easy assembly)

## Preparing for the Leak Test

DO NOT disassemble the sealed source assembly.

Test only the external, or exposed, portion of the source holder.

Keep the cotton swab inside the plastic tube while carrying it to the source holder.

Place the source holder shutter in the OFF or LOCKED position. See Figure 1.

DO NOT touch the cotton swab to any surface other than the one source holder being tested.

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## Leak Test Procedure

Remove the cap from the plastic tube.

Tilt the plastic tube and grasp the cotton swab by the wooden end.

With the cotton-tipped end wipe the external surface of the source holder. Wipe at the test points shown in Figure 1, covering at least 100 $cm^2$ of the surface. (Approximately 16 $in^2$ )

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## Completing the Leak Test

With the cotton tip DOWN, replace the cotton swab in the plastic tube.

Replace the cap on the plastic tube.

Check the Radiation Label attached to the source holder AND copy the information from that label onto the top portion of the Leak Test Form.

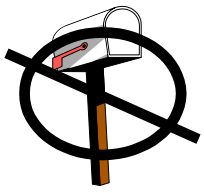
Place the plastic tube AND the completed Leak Test Form into the cardboard shipping tube.

Seal the cardboard shipping tube.

## Returning the Leak Test

Label the cardboard shipping tube as follows:

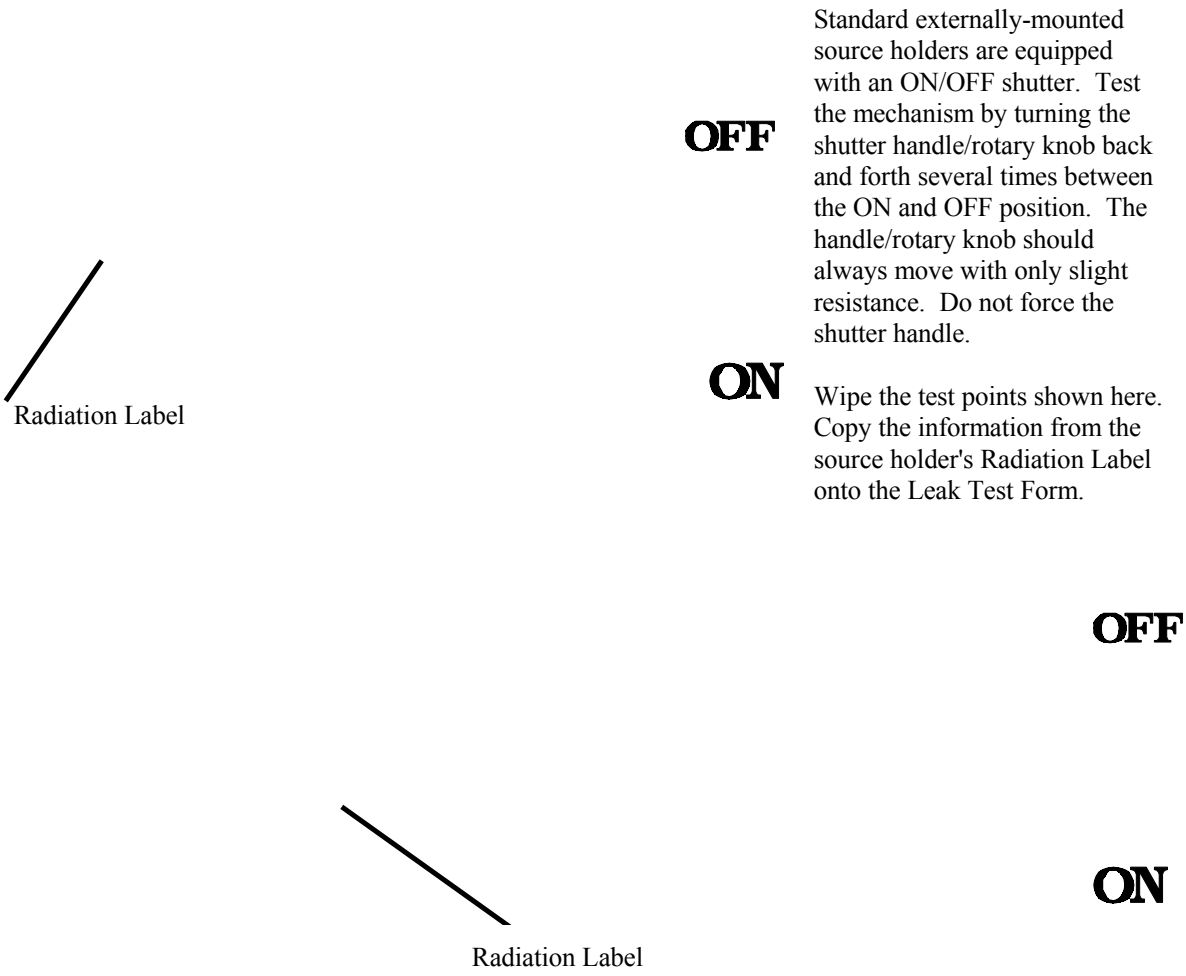
Ronan Engineering Company
8050 Production Drive
Florence, KY 41042 USA




DO NOT mail the completed leak test by conventional mail. U. S. Postal Regulations prohibit mailing radioactive material.

Return the leak test to Ronan in the cardboard shipping tube, prepaid, by a parcel express service such as UPS, FEDX, or similar carrier.

**Figure 1: Wipe Test / Shutter Test**




Standard externally-mounted source holders are equipped with an ON/OFF shutter. Test the mechanism by turning the shutter handle/rotary knob back and forth several times between the ON and OFF position. The handle/rotary knob should always move with only slight resistance. Do not force the shutter handle.

Wipe the test points shown here. Copy the information from the source holder's Radiation Label onto the Leak Test Form.

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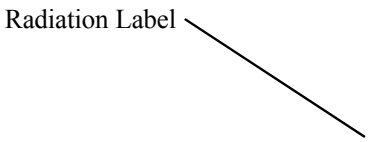
The internally-mounted well-type source holder is NOT equipped with a shutter. This source is retracted out of the well or dip tube and LOCKED back into the shielded holder for temporary storage.

Wipe the test points shown here. Copy the information from the source holder's Radiation Label onto the Leak Test Form.



## Processing the Completed Leak Test

Upon receipt of the leak test, Ronan will perform a sensitive analysis to determine the presence of radioactive material. If the cotton swab is contamination-free, Ronan will mail a certificate to the user indicating the results of the leak test. If radioactive material exceeding 0.005 micro Curies is detected on the cotton swab, Ronan will issue an emergency notification to the user, via telephone or FAX, advising that the source holder must be taken out of service and sent back for repair.

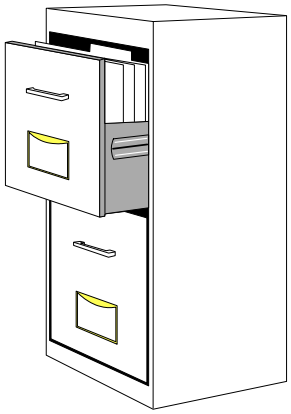
The emergency notification will contain detailed instructions for removing and shipping the source holder. Only Specifically Licensed individuals can remove a source holder and prepare to ship it.

## Records Requirement

Ronan maintains a record of each leak test analysis they perform. The record will include:

- Name and address of the customer
- Date the leak test was performed
- Name of person performing the leak test
- Name of person performing the analysis
- Date the analysis was performed
- Unique identification of the source being tested
- Source serial number
- The radioactive material and mass number of the source
- The leak test results expressed in microCuries

YOU are also responsible for maintaining records:



**Keep Records !**

Transfer Documents shipped with gage.

Initial Radiation Survey.

Periodic Leak/Shutter Tests.

Others documents as required by Federal, State, and/or local agencies.

Rev 0 - 9/94

# PART 19- NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS: INSPECTION AND INVESTIGATIONS

Sec.



## §19.1 Purpose

The regulations in this part establish requirements for notices, instructions, and reports by licensees to individuals participating in licensed activities and options available to these individuals in connections with Commission inspections of licensees to ascertain compliance with the provisions of the Atomic Energy Act of 1954, as amended, title II of the Energy Reorganization Act of 1974, and regulations, orders and licenses thereunder regarding radiological working conditions. The regulations in this part also establish the rights and responsibilties of the Commission and individuals during interviews compelled by subpoena as part of agency inspections or investigations pursuant to section 161c of the Atomic Energy Act of 1954, as amended, on any matter within the Commission's jurisdiction.

[55 FR 247, Jan. 4, 1990]

## §19.2 Scope.

The regulations in this part apply to all persons who receive, possess, use, or transfer material licensed by the Nuclear Regulatory Commission pursuant to the regulations in parts 30 through 36, 39, 40, 60, 61, 70, or part 72 of this chapter, including persons licensed to operate a production or utilization facility pursuant to part 50 of this chapter, persons licensed to possess power reactor spent fuel in an independent spent fuel storage installation (ISFSI) pursuant to part 72 of this chapter, and in accordance with 10CFR 76.60 to persons required to obtain a certificate of compliance or an approved compliance plan under part 76 of this chapter. The regulations regarding interviews of individuals under subpoena apply to all investigations and inspections within the jurisdiction of the Nuclear Regulatory Commission other than those involving NRC employees or NRC contractors. The regulations in this part do not apply to subpoenas issued pursuant to 10 CFR 2.720.

[59 FR 48959, Sept. 23,1994 as amended at 61 FR 9902, Mar. 12,1996]

## §19.3 Definitions.

As used in this part:

*Act* means the Atomic Energy Act of 1954, (68 Stat. 919) including any amendments thereto. *Commission* means the United States Nuclear Regulatory Commission.

*Exclusion* means the removal of counsel representing multiple interests from an interviewer whenever the NRC official conducting the interview has concrete evidence that the presence of the counsel would obstruct and impede the particular investigation or inspection.

*License* means a license issued under the regulations in parts 30 through 36, 39, 40, 60, 61, 70, or 72 of this chapter, including licenses to operate a production or utilization facility pursuant to part 50 of this chapter. *Licensee* means the holder of such a license.

*Restricted area* means an area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but seperate rooms in a residential building may be set apart as a restricted area.

*Sequestration* means the separation or isolation of witnesses and their attorneys from other witnesses and their attorneys during an interview conducted as part of an investigation , inspection, or other inquiry.

*Worker* means an individual engaged in activities licensed by the Commission and controlled by a licensee, but does not include the licensee.

[38 FR 22217, Aug. 17, 1973, as amended at 40 FR 8783, Mar. 3, 1975; 53 FR 31680, Aug. 19, 1988; 55 FR 247, Jan. 4 ,1990; 56 FR 23470, May 21, 1991; 56 FR 65948, Dec. 19, 1991; 57 FR 61785, Dec. 29, 1992; 58 FR 7736, Feb. 9, 1993]

## §19.4 Interpretations.

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by any officer or employee of the Commisssion other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

## §19.5 Communications

Except where otherwise specified in this part, all communications and reports concerning the regulations in this part should be addressed to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D of part 20 of this chapter. Communications, reports, and applications may be delivered in person at the Commission's offices at 2120 L Street, NW., Washington, DC, or at 11555 Rockville Pike, Rockville, Maryland.

[53 FR 6138, Mar.1,1998, as amended at 53 FR 43420,Oct. 27,1988]

### §19.11 Posting of notices to workers

(a) Each licensee shall post current copies of the following documents:

(1) The regulations in this part and in part 20 of this chapter;

(2) The license, license conditions, or documents incorporated into a license by reference, and amendments thereto;

(3) The operating procedures applicable to licensed activities;

(4) Any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or order issued pursuant to subpart B of part 2 of this chapter, and any response from the licensee.

(b) If posting of a document specified in paragraph (a) (1), (2) or (3) of this section is not practicable, the licensee may post a notice which describes the document and states where it may be examined.

(c)(1) Each licensee and each applicant for a specific license shall prominently post NRC Form 3, "Notice to Employees," dated August 1997. Later versions of NRC Form 3 that supersede the August 1997 version shall replace the previously posted version within 30 days of receiving the revised NRC Form 3 from the Commission.

(2) Additional copies of NRC Form 3 may be obtained by writing to the Regional Administrator of the appropriate U.S. Nuclear Regulatory Commission Regional Office listed in appendix D to part 20 of this chapter or by calling the NRC Information and Records Management Branch at 301-415-7232.

(d) Documents, notices, or forms posted pursuant to this section shall appear in a sufficient number of places to permit individuals engaged in licensed activities to observe them on the way to or from any particular licensed activity location to which the document applies, shall be conspicuous, and shall be replaced if defaced or altered.

(e) Commission documents posted pursuant to paragraph (a)(4) of this section shall be posted within 2 working days after receipt of the documents from the Commission; the licensee's response, if any, shall be posted within 2 working days after dispatch by the licensee. Such documents shall remain posted for a minimum of 5 working days or until action correcting the violation has been completed, whichever is later.

[38 FR 22217, Aug. 17, 1963, as amended at 40 FR 8783, Mar. 3,1975; 47 FR 30454, July 14, 1982; 58 FR 52408, Oct. 8, 1993; 60 FR 24551, May 9, 1995; 61 FR 6764, Feb. 22, 1996; 62 FR 48166, Sept. 15, 1997]

### §19.12 Instruction to workers.

(a) All individuals who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1 mSv) shall be —

(1) Kept informed of the storage, transfer, or use of radiation and/or radioactive material;

(2) Instructed in the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed;

(3) Instructed in, and required to observe, to the extent within workers control, the applicable provisions of Commission regulations and licenses for the protection of personnel from exposure to radiation and/or radioactive material;

(4) Instructed of their responsibility to report promptly to the licensee any condition which may lead to or cause a violation of Commission regulations and licenses or unnecessary exposure to radiation and/or radioactive material;

(5) Instructed in the appropriate response to warnings made in the event of any unusual occurence or malfunction that may involve exposure to radiation and/or radioactive material; and

(6) Advised as to the radiation exposure reports which workers may request pursuant to §19.13.

(b) In determining those individuals subject to the requirements of paragraph (a) of this section, licensees must take into consideration assigned activities during normal and abnormal situations involving exposure to radiation and/or radioactive materialwhich can be reasonably be expected to occur during the life of a licensed facility. The extent of these instructions must be commensurate with potential radiological health protection problems present in the work place.

[60 FR 36043, July 13, 1995]

### §19.13 Notifications and reports to individuals.

(a) Radiation exposure data for an individual, and

the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of an individual, shall be reported to the individual as specified in this section. The information reported shall include data and results obtained pursuant to Commission regulations, orders or license conditions, as shown in records maintained by the licensee pursuant to Commission regulations. Each notification and report shall: be in writing; include appropriate identifying data such as the name of the licensee, the name of the individual, the individual's social security number; include the individual's exposure information; and contain the following statement:

This report is furnished to you under the provisions of the Nuclear Regulatory Commission regulation 10 CFR part 19. You should preserve this report for further reference.

(b) Each licensee shall advise each worker annually of the worker's dose as shown in records maintained by the licensee pursuant to the provisions of §20.2106 of 10 CFR part 20.

(c)(1) At the request of a worker formerly engaged in licensed activities controlled by the licensee, each licensee shall furnish to the worker a report of the worker's exposure to radiation and/or radioactive material:

(i) As shown in records maintained by the licensee pursuant to § 20.2106 for each year the worker was required to be monitored under the provisions of § 20.1502; and

(ii) For each year the worker was required to be monitored under the monitoring requirements in effect prior to January 1,1994.

(2) This report must be furnished within 30 days from the time the request is made or within 30 days after the exposure of the individual has been made by the licensee, whichever is later. This report must cover the period of time that the worker's activities involved exposure to radiation from radioactive material licensed by the Commission and must include the dates and locations of licensed activities in which the worker participated during this period.

(d) When a licensee is required pursuant to §§ 20.2202, 20.2203, 20.2204, or 20.2206 of this chapter to report to the Commission any exposure of an individual to radiation or radioactive material the licensee shall also provide the individual a report on his or her exposure data included therein. This report must be transmitted at a time not later than the transmittal to the Commission.

(e) At the request of a worker who is terminating employment with the licensee that involved exposure to radiation or radioactive materials, during the current calendar quarter or the current year, each licensee shall provide at termination to each worker, or to the worker's designee, a written report regarding the radiation dose received by the worker from operations of the licensee during the current year or fraction thereof. If the most recent individual monitoring results are not available at that time. a written estimate of the dose must be provided together with a clear indication that this is an estimate.

[38 FR 22217, Aug. 17, 1973, as amended at 40 FR 8783, Mar. 3, 1975; 44 FR 32352, June 6, 1979; 58 FR 67658, Dec. 22, 1993; 59 FR 41642, Aug. 15, 1994]

### §19.14 Presence of representatives of licensees and workers during inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect materials, activities, facilities, premises, and records pursuant to the regulations in this chapter.

(b) During an inspection, Commission inspectors may consult privately with workers as specified in § 19.15. The licensee or licensee's representative may accompany Commission inspectors during other phases of an inspection.

(c) If, at the time of inspection, an individual has been authorized by the workers to represent them during Commission inspections, the licensee shall notify the inspectors of such authorization and shall give the workers' representative an opportunity to accompany the inspectors during the inspection of physical working conditions.

(d) Each workers' representative shall be routinely engaged in licensed activities under the control of the licensee and shall have received instructions as specified in §19.12.

(e) Different representatives of licensees and workers may accompany the inspectors during different phases of an inspection if there is no resulting interference with the conduct of the inspection. However, only one workers' representative at a time may accompany the inspectors.

(f) With the approval of the licensee and the workers' representative an individual who is not routinely engaged in licensed activities under the control of the licensee, for example, a consultant to the licensee or to the workers' representative, shall be afforded the opportunity to accompany Commission inspectors during the inspection of physical working conditions.

(g) Notwithstanding the other provisions of this section, Commission inspectors are authorized to refuse to permit accompaniment by any individual who deliberatly interferes with a fair and orderly inspection. With regard to areas containing information classified by an agency of the U.S. Government in the interest of national security, an individual who accompanies an inspector may have access to such information only if authorized to do so. With regard to

any area containing proprietary information, the workers' representative for that area shall be an individual previously authorized by the licensee to enter that area.

### §19.15 Consultation with workers during inspections

(a) Commission inspectors may consult privately with workers concerning matters of occupational radiation protection and other matters related to applicable provisions of Commission regulations and licenses to the extent the inspectors deem necessary for the conduct of an effective and thorough inspection.

(b) During the course of an inspection any worker may bring privately to the attention of the inspectors, either orally or in writing, any past or present condition which he has reason to believe may have contributed to or caused any violation of the act, the regulations in this chapter, or license condition, or any unecessary exposure of an individual to radiation from licensed radioactive material under the licensees control. Any such notice in writin shall comply with the requirements of
§ 19.16(a).

(c) The provisions of paragraph (b) of this section shall not be interpreted as authorization to disregard instructions pursuant to § 19.12.

### §19.16 Requests by workers for inspections.

(a) Any worker or representative of workers who believes that a violation of the Act, the regulations in this chapter, or license conditions exists or has occurred in license activities with regard to radiological working conditions in which the worker is engaged, may request an inspection by giving notice of the alleged violation to the Administrator of the appropriate Commission Regional Office, or to Commission inspectors. Any such notice shall be in writing, shall set forth the specific grounds for the notice, and shall be signed by the worker or the representative of workers. A copy shall be provided the licensee by the Regional Office Administrator, or the inspector no later than at the time of inspection except that, upon request of the worker giving such notice, his name and the name of individuals referred to therein shall not appear in such copy or on any record published, released or made available by the Commission, except for good cause shown.

(b) If, upon receipt of such notice, the Regional Office Administrator determines that the complaint meets the requirements set forth in paragraph (a) of this section, and that there are reasonable grounds to believe that the alleged violation exists or has occurred, he shall cause an inspection to be made as soon as practicable, to determine if such alleged violation exists or has occurred. Inspections pursuant to this section need not be limited to matters referred to in the complaint.

[ 38 FR 22217, Aug. 17,1973, as amended at 40 FR 8783, Mar. 3, 1975; 47 FR 30454, July 14, 1982; 52 FR 31610, Aug. 21, 1987]

### §19.17 Inspections not warranted; informal review.

(a) If the Administrator of the appropriate Regional Office determines, with respect to a complaint under § 19.16, that an inspection is not warranted because there are no reasonable grounds to believe that a violation exists or has occurred, he shall notify the complainant in writing of such determination. The complainant may obtain review of such determination by submitting a written statement of position with the Executive Director for Operations, U.S. Nuclear Regulatory Commission, Washington, DC 20555, who will provide the licensee with a copy of such statement by certified mail, excluding, at the request of the complainant, the name of the complainant. The licensee may submit an opposing written statement of position with the Executive Director for Operations who will provide the complainant with a copy of such statement by certified mail. Upon the request of the complainant, the Executive Director for Operations or his designee may hold an informal conference in which the complainant and the licensee may orally present their views. An informal conference may also be held at the request of the licensee, but disclosure of the identity of the complainant will be made only following receipt of written authorization from the complainant. After considering all written and oral views presented, the Executive Director for Operations shall affirm, modifying, or reverse the determination of the Administrator of the appropriate Regional Office and furnish the complainant and the licensee a written notification of his decision and the reason therefor.

(b) If the Administrator of the appropriate Regional Office determines that an inspection is not warranted because requirements of § 19.16(a) have not been met, he shall notify the complainant in writing of such determination.

Such determination shall be without prejudice to the filing of a new complaint meeting the requirements of § 19.16(a).

[ 38 FR 22217, Aug. 17, 1973, as amended at 40 FR 8783, Mar. 3, 1975; 52 FR 31610, Aug. 21, 1987]

### §19.30 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of—

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of—

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

[ 57 FR 55071, Nov. 24, 1992]

### §19.31 Application for exemptions.

The Commission may upon application by any licensee or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not result in undue hazard to life or property.

### §19.32 Discrimination prohibited.

No person shall on the ground of sex be excluded from participation in, be denied benefits of, or be subjected to discrimination under any program or activity licensed by the Nuclear Regulatory Commission. This provision will be enforced through agency provisions and rules similar to those already established, with respect to racial and other discrimination, under title VI of the Civil Rights Act of 1964. This remedy is not exclusive, however, and will not prejudice or cut off any other legal remedies available to a discriminatee.

[ 40 FR 8783, Mar. 3, 1975]

# PART 20- STANDARDS FOR PROTECTION AGAINST RADIATION

## Subpart A — General Provisions



## Subpart B—Radiation Protection Programs



## Subpart C—Occupational Dose Limits



## Subpart D—Radiation Dose Limits for Individual Members of the Public



## Subpart F—Surveys and Monitoring



## Subpart I—Storage and Control of Licensed Material



## Subpart J—Precautionary Procedures



## Subpart K—Waste Disposal



## Subpart L—Records



## Subpart M—Reports



## Subpart N—Exemptions and Additional Requirements



## Subpart O—Enforcement



AUTHORITY:Secs.3,63,65,81,103,104,161,182,186,68 Stat.930,933.935,937,948,953,955,asamended,sec.1701,106 Stat.2951,2952,2953,(42U.S.C.2073,2093,2095,2111,2133,2134, 2201,2232,2236,2297f),secs. 201,as amended, 202,206,88 Stat.1242, as amended, 1244,1246,(42 U.S.C 5841,5842,5846).

## Subpart A—General Provisions

SOURCE:56 FR 23391, May 21,1991,unless otherwise noted.

### §20.1001 Purpose

(a) The regulations in this part establish standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Reagulatory Commission. These regulations are issued under the Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974, as amended.

(b) It is the purpose of the regulations in this part to control the receipt, possession, use, transfer, and disposal of licensed material by any licensee in such a manner that the total dose to an individual (including doses resulting from licensed and unlicensed radioactive material and from radiation sources other than background radiation) does not exceed the standards for protection against radiation prescribed in the regulations in this part. However, nothing in this part shall be construed as limiting actions that may be necessary to protect health and safety.

**§20.1002 Scope**

The regulations in this part apply to persons licensed by the Commission to receive, possess, use, transfer, or dispose of byproduct, source, or special nuclear material or to operate a production or utilization facility under parts 30 through 35, 39, 40, 50, 60, 61, 70, 0r 72 of this chapter. The limits in this part do not apply to doses due to background radiation, to exposure of patients to radiation for the purpose of medical diagnosis or therapy, to exposure from individuals administered radioactive material and released in accordance with §35.75, or to exposure from voluntary participation in medical research programs.

[62 FR 4132, Jan. 29, 1997]

**§20.1003 Definitions**

As used in this part:

*Absorbed dose* means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy). *Absorbed dose* means the energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

*Act* means the Atomic Energy Act of 1954 (42 U. S.C. 2011 *et seq.*), as amended.

*Activity* is the rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the becquerel (Bq).

*Adult* means an individual 18 or more years of age.

*Airborne radioactive material* means radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

*Airborne radioactivity area* means a room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations—

(1) In excess of the derived air concentrations (DACs) specified in appendix B, to §§20.1001-20.2401 or

(2) To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours.

*ALARA* (acronym for "as low as is reasonably achievable") means making every reasonable effort to maintain exposures to radiation as far below the dose limits in this part as practical consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

*Annual limit on intake* (ALI) means the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any individual organ or tissue. (ALI values for intake by ingestion and by inhalation of selected radionuclides are given in Table 1, Columns 1 and 2, of appendix B to §§20.1001-20.2401).

*Background radiation* means radiation from cosmic sources; naturally occuring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclearexplosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "*Background radiation*" does not include radiation from source, byproduct, or special nuclear materials regulated by the Commission.

*Bioassay* (radiobioassay) means the determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

*Byproduct material* means—

(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or utilizing special nuclear material; and

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition.

*Class* (or *lung class or inhalation class*) means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (days) of less than 10 days, for Class W(Weeks) from 10 to 100 days, and for Class Y (Years) of greater than 100 days.

*Collective dose* is the sum of the individual doses

received in a given period of time by a specified population from exposure to a specified source of radiation.

*Commission* means the Nuclear Regulatory Commission or its duly authorized representatives.

*Committed dose equivalent* ($H_{T,50}$) means the dose equivalent to organs or tissues of reference (T) that will be received from the intake of radioactive material by an individual during the 50-year period following the intake.

*Committed effective dose equivalent* ($H_{E,50}$) is the sum of the products of the weighting factors applibcable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues ($H_{E,50}$) =$\sum W_T H_{T,50}$).

*Constraint (dose constraint)* means a value above which specified licensee actions are required.

*Controlled area* means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

*Controlled area* means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

*Critical Group* means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

*Declared pregnant woman* means a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

*Decommission* means to remove a facility or site safely from service and resduce residual radioactivity to a level that permits—

(1) Release of the property for unrestricted use and termination of the license; or

(2) Release of the property under restricted conditions and termination of the license.

*Deep-dose equivalent* ($H_d$), which applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1cm (1000mg/cm$^2$).

*Department* means the Department of Energy established by the Department of Energy Organization Act (Pub. L. 95-91,91 Stat. 565, 42 U.S.C 7101 *et seq*.) to the extent that the Department, or its duly authorized representatives, exercises functions formerly vested in the U.S. Atomic Energy Commission, its Chairman, members, officers, and components and transferred to the U.S. Energy Research and Development Administration and to the Administrator thereof pursuant to sections 104(b), (c), and (d) of the Energy Reorganization Act of 1974 (Pub. L. 93-438, 88 Stat. 1233 at 1237, 42 U.S.C. 5814) and retransferred to the Secretary of Energy pursuant to section 301(a) of the Department of Energy Reorganization Act (Pub. L. 95-91, 91 Stat 565 at 577-578, 42 U.S.C. 7151).

*Derived air concentration* (DAC) means the concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in Table 1, Column 3, of appendix B to §§20.1001-20.2401.

*Derived air concentration-hour* (DAC-hour) is the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rems (0.05 Sv).

*Distinguishable from background* means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

*Dose or radiation dose* is a generic term that means absorbed dose , dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent, as defined in other paragraphs of this section.

*Dose equivalent* ($H_T$) means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

*Dosimetry processor* means an individual or organization that processes and evaluates individual monitoring equipment in order to determine the radiation dose delivered to the equipment.

*Effective dose equivalent* ($H_E$) is the sum of the products of the dose equivalent to the organ or tissue ($H_T$) and the weighting factors ($W_T$) applicable to each of the body organs or tissues that are irradiated ($H_E$=$\Sigma W_T H_T$).

*Embryo / fetus* means the developing human organism from conception until the time of birth.

*Entrance or access point* means any location through which an individual could gain access to radiation areas or to radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

*Exposure* means being exposed to ionizing radiation or to radioactive material.

*External dose* means that portion of the dose equivalent received from radiation sources outside the body.

*Extremity* means hand, elbow, foot, knee, or leg below the knee.

*Eye dose equivalent* applies to the external exposure of the lens of the eye and is take as the dose

equivalent at a tissue depth of 0.3 centimeter (300mg / $cm^2$).

*Generally applicable environmental radiation standards* means standards issued by the Environmental Protection Agency (EPA) under the authority of the Atomic Energy Act of 1954, as amended, that impose limits on radiation exposures or levels, or concentrations or quantities of radioactive material, in the general environment outdside the boundaries of locations under the control of persons possessing or using radioactive material.

*Government agency* means any executive department, commission, independent establishment, corporation wholy or partly owned by the United States of America, which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the government. *Gray* [See §20.1004]

*High radiation area* means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem (1mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

*Individual* means any human being.

*Individual monitoring* means—

(1) The assessment of dose equivalent by the use of devices designed to be worn by an individual;

(2) The assessment of committed effective dose equivalent by bioassay (see *Bioassay*) or by determination of the time-weighted air concentrations to which an individual has been exposed, i.e., DAC-hours; or

(3) The assessment of dose equivalent by the use of survey data.

*Individual Monitoring Devices (individual monitoring equipment)* means devices designed to be worn by a single individual for the assessment of dose equivalent such as films badges, thermoluminescent dosimeters (TLDs), pocket ionziation chambers, and personal ("lapel") air sampling devices.

*Internal dose* means that portion of the dose equivalent received from radioactive material taken into the body.

*License* means a license issued under the regulations in parts 30 through 36, 39, 40, 50, 60, 61, 70, or 72 of this chapter.

*Licensed material* means source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the Commission.

*LIcensee* means the holder of a license.

*Limits* (dose limits) means the permissible upper bounds of radiation doses.

*Lost or missing licensed material* means licensed material whose location is unknown. It includes material that has been shipped but has not reached its destination and whose location cannot be readily traced in the transportation system.

*Member of the public* means any individual except when that individual is receiving an occupational dose.

*Minor* means an individual less than 18 years of age.

*Monitoring* (radiation monitoring, radiation protection monitoring) means the measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

*Nonstochastic effect* means health effects, the severity of which varies with the dose and for which a threshold is believed to exist. Radiation-induced cataract formation is an example of a nonstochastic effect (also called a deterministic effect).

*NRC* means the Nuclear Regulatory Commission or its duly authorized representatives.

*Occupational dose* means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include dose received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive materials and released in accordance with §35.75 from voluntary participation in medical research programs, or as a member of the public.

*Person* means—

(1) Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department of Energy (except the Department shall be considered a person within the meaning of the regulations in 10 CFR chapter I to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission under section 202 of the Energy Reorganization Act of 1974 (88 Stat. 1244), the Uranium Mill Tailings Radiation Control Act of 1978 (92 Stat.3021), the Nuclear Waste Policy Act of 1982 (96 Stat. 2201), and section 3(b)(2) of the Low-Level Radioactive Waste Policy Amendments Act of 1985 (99 Stat. 1842), any State or any political subdivision of any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and

(2) Any legal successor, representative, agent, or agency of the foregoing.

*Planned special exposure* means an infrequent

exposure to radiation, seperate from and in addition to the annual dose limits.

*Public dose* means the dose received by a member of the public from exposure to radiation or radioactive material released by a licensee, or to any other source of radiation under control of a licensee. Public dose does not include occupational dose or doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with §35.75, or from voluntary participation in medical research programs.

*Quality factor (Q)* means the modifying factor (listed in tables 1004(b).1 and 1004(b).2 of §20.1004) that is used to derive dose equivalent from absorbed dose.

*Quarter* means a period of time equal to one-fourth of the year observed by the licensee (approximately 13 consecutive weeks), providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

*Rad* (See §20.1004).

*Radiation* (ionizing radiation) means alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this part, does not include non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

*Radiation area* means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

*Reference man* means a hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used by researchers and public health workers to standardize results of experiments and to relate biological input to a common base.

*Rem* (See §20.10014)

*Residual radioactivity* means radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under a licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site and previous burials at the site, even if those burials were made in accordance with the provisions of 10 CFR part 20.

*Respiratory protective device* means an appartus, such as a respirator, used to reduce the individual's intake of airborne radioactive materials.

*Restricted area* means an area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms un a residential building may be set apart as a restricted area.

*Sanitary sewerage* means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the licensee.

*Shallow-dose equivalent* ($H_S$), which applies to the external exposure of the skin or an extremity, is taken as the dose equivalent at a tissue depth of 0.007 centimeter (7mg / $cm^2$) averaged over an area of 1 square centimeter.

*Sievert* (See §20.1004)

*Site boundary* means that line beyond which the land or property is not owned, leased, or otherwise controlled by the licensee.

*Source material* means—

(1) Uranium or thorium or any combination of uranium and thorium in any physical or chemical form; or

(2) Ores that contain, by weight, one-twentieth of 1 percent (0.05 percent), or more, of uranium, thorium, or any combination of uranium and thorium. Source material does not include special nuclear material.

*Special nuclear material* means—

(1) Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the Commission, pursuant to the provisions of section 51 of the Act, determines to be special nuclear material, but does not include source material; or

(2) Any material artificially enriched by any of the foregoing but does not include source material.

*Stochastic effects* means health effects that occur randomly and for which the probability of the effect occuring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

*Survey* means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels or quantities of radioactive material present.

*Total Effective Dose Equivalent* (TEDE) means the sum of the deep-dose equivalent (for external exposures)and the committed effective dose equivalent (for internal exposures)

*Unrestricted area* means an area, access to which is neither limited nor controlled by the licensee.

*Uranium fuel cycle* means the operations of milling of uranium ore, chemical conversion of uranium, isotopic enrichment of uranium, fabrication of uranium fuel, generation of electricity by a light-water-cooled nuclear power plant using uranium fuel, and reprocessing of spent uranium fuel to the extent that these activities directly support the production of electrical power for public use. Uranium fuel cycle does not include mining operations, operations at waste disposal sites, transportation of radioactive material in support of these operations, and the reuse of recovered non-uranium special nuclear and byproduct materials from the cycle.

*Very high radiation area* means an area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source or from any surface that the radiation penetrates. Note: At very high doses received at high dose rates, units of absorbed dose (e. g., rads and grays) are appropriate, rather than units of dose equivalent (e.g., rems and sieverts).

*Week* means 7 consecutive days starting on Sunday.

*Weighting factor* $W_T$, for an organ or tissue (T) is the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of $W_T$ are:

ORGAN DOSE WEIGHTING FACTORS

| Organ or tissue | $W_T$ |
|---|---|
| Gonads | 0.25 |
| Breast | 0.15 |
| Red bone marrow | 0.12 |
| Lung | 0.12 |
| Thyroid | 0.03 |
| Bone surfaces | 0.03 |
| Remainder | [1] 0.30 |
| Whole body | [2] 1.00 |

[1] 0.30 results from 0.06 for each of the "remainder" organs (excluding the skin and the lens of the eye) that receive the highest doses.

[2] For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor, $W_T$=1.0 has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

*Whole body* means, for purposes of external exposure, head, trunk, (including male gonads), arms above the elbow, or legs above the knee.

*Working level* (WL) is any combination of short-lived radon daughters (for radon-222: polonium-218, lead-214, bismuth-214, and polonium-214;and for radon-220: polonium-216, lead-212, bismuth-212, and polonium-212) in 1 liter of air that will result in the ultimate emission of 1.3 x $10^5$ MeV of potential alpha particle energy.

*Working level month* (WLM) means an exposure to 1 working level for 170 hours (2,000 working hours per year/12 months per year = approximately 170 hours per months).

*Year* means the period of time beginning in January used to determine compliance with the provisions of this chapter. The licensee may change the starting date of the year used to determine compliancs by the licensee provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

[56 FR 23391, May 21, 1991, as amended at 57 FR 57878, Dec. 8, 1992; 58 FR 7736, Feb. 9, 1993; 60 FR 36043, July 13, 1995; 60 FR 48625, Sept. 20, 1995; 61 FR 65127, Dec. 10, 1996; 62 FR 4133, Jan. 29, 1997; 62 FR 39087, July 21, 1997]

### §20.1004 Units of radiation dose.

(a) Definitions. As used in this part, the units of radiation dose are:

*Gray* (Gy) is the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule/kilogram (100 rads).

*Rad* is the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 egrs/gram or 0.01joule/kilogram (0.01 gray).

*Rem* is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem=0.01 sievert).

*Sievert* is the SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv=100 rems).

(a) As used in this part, the quality factors for converting absorbed dose to dose equivalent are shown in table 1004(b).1.

Table 1004(b).1 —Quality Factors and Absorbed Dose Equivalencies

* Absorbed dose in rad equal to 1 rem or the absorbed dose in gray equal 1 sievert

(c) If it is more convenient to measure the neu-

tron fluence rate than to determine the neutron dose equivalent rate in rems per hour or sieverts per hour, as provided in paragraph (b) of this section, 1 rem (0.01 Sv) of neutron radiation of unknown energies may, for purposes of the regulations in this part, be assumed to result from a total fluence of 25 million neutrons per square centimeter incident upon the nody. If sufficient information exists to estimate the approximate energy distribution of the neutrons, the licensee may use the fluence rate per unit dose equivalent or the appropriate Q value from table 1004(b).2 to convert a measured tissue dose in rads to dose equivalent in rems.

Table 1004(b).2 —Mean Quality Factors, Q, And Fluence Per Unit Dose Equivalent

| Type of radiation | Quality factor (Q) | Absorbed dose equal to a unit dose equivalent* |
|---|---|---|
| X-,gamma, or beta radiation | 1 | 1 |
| Alpha particles, multiple-charged particles, fission fragments and heavy particles of unknown charge | 20 | 0.05 |
| Neutrons of unknown energy | 10 | 0.1 |
| High-energy protons | 10 | 0.1 |

For Monoenergetic Neutrons

[a] Value of quality factor (Q) at the point where the dose equivalent is maximum in a 30-cm diameter cylinder tissue-equivalent phantom.

[b] Monoenergetic neutrons incident normally on a 30-cm diameter cylinder tissue-equivalent phantom.

### §20.1005 Units of radioactivity

For the purposes of this part, activity is expressed in the special unit of curies (Ci) or in the SI unit of becquerels (Bq), or their multiples, or disintegrations (transformations) per unit of time.

(a) One becquerel = 1 disintegration per second ($s^{-1}$).

(b) One curie = $3.7x10^{10}$ disintegrations per second = $3.7x10^{10}$ becquerels = $2.22x10^{12}$ disintegrations per minute.

[56 FR 23391, May 21, 1991, 56 FR 61352, Dec. 3, 1991]

### §20.1006 Interpretations

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part by an officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

| | Neutron energy (MeV) | Quality factor (Q)[a] | Fluence per unit dose equivalent[b] (neutrons $cm^{-2}$ $rem^{-1}$) |
|---|---|---|---|
| (thermal) | $2.5x10^{-8}$ | 2 | $980x10^{6}$ |
| | $1x10^{-7}$ | 2 | $980x10^{6}$ |
| | $1x10^{-6}$ | 2 | $810x10^{6}$ |
| | $1x10^{-5}$ | 2 | $810x10^{6}$ |
| | $1x10^{-4}$ | 2 | $840x10^{6}$ |
| | $1x10^{-3}$ | 2 | $980x10^{6}$ |
| | $1x10^{-2}$ | 2.5 | $1010x10^{6}$ |
| | $1x10^{-1}$ | 7.5 | $170x10^{6}$ |
| | $5x10^{-1}$ | 11 | $39x10^{6}$ |
| | 1 | 11 | $27x10^{6}$ |
| | 2.5 | 9 | $29x10^{6}$ |
| | 5 | 8 | $23x10^{6}$ |
| | 7 | 7 | $24x10^{6}$ |
| | 10 | 6.5 | $24x10^{6}$ |
| | 14 | 7.5 | $17x10^{6}$ |
| | 20 | 8 | $16x10^{6}$ |
| | 40 | 7 | $14x10^{6}$ |
| | 60 | 5.5 | $16x10^{6}$ |
| | $1x10^{2}$ | 4 | $20x10^{6}$ |
| | $2x10^{2}$ | 3.5 | $19x10^{6}$ |
| | $3x10^{2}$ | 3.5 | $16x10^{6}$ |
| | $4x10^{2}$ | 3.5 | $14x10^{6}$ |

### §20.1007 Communications

Unless otherwise specified, communications or reports concerning the regulations in this part should be addressed to the Executive Director for Operations, U.S. Nuclear Regulatory Commission, Washington, DC 20555. A communication, report, or application may be delivered in person to the Office of the Executive Director for Operations, 11555 Rockville Pike, Rockville MD 20852.

## Subpart B—Radiation Protection Programs

SOURCE: 56 FR 23396, May 21, 1991, unless otherwise noted.

### §20.1101 Radiation protection programs.

(a) Each licensee shall develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of this part. (See §20.2102 for recordkeeping requirements relating to these programs.)

(b) The licensee shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

(c) The licensee shall periodically (at least annually) review the radiation protection program content and implementation.

(d) To implement the ALARA requirements of §20.1101 (b), and not withstanding the requirements in §20.1301 of this part, a constraint on air emissions of radioactive material to the environments, excluding Radon-222 and its daughters, shall be established by licensees other than those subject to §50.34a, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10mrem (0.1mSv) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in §20.2203 and promptly take appropriate corrective action to ensure against reocurrence.

[56 FR 23396, May 21,1991, as amended at 61 FR 65127, Dec. 10, 1996.]

## Subpart C—Occupational Dose Limits

SOURCE: 56 FR 23396, May 21,1991, unless otherwise noted.

### §20.1201 Occupational dose limits for adults.

(a) The licensee shall control the occupational dose to individual adults, except for planned special exposures under §20.1206, to the following dose limits.

(1) An annual limit, which is the more limiting of—

(i) The total effective dose equivalent being equal to 5 rems (0.05 Sv); or

(ii) The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 Sv). (2) The annual limits to the lens of the eye, to the skin, and to the extremities, which are:

(i) An eye dose equivalent of 15 rems (0.15 Sv), and

(ii) A shallow-dose equivalent of 50 rems (0.50 Sv) to the skin or to any extremity.

(b) Doses received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, must be subtracted from the limits for planned special exposures that the individual may receive during the current year (see §20.1206(e)(1) and during the individual's lifetime (see §20.1206(e)(2).

(c) The assigned deep-dose equivalent and shallow-dose equivalent must be for the part of the body receiving the highest exposure. Thee deep-dose equivalent, eye dose equivalent and shallow-dose equivalent may be assessed from surveys or other radiation measurements for the purpose of demonstrating compliance with the occupational dose limits, if the individual monitoring device was not in the region of highest potential exposure, or the results of individual monitoring are not available.

(d) Derived air concentration (DAC) and annual limit on intake (ALI) values are presented in table 1 of appendix B to part 20 and may be used to determine the individual's dose (see §20.2106) and to demonstrate compliance with the occupational dose limits.

(e) In addition to the annual dose limits, the licensee shall limit the soluble uranium intake by an individual to 10 milligrams in a week in consideration of chemical toxicity (see footnote 3 of appendix B to part 20).

(f) The licensee shall reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other person (see §20.2104 (e)).

[56 FR 23396, May 21, 1991, as amended at 60 FR 21085, Apr. 25,1995]

### §20.1202 Compliance with requirements for summation of external and internal doses.

(a) If the licensee is required to monitor under both §§20.1502(a) and (b), the licensee shall demonstrate compliance with the dose limits by summing external and internal doses. If the licensee is required to monitor only under §20.1502(a) or only under §20.1502(b), then summation is not required to demonstrate compliance with the dose limits. The licensee may demonstrate compliance with the requirements for summation of external and internal doses by meeting one of the conditions specified in paragraph (b) of this section and the conditions in paragraphs (c) and (d) of this section.

(NOTE: The dose equivalents for the lens of the eye, the skin, and the extremities are not included in the summation, but are subject to

seperate limits.)

(b) *Intake by inhalation.* If the only intake of radionuclides is by inhalation, the total effective equivalent limit is not exceeded if the sum of the deep-dose equivalent divided by the total effective dose equivalent limit, and one of the following, does not exceed unity:

(1) The sum of the fractions of the inhalation ALI for each radionuclide, or

(2) The total number of derived air concentration-hours (DAC-hours) for all radionuclides divided by 2,000, or

(3) The sum of the calculated committed effective dose equivalents to all significantly irradiated[1] organs or tissues (T) calculated from bioassay data using appropriate biological models and expressed as a fraction of the annual limit.

(c) *Intake by oral ingestion.* If the occupationally exposed individual also receives and intake of radionuclides by oral ingestion greater than 10 percent of the applicable oral ALI, the licensee shall account for this intake and include it in demonstrating compliance with the limits.

(d) *Intake through wounds or absorption through skin.* The licensee shall evaluate and , to the extent practical, account for intakes through wounds or skin absorption.

NOTE: The intake through intact skin has been included in the calculation of DAC for hydrogen-3 and does not need to be further evaluated.

[56 FR 23396, May 21, 1991, as amended at 57 FR 57878, Dec. 8, 1992]

### §20.1203 Determination of external dose from airborne radioactive material.

Licensees shall, when determining the dose from airborne radioactive material, include the contributiom to the deep-dose equivalent, eye-dose equivalent, and shallow-dose equivalent from external exposure to the radioactive cloud (see appendix B to part 20, footnotes 1 and 2).

NOTE: Airborne radioactivity measurements and DAC values should not be used as the primary means to assess the deep-dose equivalent when the airborne radioactive material includes radionuclides other than noble gases or if the cloud of airborne radioactive material is not relatively uniform. The determination of the deep-dose equivalent to an individual should be based upon measurements using instruments or individual monitoring devices.[1] An organ or tissue is deemed to be significantly irradiated if, for that organ or tissue, the product of the weighting factor, $w_T$, and the committed dose equivalent, $H_{T,50}$, per unit intake is greater than 10 percent of the maximum weighted value of $H_{T,50}$, (i.e. $w_T$ $H_{T,50}$) per unit intake for any organ or tissue.

[56 FR 23396, May 21, 1991, as amended at 60 FR 20185, Apr. 25, 1995]

### §20.1204 Determination of internal exposure

(a) For purposes of assessing dose used to determine compliance with occupational dose equivalent limits, the licensee shall, when required under §20.1502, take suitable and timely measurements of—

(1) Concentrations of radioactive materials in air in work areas; or

(2) Quantities of radionuclides in the body; or

(3) Quantities of radionuclides excreted from the body; or

(4) Combinations of these measurements.

(b) Unless respiratory protective equipment is used, as provided in §20.1703, or the assessment of intake is based on bioassays, the licensee shall assume that an individual inhales radioactive material at the airborne concentration in which the individual is present.

(c) When specific information on the physical and biochemical properties of the radionuclides taken into the body or the behavior or the material in an individual is known, the licensee may—

(1) Use that information to calculate the committed effective dose equivalent , and, if used, the licensee shall document that information in the individual's record; and

(2) Upon prior approval of the Commission, adjust the DAC or ALI values to reflect the actual physical and chemical characteristics of airborne radioactive material (e.g. aerosol size distribution or density); and

(3) Separately assess the contribution of fractional intakes of Class D, W, or Y compounds of a given radionuclide (see appendix B to part 20) to the committed effective dose equivalent.

(d) If the licensee chooses to assess intakes of Class Y material using the measurements given in §20.1204(a)(2) or (3), the licensee may delay the recording and reporting of the assessments for periods up to 7 months, unless otherwise required by §§20.2202 or 20.2203, in order to permit the licensee to make additional measurements basic to the assessments.

(e) If the identity and concentration of each radionuclide in a mixture are know, the fraction of the DAC applicable to the mixture for use in calculating DAC-hours must be either— (1) The sum of the ratios of the concentration to the appropriate DAC value (e.g. D, W, Y) from appendix B to part 20 for each radionuclide in the mixture; or

(2) The ratio of the total concentration for all the radionuclides in the mixture to the most restrictive DAC value for any radionuclide in the mixture.

(f) If the identity of each radionuclide in a mixture is known, but the concentration of one or more of the radionuclides is not known, the DAC for the mixture

must be the most restrictive DAC of any radionuclide in the mixture.

(g) When a mixture of radionuclides in air exists, licensees may disregard certain radionuclides in the mixture if—

(1) The licensee uses the total activity of the mixture in demonstrating compliance with the dose limits in §20.1201 and in complying with the monitoring requirements of §20.1502(b), and

(2) The concentration of any radionuclide disregarded is less than 10 percent of its DAC, and

(3) The sum of these percentages for all of the radionuclides disregarded in the mixture does not exceed 30 percent.

(h)(1) In order to calculate the committed effective dose equivalent, the licensee may assume that the inhalation of one ALI, or an exposure of 2,000 DAC-hours, results in a committed effective dose equivalent of 5 rems (0.05 Sv) for radionuclides that have their ALIs or DACs based on the committed effective dose equivalent.

(2) When the ALI (and the associated DAC) is determined by the nostochastic organ dose limit of 50 rems (0.5 Sv), the intake of radionuclides that would result in a committed effective dose equivalent of 5 rems (0.05 Sv) (the stochastic ALI) is listed in parantheses in table 1 of appendix B to part 20. In this case, the licensee may, as a simplifying assumption, use the stochastic ALIs to determine committed effective dose equivalent. However, if the licensee uses the stochastic ALIs, the licensee must also demonstrate that the limit in §20.1201(a)(1)(ii) is met.

[56 FR 23396, May 21, 1991, as amended at 60 FR 20185, Apr.25, 1995]

### §20.1207 Occupational dose limits for minors.

The annual occupational dose limits for minors are 10 percent of the annual dose limits specified for adults workers in §20.1201.

### §20.1208 Dose to an embryo / fetus.

(a) The licensee shall ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). (For recordkeeping requirements see §20.2106.)

(b) The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisy the limit in paragraph (a) of this section.

(c) The dose to an embryo/fetus shall be taken as the sum of—

(1) The deep-dose equivalent to the declared pregnant woman; and

(2) The dose to the embry/fetus from radionuclides in the embry/fetus and radionuclides in the declared pregnant woman.

(d) If the dose to the embry/fetus is found to have exceeded 0.5 rem (5mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with paragraph (a) of this section if the additional dose to the embry/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

## Subpart D—Radiation Dose Limits for Individual Members of the Public

SOURCE: 56 FR 23398, May 21, 1991, unless otherwise noted.

### §20.1301 Dose limits for individual members of the public.

(a) Each licensee shall conduct operations so that—

(1) The total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem(1 millisievert) in a year, exclusive of the dose contributions from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with §35.75, from voluntary participation in medical research programs, and from the licensee's disposal of radioactive material into sanitary sewerage in accordance with §20.2003, and

(2) The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material and released in accordance with §35.75, does not exceed 0.002 rem (0.02 millisievert) in any one hour.

(b) If the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals.

(c) A licensee or license applicant may apply for prior NRC authorization to operate up to an annual dose limit for an individual member of the public of 0.05 rem (5 mSv). The licensee or license applicant shall include the following information in this application:

(1) Demonstration of the need for and the expected duration of operations in excess of the limit in paragraph (a) of this section;

(2) The licensee's program to assess and control dose within the 0.5rem (5mSv) annual limit; and

(3) The procedures to be followed to maintain the dose as low as is reasonably achievable.

(d) In addition to the requirements of this part, a licensee subject to the provisions of EPA's generally applicable environmental radiation standards in 40

CFR part 190 shall comply with those standards.

(e) The Commission may impose additional restrictions on radiation levels in unrestricted areas and on the total quantity of radionuclides that a licensee may release in effluents in order to restrict the collective dose,

[56 FR 23398, May 21, 1991,as amended at 60 FR 48625, Sept. 20, 1995; 62 FR 4133, Jan. 29, 1997]

### Subpart F—Surveys and Monitoring

SOURCE: 56 FR 23398, May 21, 1991, unless otherwise noted.

#### §20.1501 General

(a) Each licensee shall make or cause to be made, surveys that—

(1) May be necessary for the licensee to comply with the regulations in this part; and

(2) Are reasonable under the circumstances to evaluate—

(i) The extent of radiation levels; and

(ii) Concentrations or quantities of radioactive material; and

(iii) The potential radiological hazards that could be present.

(b) The licensee shall ensure that instruments and equipment used for quantitive radiation measurements (e.g., dose rate and effluent monitoring) are calibrated periodically for the radiation measured.

(c) All personnel dosimeters (except for direct and indirect reading pocket ionization chambers and those dosimeters used to measure the dose to the extremities) that require processing to determine the radiation dose and that are used by licensees to comply with §20.1201, with other applicable provisions of this chapter, or with conditions specified in a license must be processed and evaluated by a dosimetry processor—

(1) Holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accredidation Program (NVLAP) of the National Institute of Standards and Technology; and

(2) Approved in this accredidation process for the type of radiation or radiations included in the NVLAP program that most closely approximates the type of radiations for which the individual wearing the dosimeter is monitored.

#### §20.1502 Conditions requiring individual monitoring of external and internal occupational dose.

Each licensee shall monitor exposures to radiation and radioactive material at levels sufficient to demonstrate compliance with the occupational dose limits of this part. As a minimum—

(a) Each licensee shall monitor occupational exposure to radiation and shall supply and require the use of individual monitoring devices by—

(1) Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits in §20.1201(a),

(2) Minors and declared pregnant women likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of any applicable limits in §20.1207 or §20.1208, and

(3) Individuals entering a high or very high radiation area.

(b) Each licensee shall monitor (see §20.1204) the occupational intake of radioactive material by and assess the committed effective dose equivalent to—

(1) Adults likely to receive, in 1 year, an intake in excess of 10 percent of the applicabel ALI(s) in table 1, Columns 1 and 2, of appendix B to part 20; and

(2) Minors and declared pregnant women likely to receive, in 1 year, a committed effective dose equivalent in excess of 0.05 rem (0.5 mSv).

[56 FR 23398, May 21, 1991, as amended at 60 FR 20185, Apr.26,1995]

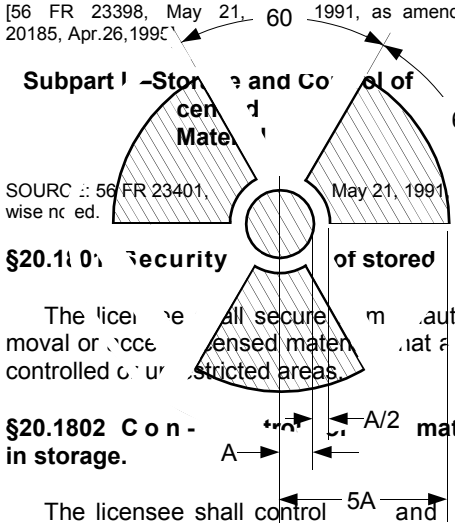
### Subpart I—Storage and Control of Licensed Material

SOURCE: 56 FR 23401, May 21, 1991 unless otherwise noted.

#### §20.1801 Security of stored material.

The licensee shall secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas.

#### §20.1802 Control of material not in storage.




The licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

### Subpart J—Precautionary Procedures

SOURCE: 56 FR 23401, May 21, 1991, unless otherwise noted.

#### §20.1901 Caution signs.

(a) *Standard radiation symbol.* Unless otherwise authorized by the Commission, the symbol prescribed by this part shall use the colors magenta, or purple, or black on yellow background. The symbol prescribed by this part is the three-bladed design:

**RADIATION SYMBOL**

(1) Cross-hatched area is to be magenta, or purple, or black, and

(2) The background is to be yellow.

(b) *Exception to color requirements for standard radiation symbol.* Notwithstanding the requirements of paragraph (a) of this section, licensees are authorized to label sources, source holders, or device components containing sources of licensed materials that are subjected to high temperatures, with conspicuously etched or stamped radiation caution symbols and without color requirement.

(c) *Additional information on signs and labels.* In addition to the contents of signs and labels prescribed in this part, the licensee may provide, on or near the required signs and labels, additional information, as appropriate, to make individuals aware of potential radiation exposures and to minimize the exposures.

**§20.1902 Posting requirements.**

(a) *Posting of radiation areas.* The licensee shall post each radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIATION AREA."

(b) *Posting of high radiation areas.*The licensee shall post each high radiation area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, HIGH RADIATION AREA" or "DANGER, HIGH RADIATION AREA".

(c) *Posting of very high radiation areas.* The licensee shall post each very high radiation area with a conspicuous sign or signs bearing the radiation symbol and words "GRAVE DANGER, VERY HIGH RADIATION AREA".

(d)*Posting of airborne radioactivity areas.*The Licensee shall post each airborne radioactivity area with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, AIRBORNE RADIOACTIVITY AREA" or DANGER, AIRBORNE RADIOACTIVITY AREA."

(e) *Posting of areas rooms in which licensed material is used or stored.* The licensee shall post each area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in appendix C to part 20 with a conspicuous sign or signs bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)."

[56 FR 23401, May 21,1991, as amended at 60 FR 20185, Apr. 25,1995]

**§20.1903 Exceptions to posting requirements.**

(a) A licensee is not required to post caution signs in areas or rooms containing radioactive materials for periods of less than 8 hours, if each of the following conditions are met:

(1) The materials are constantly attended during these periods by an individual who takes the precautions necessary to prevent the exposure of individuals to radiation or radioactive materials in excess of the limits established in this part; and

(2) The area or room is subject to the licensee's control.

(b) Rooms or other areas in hospitals that are occupied by patients are not required to be posted with caution signs pursuant to §20.1902 provided that the patient could be released from licensee control pursuant to §35.75 of this chapter.

(c) A room or area is not required to be posted with a caution sign because of the presence of a sealed source provided the radiation level at 30 centimeters (12 inches) from the surface of the source container or housing does not exceed 0.005 rem (0.05 mSv) per hour.

[56 FR 23401, May 21, 1991, as amended at 57 FR 39357, Aug. 31, 1992; 62 FR 4133, Jan. 29, 1997]

**§20.1904 Labeling containers.**

(a) The licensee shall ensure that each containers of licensed material bears a durable, clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL". The label must also provide sufficient information (such as the radionuclide(s) present, an estimate of the quantity of radioactivity, the date for which the activity is estimated, radiation levels, kinds of materials, and mass

enrichment) to permit individuals handling or using the containers, or working in the vicinity of the containers, to take precautions to avoid or minimize exposures.

(b) Each licensee shall, prior to removal or disposal of empty uncontaminated containers to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive materials.

**§20.1905 Exemptions to labeling requirements.**

A licensee is not required to label—

(a) Containers holding licensed material in quantities less than the quantities listed in appendix C to part 20; or

(b) Containers holding licensed material in concentrations less than those specified in table 3 of appendix B to part 20; or

(c) Containers attended by an individual who takes the precautions necessary to prevent the exposure of individuals in excess of the limits established by this part; or

(d) Containers when they are in transport and packaged and labeled in accordance with the regulations of the Department of Transportation,[3] or

(e) Containers that are accessible only to individuals authorized to handle or use them, or to work in the vicinity of the containers, if the contents are identified to these individuals by a readily available written record (examples of containers of this type are containers in locations such as water-filled canals, storage vaults, or hot cells). The record must be retained as long as the containers are in use for the purpose indicated on the record; or

(f) Installed manufacturing or process equipment, such as reactor components, piping, and tanks.

[56 FR 23401, May 21, 1991, as amended at 60 FR 20185, Apr. 25, 1995]

[3]Labeling of packages containing radioactive materials is required by the Department of Transportation (DOT) if the amount and type of radioactive material exceeds the limits for an excepted quantity or article as defined and limited by DOT regulations 49 CRF 173.403 (m) and (w) and 173.421-424.

**§20.1906 Procedures for receiving and opening packages.**

(a) Each licensee who expects to receive a package containing quantities of radioactive material in excess of a Type A quantity, as defined in §71.4 and appendix A to part 71 of this chapter, shall make arrangements to receive—

(1) The package when the carrier offers it for delivery; or

(2) Notification of the arrival of the package at the carrier's terminal and to take possession of the package expeditiously.

(b) Each licensee shall—

(1) Monitor the external surfaces of a labeled[3a] package for radioactive contamination unless the package contains only radioactive material in the form of a gas or in special form as defined in 10 CFR 71.4;

(2) Monitor the external surfaces of a labeled[3a] package for radiation levels unless the package contains quantities of radioactive material that are less than or equal to the Type A quantity as defined in §71.4 and appendix A to part 71 of this chapter; and

(3) Monitor all packages known to contain radioactive material for radioactive contamination and radiation levels if there is evidence of degradation of package integrity, such as packages that are crushed, wet, or damaged.

(c) The licensee shall perfom the monitoring required by paragraph (b) of this section as soon as practical after receipt of the package, but not later than 3 hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours, or not later than 3 hours from the beginning of the next working day if it is received after working hours.

(d) The licensee shall imediately notify the final delivery carrier and, by telephone and telegram, mailgram, or facsimile, the Administrator of the appropriate NRC Regional Office listed in appendix d to part 20 when—

(1) Removable radioactive surface contamination exceeds the limits of §71.87(i) of this chapter; or

(2) External radiation levels exceed the limits of §71.47 of this chapter.

(e) Each licensee shall—

(1) Establish, maintain, and retain written procedures for safely opening packages in which radioactive material is received; and

(2) Ensure that the procedures are followed and that due consideration is given to special instructions for the type of package being opened.

(f) Licensees transferring special form sources in licensee-owned or licensee-operated vehicles to and from a work site are exempt from the contamination monitoring requirements of paragraph (b) of this section, but are not exempt from the survey requirement in paragraph (b) of this section for measuring radiation levels that is required to ensure that the source is still properly lodged in its shield.

[3a]Labeled with a Radioactive White I, Yellow II, or Yellow III label as specified in U.S. Department of Transportation regulations, 49 CFR 172.403 and 172.436-440.

[56 FR 23401, May 21, 1991,as amended at 57 FR 39357, Aug. 31,1992; 60 FR 20185, Apr. 25, 1995]

## Subpart K-Waste Disposal

SOURCE: 56 FR 23403, May 21,1991, unless otherwise noted.

### §20.2001 General requirements.

(a) A licensee shall dispose of licensed material only—

(1) By transfer to an authorized recipient as provided in §20.2006 or in the regulations in parts 30,40,60,61,70, or 72 of this chapter; or

(2) By decay in storage; or

(3) By release in effluents within the limits of §20.1301; or

(4) As authorized under §§20.2002, 20.2003, 20.2004, or §20.2005.

(b) A person must be specifically licensed to receive waste containing licensed material from other persons for:

(1) Treatment prior to disposal; or

(2) Treatment or disposal by incineration; or

(3) Decay in storage; or

(4) Disposal at a land disposal facility licensed under part 61 of this chapter; or

(5) Disposal at a geologic repository under part 60 of this chapter .

### §20.2002 Method for obtaining approval of proposed disposal procedures.

A licensee or applicant for a license may apply to the Commission for approval of proposed procedures, not otherwise authorized in the regulations in this chapter, to dispose of licensed material generated in the licensee's activities. Each application shall include:

(a) A description of the waste containing licensed material to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal; and

(b) An analysis and evaluation of pertinent information on the nature of the environment; and

(c) The nature and location of other potentially affected licensed and unlicensed facilities; and

(d) Analyses and procedures to ensure that doses are maintained ALARA and within the dose limits in this part.

### §20.2003 Disposal by release into sanitary sewerage

(a) A licensee may discharge licensed material into sanitary sewerage if each of the following conditions is satisfied:

(1) The material is readily soluble (or is readily dispersible biological material) in water; and

(2) The quantity of licensed or other radioactive material that the licensee releases into the sewer in 1month divided by the average monthly volume of water released into the sewer by the licensee does not exceed the concentration listed in table 3 of appendix B to part 20; and

(3) If more than one radionuclide is released, the following conditions must also be satisfied:

(i) The licensee shall determine the fraction of the limit in table 3 of appendix B to part 20 represented by discharges into sanitary sewerage by dividing the actual monthly average concentration of that radionuclide listed in table 3 of appendix B to part 20; and

(ii) The sum of the fractions for each radionuclide required by paragraph (a)(3)(i) of this section does not exceed unity; and

(4) The total quantity of licensed and other radioactive material that the licensee releases into the sanitary sewerage system in a year does not exceed 5 curies(185GBq) of hydrogen-3, 1 curie (37GBq) of carbon-14, and 1 curie (37GBq) of all other radioactive materials combined.

(b) Excreta from individuals undergoing medical diagnosis or therapy with radioactive material are not subject to the limitations contained in paragraph (a) of this section.

[56 FR 23404, May 21, 1991, as amended at 60 FR 20185, Apr. 25, 1995]

### §20.2006 Transfer for disposal and manifests.

(a)(1) The requirements of this section and appendices F and G to 10 CFR part 20 are designed to:

(i) Control transfers of low-level radioactive waste by any waste generator, waste collector, or waste processor licensee, as defined in this part, who ships low-level waste either directly, or indirectly, through a waste collector or waste processor, to a licensed low-level waste land disposal facility (as defined in part 61 of this chapter).

(ii) Establish a manifest tracking system; and

(iii) Supplement existing requirements concerning transfers and recordkeeping for those wastes.

(2) Beginning March 1, 1998, all affected licensees must use appendix G. Prior to March 1, 1998, a LLW disposal facility operator or its regulatory may require the shipper to use appendix F or appendix G. Licensees using appendix F shall comply with paragraph (b)(1) of this section. Licensees using appendix G shall comply with paragraph (b)(2) of this section.

(b)(1) Each shipment of radioactive waste intended for disposal at a licensed land disposal facility must be accompanied by a shipment manifest in accordance with section I of appendix F to 10 CFR part

20.

(2) Any licensee shipping radioactive waste intended for ultimate disposal at a licensed land disposal facility must document the information required on NRC's Uniform Low-Level Radioactive Waste Manifest and transfer this recorded manifest information to the intended consignee in accordance with appendix G 10 CFR part 20.

(c) Each shipment manifest must include a certification by the waste generator as specifiec in section II of appendix F or appendix G to 10 CFR part 20, as appropriate. See paragraph (a)(2) of this section to determine the appropriate appendix.

(d) Each person involved in the transfer for disposal and disposal of waste, including the waste generator, waste collector, waste processor, and disposal facility operator, shall comply with the requirements specified in section III of appendix F or appendix G to 10 CFR part 20, as appropriate. See paragraph (a)(2) of this section to determine the appropriate appendix.

[60 FR 15663, Mar. 27, 1995]

### §20.2007 Compliance with environmental and health protection regulations

Nothing in this subpart relieves the licensee from complying with other applicable Federal, State, and local regulations governing any other toxic or hazardous properties of materials that may be disposed of under this part.

## Subpart L—Records

SOURCE: 56 FR 23404, May 21, 1991, unless otherwise noted.

### §20.2101 General provisions.

(a) Each licensee shall use the units: curie, rad, rem, including multiples and subdivisions, and shall clearly indicate the units of all quantites on records required by this part.

(b) Not withstanding the requirements of paragraph (a) of this section, when recording information on shipment manifests, as required in §20.2006(b), information must be recorded in the International System of Units (SI) or in SI and units as specified in paragraph (a) of this section.

(c) The licensee shall make a clear distinction among the quantities entered on the records required by this part (e.g., total effective dose equivalent, shallow-dose equivalent, eye dose equivalent, deep-dose equivalent, committed effective dose equivalent).

[56 FR 23404, May 21, 1991, as amended at 60 FR 15663, Mar. 27, 1995]

EFFECTIVE DATE NOTE: At 60 FR 15663, Mar. 27,1995, in §20.2101, paragraph (b) was redesignated as (c), and a new paragraph (b) was added, effective Mar. 1,1998.

### §20.2102 Records of radiation protection programs

(a) Each licensee shall maintain records of the radiation protection program, including:

(1) The provisions of the program; and

(2) Audits and other reviews of program content and implementation.

(b) The licensee shall retain the records required by paragraph (a)(1) of this section until the Commission terminates each pertinent license requiring the record. The licensee shall retain the records required by paragraph (a)(2) of this section for 3 years after the record is made.

### §20.2130 Records of surveys.

(a) Each licensee shall maintain records showing the results of surveys and calibrations required by §§20.1501 and 20.1906(b). The licensee shall retain these records for 3 years after the record is made.

(b) The licensee shall retain each of the following records until the Commission terminates each pertinent license requiring the record:

(1) Records of the results of surveys to determine the dose from external sources and used, in the absence of or in combination with individual monitoring data, in the assessment of individual dose equivalents required under the standards for protection against radiation in effect prior to January 1, 1994; and

(2) Records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose. This includes those records of the results of measurements and calculations used to determine individual intakes of radioactive material and used in the assessment of internal dose required under the standards for protection against radiation in effect prior to January 1, 1994; and

(3) Records showing the results of air sampling, surveys, and bioassays required pursuant to §20.1703(a)(3)(i) and (ii). This includes those records showing the results of air sampling, surveys, and bioassays required under the standards for protection against radiation in effect prior to January 1, 1994; and

(4) Records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment. This includes those records of the results of measurements and calculations used to evaluate the release of radioactive effluents to the environment required under the stan-

dards for protection against radiation in effect prior to January 1, 1994.

[56 FR 23404, May 21, 1991, as amended at 60 FR 20185, Apr. 25, 1995]

### §20.2104 Determination of prior occupational dose.

(a) For each individual who is likely to receive in a year, an occupational dose requiring monitoring pursuant to §20.1502 the licensee shall—

(1) Determine the occupational radiation dose received during the current year; and

(2) Attempt to obtain the records of cumulative occupational radiation dose.

(b) Prior to permitting an individual to participate in a planned special exposure, the licensee shall determine—

(1) The internal and external doses from all previous planned special exposures; and

(2) All doses in excess of the limits (including doses received during accidents and emergencies) received during the lifetime of the individual.

(c) In complying with the requirements of paragraph (a) of this section, a licensee may—

(1) Accept, as a record of the occupational dose that the individual received during the current year, a written signed statement from the individual, or from the individual's most employer for work involving radiation exposure, that discloses the nature and the amount of any occupational dose that the individual may have received during the current year;

(2) Accept, as the record of cumulative radiation dose, an up-to-date NRC Form4, or equivalent, signed by the individual and countersigned by an appropriate official of the most recent employer for work involving radiation exposure, or the individual's current employer (if the individual is not employed by the licensee); and

(3) Obtain reports of the individual's dose equivalent(s) from the most recent employer for work involving radiation exposure, or the individual's current employer (if the individual is not employed by the licensee) by telephone, telegram, electronic media, or letter. The licensee shall request a written verification of the dose data if the authenticity of the transmitted report cannot be established.

(d) The licensee shall record the exposure history of each individual, as required by paragraph (a) of this section, on NRC Form 4, or other clear and legible record, including all of the information required by NRC Form 4[4]. The form or record must show each period in which the individual received occupational exposure to radiation or radioactive material and must be signed by the individual who received the exposure. For each period for which the licensee obtains reports, the licensee shall use the dose shown in the report in preparing the NRC Form 4. For any period for which the licensee does not obtain a report, the licensee shall place a notation on the NRC Form 4 indicating the periods of time for which data are not available.

(e) If the licensee is unable to obtain a complete record of an individual's current and previously accumulated occupational dose, the licensee shall assume—

(1) In establishing administrative controls under §20.1201(f) for the current year, that the allowable dose limit for the individual is reduced by 1.25 rem (12.5 mSv) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure; and

(2) That the individual is not available for planned special exposures.

(f) The licensee shall retain the records on NRC Form 4 or equivalent until the Commission terminates each pertinent license requiring this record. The licensee shall retain records used in preparing NRC Form 4 for 3 years after the record is made. This includes records required under the standards for protection against radiation in effect prior to January 1, 1994.

[4] Licensees are not required to partition historical dose between external dose equivalent(s) and internal committed dose equivalent (s). Further, occupational exposure histories obtained and recorded on NRC Form 4 before January 1, 1994, might not have included effective dose equivalent, but may be used in the absence of specific information on the intake of radionuclides by the individual.

[56 FR 23404, May 21, 1991, as amended at 57 FR 57878, Dec. 8, 1992; 60 FR 20186, Apr. 25, 1995; 60 FR 36043, July 13, 1995]

### §20.2106 Records of individual monitoring results

(a) *Recordkeeping requirement.* Each licensee shall maintain records of doses received by all individuals for whom monitoring was required pursuant to §20.1502, and records of doses received during planned special exposures, accidents, and emergency conditions. These records[5] must include when applicable—

(1) The deep-dose equivalent to the whole body, eye dose equivalent, shallow-dose equivalent to the skin, shallow-dose equivalent to the extremities; and

(2) The estimated intake or body burden of radionuclides (see §20.1202); and

(3) The committed effective dose equivalent assigned to the intake or body burden of radionuclides; and

(4) The specific information used to calculate the committed effective dose equivalent pursuant to §20.1204(c); and

(5) The total effective dose equivalent when re-

quired by §20.1202; and

(6) The total of the deep-dose equivalent and the committed dose to the organ receiving the highest total dose.

(b) *Recordkeeping frequency.*The licensee shall make entries of the records specified in paragraph (a)
of this section at least annually.

(c)*Recordkeeping format.* The licensee shall maintain records specified in paragraph (a) of this section on NRC Form 5, in accordance with the instructions for NRC Form 5, or in clear and legible records containing all the information required by NRC Form 5.

(d) *Privacy protection.* The records required under this section should be protected from public disclosure because of their personal privacy nature. These records are protected by most State privacy laws and. when transferred to the NRC, are protected by the Privacy Act of 1974, Public Law 93-579, 5 U. S.C. 552a, and the Commission's regulations in 10 CFR part 9.

(e) The licensee shall maintain the records of dose to an embry/fetus with the records of dose to the declared pregnant woman. The declaration of pregnancy shall also be kept on file, but may be maintained separately from the dose records.

(f) The licensee shall retain the required form or record until the Commission terminates each pertinent license requiring this record. This includes records required under the standards for protection against radiation in effect prior to January 1, 1994.

[56 FR 23404, May 21, 1991, as amended at 60 FR 21086, Apr. 25, 1995]

### §20.2108 Records of waste disposal

(a) Each licensee shall maintain records of the disposal of licensed materials made under §§20.2002, 20.2003, 20.2004, 20.2005, 10 CFR part 61 and disposal by buiral in soil, including burials authorized before January 28, 1981.[6]

(b) The licensee shall retain the records required by paragraph (a) of this section until the Commission terminates each pertinent license requiring the record. Requirements for disposition of these records, prior to license termination, are located in §§30.51, 40.61, 70.51, and 72.80 for activities licensed under these parts.

[6]A previous §20.304 permitted burial of small quantities of licensed materials in soil before January 28,1981, without specific Commission authorization.

[56 FR 23404, May 21, 1991, as amended at 60 FR 20186, Apr. 25, 1995; 61 FR 24673, May 16, 1996]

## Subpart M—Reports

SOURCE: 56 FR 23406, May 21, 1991, unless otherwise noted.

### §20.2201 Reports of theft or loss of licensed material

(a) telephone reports. (1) Each licensee shall report by telephone as follows:

(i) Immediately after its occurrence becomes know to the licensee, any lost, stolen, or missing licensed material in an aggregate quantity equal to or greater than 1,000 times the quantity specified in appendix C to part 20 under such circumstances that it appears to the licensee that an exposure could result to persons in unrestricted areas; or

(ii) Within 30 days after the occurrence of any lost, stolen, or missing licensed material becomes known to the licensee, all licensed material in a quantity greater than 10 times the quantity specified in appendix C to part 20 that is still missing at this time.

(2) Reports must be made as follows:

(i) Licensees having an installed Emergency Notification System shall make the reports to the NRC Operations Center in accordance with §50.72 of this chapter, and

(ii) All other licensees shall make reports by telephone to the NRC Operations Center (301-951-0550).

(b) *Written reports.* (1) Each licensee required to make a report under paragraph (a) of this section shall, within 30 days after making the telephone report, make a written report setting forth the following information:

(i) A description of the licensed material involved, including kind, quantity, and chemical and physical form; and

(ii) A description of the circumstances under which the loss or theft occurred; and

(iii) A statement of disposition , or probable disposition, of the licensed material involved; and

(iv) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas; and

(v) Actions that have been taken, or will be, to recover the material; and

(vi) Procedures or measures that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

(2) Reports must be made as follows:

(i) For holders of an operating license for a nuclear power plant, the events included in paragraph (b) of this section must be reported in accordance with the procedures described in §50.73(b), (c), (d), (e), and (g) of this chapter and must include the information in paragraph (b)(1) of this section; and

(ii) All other licensees shall make reports to the Administrator of the appropriate NRC Regional Office listed in appendix D to part 20.

(c) A duplicate report is not required under paragraph (b) of this section if the licensee is also required to submit a report pursuant to §§30.55(c), 40.64(c), 50.72, 50.73, 70.52, 73.27(b), 73.67(e)(3)(vi), 73.67(g)(3)(iii), 73.71, or §150.19(c) of this chapter.

(d) Subsequent to filing the written report, the licensee shall also report any additional substantitive information on the loss or theft within 30 days after the licensee learns of such information.

(e) The licensee shall prepare any report filed with the Commission pursuant to this section so that names of individuals who may have received exposure to radiation are stated in a separate and detachable part of the report.

[56 FR 23406, May 21, 1991, as amended at 58 FR 69220, Dec.30, 1993; 60 FR 20186, Apr. 25, 1995]

### §20.2202 Notification of incidents.

(a) Immediate notification. Notwithstanding any other requirements for notification, each licensee shall immediately report any event involving byproduct, source, or special nuclear material possessed by the licensee that may have caused or threatens to cause any of the following conditions—

(1) An individual to receive—

(i) A total effective dose equivalent of 25 rems (0.25 Sv) or more; or

(ii) An eye dose equivalent of 75 rems (0.75Sv) or more; or

(iii) A shallow-dose equivalent to the skin or extremities of 250 rads (2.5Gy) or more; or

(2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures).

(b) Twenty-four hour notification. Each licensee shall, within 24 hours of discovery of the event, report any event involving loss of control of licensed material possessed by the licensee that may have caused, or threatens to cause, any of the following conditions:

(1) An individual to receive, in a period of 24 hours—

(i) A total effective dose equivalent exceeding 5 rems (0.05 Sv); or

(ii) An eye dose equivalent exceeding 15 rems (0.15Sv); or

(iii) A shallow -dose equivalent to the skin or extremities exceeding 50 rems (0.5 Sv); or

(2) The release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit on intake (the provisions of this paragraph do not apply to locations where personnel are not normally stationed during routine operations, such as hot-cells or process enclosures).

(d) Reports made by licensees in response to the requirements of this section must be made as follows:

(1) Licensees having an installed Emergency Notification System shall make the reports required by paragraphs (a) and (b) of this section to the NRC Operations Center in accordance with 10 CRF 50.72; and

(2) All other licensees shall make reports required by paragraph (a) and (b) of this section by telephone to the NRC Operations Center (301) 816-5100 and by telegram, mailgram, or facsimile to the Administrator of the appropriate NRC Regional Office listed in appendix D to 10 CFR part 20.

(e) The provisions of this section do not include doses that result from planned special exposures, that are within the limits for planned special exposures and that are reported under §20.2204.

[56 FR 23406, May 21, 1991, as amended at 56 FR 40766, Aug. 16, 1991; 57 FR 57879, Dec. 8, 1992; 59 FR 14086, Mar. 25, 1994]

### §20.2203 Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the constraints or limits.

(a) *Reportable events.* In addition to the notification required by §§20.2202, each licensee shall submit a written report within 30 days after learning of any of the following occurrences:

(1) Any incident for which notification is required by §20.2202; or

(2) Doses in excess of the following:

(i) The occupational dose limits for adults in §20.1201; or

(ii) The occupational dose limits for a minor in §20.1207; or

(iii) The limits for an embryo/fetus of a declared pregnant woman in §20.1208; or

(iv) The limits for an individual member of the public in §20.1301; or

(v) Any applicable limit in the license; or

(vi) The ALARA constraints for air emissions established under §20.1101(d); or

(3) Levels of radiation or concentrations of radioactive material in—

(i) A restricted area in excess of any applicable limit in the license; or

(ii) An unrestricted area in excess of 10 times any applicable limit set forth in this part or in the license (whether or not involving exposure of any individual in excess of the limits in §20.1301); or

(4) For licensees subject to the provisions of EPA's generally applicable environmental radiation standards in 40 CFR part 190, levels of radiation or releases of radioactive material in excess of those standards, or of license conditions related to those standards.

(b) *Contents of reports.* (1) Each report required by paragraph (a) of this section must describe the extent of exposure of individuals to radiation and radioactive material, including, as appropriate:

(i) Estimates of each individual's dose; and

(ii) The levels of radiation and concentrations of radioactive material involved; and

(iii) The cause of the elevated exposures, dose rates, or concentrations; and

(iv) Corrective steps taken or planned to ensure against recurrence, including the schedule for achieving conformance with applicable limits, ALARA constraints, generally applicable environmental standards, and associated license conditions.

(2) Each report filed pursuant to paragraph (a) of this section must include for each occupationally overexposed[7] individual: the name, Social Security account number, and date of birth. The report must be prepared so that this information is stated in a seperate and detachable part of the report.

(c) For holders of an operating license for a nuclear power plant,the occurrences included in paragraph (a) of this section must be reported in accordance with the procedures described in §50.73(b), (c), (d), (e), and (g) of this chapter and must also include the information required by paragraph (b) of this section. Occurrences reported in accordance with §50.73 of this chapter need not be reported by a duplicate report under paragraph (a) of this section.

(d) All licensees, other than those holding an operating license for a nuclear power plant, who make reports under paragraph (a) of this section shall submit the report in writing to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555, with a copy to the appropriate NRC Regional Office listed in appendix D to part 20.

[7]With respect to the limit for the embryo/fetus (§20.1208), the identifiers should be those of the declared pregnant woman.

[56 FR 23406, May 21, 1991, as amended at 60 FR 20186, Apr. 25,1995; 61 FR 65127, Dec.10, 1996]

### §20.2205 Reports to individuals of exceeding dose limits.

When a licensee is required, pursuant to the provisions of §§20.2203, 20.2204, or 20.2206, to report to the Commission any exposure of an identified occupationally exposed individual,or an identified member of the public, to radiation or radioactive, the licensee shall also provide a copy of the report submitted to the Commission to the individual. This report must be transmitted at a time no later than the transmittal to the Commission.

[60 FR 36043, July 13, 1995]

## Subpart N—Exemptions and Additional Requirements

SOURCE: 56 FR 23408, May 21, 1991, unless otherwise noted.

### §20.2301 Applications for exemptions.

The Commission may, upon application by a licensee or upon its own initiative, grant an exemption from the requirements of the regulations in this part if it determines the exemption is authorized by law and would not result in undue hazard to life or property.

### §20.2302 Additional requirements.

The Commission may, by rule, regulation, or order, impose requirements on a licensee, in addition to those established in the regulations in this part, as it deems appropriate or necessary to protect health or to minimize danger to life or property.

## Subpart O—Enforcement

### §20.2401 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of—

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violation of—

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107 or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under Section a86 of the Atomic Energy Act of 1954, as amended.

[56 FR 23408, May 21, 1991; 56 FR 61352, Dec. 3, 1991, as amended at 57 FR 55071, Nov. 24, 1992]

## APPENDIX B TO PART 20— Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage.

*Introduction*

For each radionuclide Table 1 indicates the chemical form which is to be used for selecting the appropriate ALI or DAC value. The ALIs and DACs for inhalation are given for an aerosol with an activity median aerodynamic diameter (AMAD) of 1μm and for three classes (D,W,Y) of radioactive material, which refer to their retention (approximately days, weeks or years) in the pulmonary region of the lung. This classification applies to a range of clearance half-times of less than 10 days for D, for W from 10 to 100 days, and for Y greater than 100 days. The class (D,W, or Y) given in the column headed "Class" applies only to the inhalation ALIs and DACs given in Table 1, columns 2 and 3. Table 2 provides concentration limits to the general environment. Table 3 provides concentration limits for discharges to sanitary sewer systems.

*Notation*

The values in Tables 1,2, and 3 are presented in the computer "E" notation. In this notation a value of 6E-02 represents a value of $6x10^{-2}$ or 0.06, 6E+2 represents $6x10^{2}$ or 600, and 6E+0 represents $6x10^{0}$ or 6.

*Table 1 "Occupational"*

Note that the columns in Table 1, of this appendix captioned "Oral Ingestion ALI", "Inhalation ALI", and "DAC" are applicable to occupational exposure to radioactive material.

The ALIs in this appendix are the annual intakes of a given radionuclide by "reference Man" which would result in either (1) a committed effective dose equivalent of 5 rems (stochastic ALI) or (2) a committed dose equivalent of 50 rems to an organ or tissue (non-stochastic ALI). The stochastic ALIs were derived to result in a risk, due to irradiation of organs and tissues, comparable to the risk associated with deep dose equivalent to the whole body of 5 rems. The derivation includes multiplying the committed dose equivalent to an organ or tissue by a weighting factor, $W_T$. This weighting factor is the proportion of the rsik of stochastic effects resulting from irradiation of the organ or tissue, T, to the total risk of stochastic effects when the whole body is irradiated uniformly. The values of $W_T$ are listed under the definition of weighting factor in §20.1003. The non-stochastic ALIs were derived to avoid non-stochastic effects, such as prompt damage to tissue or reduction in organ function.

A value of $W_T$ = 0.06 is applicable to each of the five organs or tissues in the "remainder" category receiving the highest dose equivalent, and the dose equivalents of all other remaining tissues may be disregarded. The following parts of the GI tract—stomach, small intestine, upper large intestine—are to be treated as four seperate organs.

Note that the dose equivalents for extremities (hands, and forearms, feet and lower legs) skin, and lens of the eye are not considering in computing the committed effective dose equivalent, but are subject to limits that must be met separately.

When an ALI is defined by the stochastic dose limit, this value alone, is given. When an ALI is determined by the non-stochastic dose limit to an organ, the organ or tisuue to which the limit applies is shown, and the ALI for the stochastic limit is shown in parentheses. (Abbreviated organ or tissue designations are used: LLI wall=lower large intestine wall; St.wall=stomach wall; blad wall=bladder wall; and Bone surf=bone surface.)

The use of the ALIs listed first, the more limiting of the stochastic and non-stochastic ALIs, will ensure that non-stochastic effects are avoided and that the risk of stochastic effects is limited to an acceptably low value. If, in a particular situation involving a radionuclide for which the non-stochastic ALI is limiting, use of that non-stochastic ALI is considered unduly conservative, the licensee may use the stochastic ALI to determine the committed effective dose equivalent. However, the licensee shall also ensure that the 50-rem dose equivalent limit for any organ or tissue is not exceeded by the sum of the external deep dose equivalent plus the internal committed dose to that organ (not the effective dose).For the case where there is no external dose contribution, this would be demonstrated if the sum of the fractions of the non-stochastic ALIs ($ALI_{ns}$) that contribute to the committed dose equivalent to the organ receiving the highest dose does not exceed unity (i.e. Σ (intake (in μCi) of each radionuclide / $ALI_{ns}$)<1.0). If there is an external deep dose equivalent contribution of $H_d$ the this sum must be less tha 1-($H_d$/50) instead of being <1.0.

The derived air concentration (DAC) values are derived limits intended to control chronic occupational exposures. The relationship between the DAC and the ALI is given by: DAC=ALI (in μCi)/(2000 hours per working year x 60 minutes/hour x $2x10^4$ ml per minute)= [ALI / $2.4x10^9$] μCi/ml, where $2.4x10^4$ ml is the volume of air breathed per minute at work by "Reference Man" under working conditions of "light work".

The DAC values relate to one of two modes of exposure: either external submersion or the internal committed dose equivalents resulting from inhalation of radioactive materials. Derived air concentrations based upon submersion are for immersion in a semi-infinite cloud of uniform concentration and apply to each radionuclide seperately.

The ALI and DAC values relate to exposure to the single radionuclide named, but also include contributions from the in-growth of any daughter radionuclide produced in the body by the decay of the parent. However, intakes that include both the parent and daughter radionuclides should be treated by the general method appropriate for mixtures.

The value of ALI and DAC do not apply directly when the individual both ingests and inhales a radionuclide, when the individual is exposed to a mixture of radionuclides by either inhalation or ingestion or both, or when the individual is exposed to both internal and external radiation (see §20.1202). When an individual is exposed to radioactive materials which fall under several of the translocation classifications (i.e. Class D, Class W, or Class Y) of the same radionuclide, the exposure may be evaluated as if it were a mixture of different radionuclides.

It should be noted that the classification of a compound as Class D, W, or Y is based on the chemical form of the compound and does not take into account the radiological half-life of different radioisotopes. For this reason, values are given for Class D, W, and Y compounds, even for very short-lived radionuclides.

*Table 2*

The columns in Table 2 of this appendix captioned "Effluents," "Air," and "Water," are applicable to the assessment and control of dose to the public, particularly in the implementation of the provisions of §20.1302. The concentration values given in Columns 1 and 2 of Table 2 are equivalent to the radionuclide concentrations which, if inhaled or ingested continuously over the course of a year, would produce a total effective dose equivalent of 0.05 rem (50 millirem or 0.5 millisieverts).

Consideration of non-stochastic limits has not been included in deriving the air and water effluent concentration limits because non-stochastic effects are presumed not to occur at the dose levels established for individual members of the public. For radionuclides, where the non-stochastic limit was governing in deriving the occupational DAC, the stochastic ALI was used in deriving the corresponding airborne effluent limit in Table 2. For thie reason, the DAC and airborne effluent limits are not always proportional as was the case in appendix B to §§20.1-20.601.

The air concentration values listed in Table 2, Column 1, were derived by one of two methods. For those radionuclides for which the stochastic limit is governing, the occupational stochastic inhala-

tion ALI was divided by $2.4x10^9$ ml, relating the inhalation ALI to the DAC, as explained above, and then divided by a factor of 300. The factor of 300 includes the following components: a factor of 50 to relate the 5-rem annual occupational dose limit to the 0.1-rem limit for members of the public, a factor of 3 to adjust for the difference in exposure time and the inhalation rate for a worker and that for members of the public; and a factor of 2 to adjust the occupational values (derived for adults) so that they are applicable to other age groups.

For other radionuclides for which submersion (external dose) is limiting, the occupational DAC in Table 1, Column 3, was divided by 219. The factor of 219 is composed of a factor of 50, as described above, and a factor of 4.38 relating occupational exposure for 2,000 hours per year to full-time exposure (8,760 hours per year). Note that an additional factor of 2 for age considerations is not warranted in the submersion case.

The water concentrations were derived by taking the most restrictive occupational stochastic oral ingestion ALI and dividing by $7.3x10^7$ . The factor $7.3x10^7$ (ml) includes the following components: the factors of 50 and 2 described above and a factor of $7.3x10^5$ (ml) which is the annual water intake of "Reference Man".

Note 2 of this appendix provides groupings of radionuclides which are applicable to unknown mixtures of radionuclides. These groupings (including occupational) inhalation A:ls and DACs, air and water effluent concentrations and sewerage) require demonstrating that the most limiting radionuclides in successive classes are absent. The limit for the unknow mixture is defined when the presence of one of the listed radionuclides cannot be definitely excluded either from knowledge of the radionuclide composition of the source or from actual measurements.

*Table 3 "Sewer Disposal"*

The monthly average concentrations for release to sanitary sewers are applicable to the provisions in §20.2003. The concentration values were derived by taking the most restrictive occupational stochastic oral ingetsion ALI and dividing by $7.3x10^6$ (ml). The factor of $7.3x10^6$ (ml) is composed of a factor of $7.3x10^5$ (ml), the annual water intake by ":Reference Man", and a factor of 10, such that the concentrations, if the sewage released by the licensee were the only source of water ingested by a reference man during a year, would result in a committed effective dose equivalent of 0.5 rem.

## List of Elements

NOTE: The following tables have been condensed to reflect only the radionuclides used in Ronan gaging devices. For a complete list of all radionuclides and their quantities, refer to a current copy of 10 CFR Part 20, Appendix B.

## Table 1
## Occupational Values

Table 1
Occupational Values

## Table 2
## Effluent Concentrates

## Table 3
## Releases to Sewers

[56 FR 23409, May 21, 1991; 56 FR 61352, Dec. 3,1991, as amended at 57 FR 57879, Dec. 8, 1992. Redesignated at 58 FR 67659, Dec. 22,1993]

NOTE: The following appendix has been condensed to reflect only the radionuclides used in Ronan gaging devices. For a complete list of all radionuclides and their quantities, refer to a current copy of 10 CFR Part 20, Appendix C.

| Name | Atomic | | Name | Atomic | |
|---|---|---|---|---|---|
| | Symbol | Number | | Symbol | Number |
| Actinium | Ac | 89 | Californium | Cf | 98 |
| Aluminum | Al | 13 | Carbon | C | 6 |
| Americium | Am | 95 | Cerium | Ce | 58 |
| Antimony | Sb | 51 | Cesium | Cs | 55 |
| Argon | Ar | 18 | Chlorine | Cl | 17 |
| Arsenic | As | 33 | Chromium | CR | 24 |
| Astatine | At | 85 | Cobalt | Co | 27 |
| Barium | Ba | 56 | Copper | Cu | 29 |
| Berkelium | Bk | 97 | Curium | Cm | 96 |
| Beryllium | Be | 4 | Dysprosium | Dy | 66 |
| Bismuth | Bi | 83 | Einsteinium | Es | 99 |
| Bromine | Br | 35 | Erbium | Er | 68 |
| Cadmium | Cd | 48 | Europium | Eu | 63 |
| Calcium | Ca | 20 | Fermium | Fm | 100 |

| Name | Atomic | | Name | Atomic | |
|---|---|---|---|---|---|
| | Symbol | Number | | Symbol | Number |
| Fluorine | F | 9 | Promethium | Pm | 61 |
| Francium | Fr | 87 | Protactinium | Pa | 91 |
| Gadolinium | Gd | 64 | Radium | Ra | 88 |
| Gallium | Ga | 31 | Radon | Rn | 86 |
| Germanium | Ge | 32 | Rhenium | Re | 75 |
| Gold | Au | 79 | Rhodium | Rh | 45 |
| Hafnium | Hf | 72 | Rubidium | Rb | 37 |
| Holmium | Ho | 67 | Ruthenium | Ru | 44 |
| Hydrogen | H | 1 | Samarium | Sm | 62 |
| Indium | In | 49 | Scandium | Sc | 21 |
| Iodine | I | 53 | Selenium | Se | 34 |
| Iridium | Ir | 77 | Silicon | Si | 14 |
| Iron | Fe | 26 | Silver | Ag | 47 |
| Krypton | Kr | 36 | Sodium | Na | 11 |
| Lanthanum | La | 57 | Strontium | Sr | 38 |
| Lead | Pb | 82 | Sulfur | S | 16 |
| Lutetium | Lu | 71 | Tantalum | Ta | 73 |
| Magnesium | Mg | 12 | Technetium | Tc | 43 |
| Mendelevium | Md | 101 | Tellurium | Te | 52 |
| Mercury | Hg | 80 | Terbium | Tb | 65 |
| Molybdenum | Mo | 42 | Thallium | Tl | 81 |
| Neodymium | Nd | 60 | Thorium | Th | 90 |
| Neptunium | Np | 93 | Thalium | Tm | 69 |
| Nickel | Ni | 28 | Tin | Sn | 50 |
| Niobium | Nb | 41 | Titanium | Ti | 22 |
| Osmium | Os | 76 | Tungsten | W | 74 |
| Palladium | Pd | 46 | Uranium | U | 92 |
| Phosphorus | P | 15 | Vanadium | V | 23 |
| Platinum | Pt | 78 | Xenon | Xe | 54 |
| Plutonium | Pu | 94 | Ytterbium | Yb | 70 |
| Polonium | Po | 84 | Yttrium | Y | 39 |
| Potassium | K | 19 | Zinc | Zn | 30 |
| Praseodymium | Pr | 59 | Zirconium | Zr | 40 |

## APPENDIX C TO PART 20—Quantities[1] of Licensed Material Requiring Labeling

| | | | Col. 1 | Col. 2 | Col.3 |
|---|---|---|---|---|---|
| | | | Oral Ingestion | Inhalation | |
| Atomic Number | Radionuclide | Class | ALI | ALI | DAC |
| 95 | Americium 241 | W, all compounds | 8E-1 Bone surf (1E+0) | 6E-3 Bone surf (1E-2) | 3E-12 |

| | | | Col. 1 | Col. 2 | Col.3 |
|---|---|---|---|---|---|
| | | | Oral Ingestion | Inhalation | |
| Atomic Number | Radionuclide | Class | ALI | ALI | DAC |
| 55 | Cesium 137 | D, all compounds | 1E+2 | 2E+2 | 6E-8 |
| 27 | Cobalt 60 | W, all compounds except those given for Y | 5E+2 | 2E+2 | 7E-8 |
| 27 | Cobalt 60 | Y, oxides, hydroxides, halides & nitrates | 2E+2 | 3E+1 | 1E-8 |

| | | | Col. 1 | Col. 2 |
|---|---|---|---|---|
| Atomic Number | Radionuclide | Class | Air | Water |
| 95 | Americium 241 | W, all compounds | —- | —- |
| 55 | Cesium 137 | D, all compounds | 2E-10 | 1E-6 |
| 27 | Cobalt 60 | W, all compounds except those given for Y | 2E-10 | 3E-6 |
| 27 | Cobalt 60 | Y, oxides, hydroxides, halides & nitrates | 5E-11 | —- |

| Atomic Number | Radionuclide | Class | Monthly Average Concentration |
|---|---|---|---|
| 95 | Americium 241 | W, all compounds | —- |
| 55 | Cesium 137 | D, all compounds | 1E-5 |
| 27 | Cobalt 60 | W, all compounds except those given for Y | 3E-5 |
| 27 | Cobalt 60 | Y, oxides, hydroxides, halides & nitrates | —- |

| Radionuclide | Quantity (μCi) |
|---|---|
| Americium-241 | 0.001 |
| Cesium-137 | 10 |
| Cobalt-60 | 1 |

[1]The quantities listed above were derived by taking 1/10th of the most restrictive ALI listed in table 1, columns 1 and 2, of appendix B to §§20.1001-20.2401 of this part, rounding to the nearest factor of 10, and arbitrarily constraining the values listed between 0.001 and 1000 μCi. Values of 100 μCi have been assigned for radionuclides having a radioactive half-life in excess of $10^9$ years (except rhenium, 1000 μCi) to take into account their low specific activity.

NOTE: For purposes of §20.1902(e), 20.1905(a), and 20.2201 (a) where there is involved a combination of radionuclides in known amounts, the limit for the combination should be derived as follows: determine, for each radionuclide in the combination, the ratio between the quantity present in the combination and the limit otherwise established for the specific radionuclide when not in combination. The sum of such ratios for all radionuclides in the combination may not exceed "1" (i.e. "unity").

[56 FR 23465, May 21, 1992; 56 FR 61352, Dec. 3, 1991. Redesignated and amended at 58 FR 67659, Dec. 22, 1993; 60 FR 20186, Apr. 25, 1995]

## APPENDIX D to Part 20—United States Nuclear Regulatory Commission Regional Offices

| | Address | Telephone (24 hour) |
|---|---|---|
| **REGION I:** | | |
| Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont | USNRC, Region I<br>475 Allendale Road<br>King of Prussia, PA 19406 | (610) 337-5000<br>(FTS) 346-5000 |
| **REGION II:** | | |
| Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Virginia, Virgin Islands, and West Virginia | USNRC, Region II<br>Atlanta Federal Center<br>61 Forsyth Street SW,<br>Suite 23T85 | (404) 562-4400<br>(FTS) 841-4503 |
| **REGION III:** | | |
| Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin | USNRC, Region III<br>801 Warren Road | (708) 829-9500<br>(FTS) 829-9500 |
| **REGION IV:** | | |
| Alaska, Arizona, Arkansas, California, Colorado, Hawaii, Idaho, Kansas, Louisiana, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, Wyoming, and the U.S. territories and possessions in the Pacific. | USNRC, Region IV<br>611 Ryan Plaza Drive<br>Suite 400<br>Arlington, TX 76011 | (817) 860-8100<br>(FTS) 728-8100 |
| **REGION IV: Field Office** | USNRC, Region IV<br>Walnut Creek Field Office<br>1450 Maria Lane<br>Suite 300 | (510) 975-0200 |

[56 FR 23468, May 21, 1991, as amended at 56 FR 41449, Aug. 21, 1991; 58 FR 64111, Dec 6, 1993; 59 FR 17465, Apr. 13, 1994; 60 FR 24551, May 9, 1995; 62 FR 22880, Apr. 28, 1997]

# PART 30-RULES OF GENERAL APPLICABILITY TO DOMESTIC LICENSING OF BYPRODUCT MATERIAL

## General Provisions



### EXEMPTIONS



### LICENSES



### RECORDS, INSPECTIONS, TESTS, AND REPORTS



### ENFORCEMENT



### SCHEDULES



AUTHORITY: Secs.81,82,161,182,186,68 Stat.935,948,955,as amended, sec. 234,83, Stat.444, as amended (42U.S.C 2111,2112,2201,2232,2233,2236,2282); secs.201 as amended,202,206,88 Stat, 1242, as amended, 1244,1246,(42 U.S.C 5841,5842,5846).

Section 30.7 also issued under Pub. L.95-601, sec 10,92 Stat.2951 as amended by Pub.L. 102-486, sec.2902, 106 Stat. 3123 (42 U.S.C. 5851). Section 30.34(b) also issued under sec. 184, 68 Stat.954, as amended (42 U.S.C. 2234). Section 30.61 also issued under sec. 187, 68 Stat. 955 (42 U.S.C 2237).

### §30.1 Scope

This part prescribes rules applicable to all persons in the United States governing domestic licensing of byproduct material under the Atomic Energy Act of 1954, as amended (68 Stat. 919), and under title II of the Energy Reorganization Act of 1974 (88 Sta. 1242), and exemptions from the domestic licensing requirements permitted by section 81 of the Act. This part also gives notice to all persons who knowingly provide to any licensee, contractor, or subcontractor, components, equipment, materials, or other goods or services, that relate to a licensee's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of §30.10.

[56 FR 40689, Aug. 15, 1991]

### §30.3 Activities requiring licenses.

Except for persons exempt as provided in this part and part 150 of this chapter, no person shall manufacture, produce, transfer, receive, acquire, own, possess, or use byproduct material except as authorized in a specific or general license issued pursuant to the regulations in this chapter.

[30 FR 8185, June 26, 1965, as amended at 43 FR 6921, Feb. 17, 1978]

### §30.4 Definitions

*Act* means the Atomic Enegry Act of 1954 (68 Stat. 919), including any amendments thereto;

*Agreement State* means any state with which the Atomic Energy Commission or Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b. of the Act.

*Non-agreement State* mean any other State;

*Alert* means events may occur, are in progress, or have occurred that could lead to a release of radioactive material but that the release is not expected to require a response by offsite response organizations to protect persons offsite.

*Byproduct material* means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

*Commencement of construction* means any clearing of land, excavation, or other substantial action that would adversely affect the natural environment of a site but does not include changes desirable for the temporary use of the land for public recreational uses, necessary borings to determine site characteristics or other preconstruction monitoring to establish background information related to the suitability of a site or to the protection of environmental values.

*Commission* means the Nuclear Regulatory Commission and its duly authorized representative.

*Curie* means that amount of radioactive material which disintegrates at the rate of 37 billion atoms per second.

*Decommission* means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits—

(1) Release of the property for unrestricted use and termination of the license; or

(2) Release of the property under restricted conditions and termination of the license.

*Dentist* means an individual licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to practice dentistry.

*Department and Department of Energy* means the Department of Energy established by the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565, 42 U.S.C 7101 *et seq.*) to the extent that the Department , or its duly authorized representatives, exercises functions formerly vested in the U.S. Atomic Energy Commission, its Chairman, members, officers, and components and transferred to the U.S. Energy Research and Development Administration and to the Administrator thereof pursuant to sections 104(b), (c) and (d) of the Energy Reorganization Act ot 1974 (Pub. L. 93-438, 88 Stat. 1233 at 1237, 42 U. S.C. 5814) and retransferred to the Secretary of Energy pursuant to section 301(a) of the Department of Energy Organization Act (Pub. L. 95-91, 91 Stat. 565 at 577-578, 42 U.S.C. 7151).

*Effective dose equivalent* means the sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated. Weighting factors are: 0.25 for gonads, 0.15 for breast, 0.12 for red bone marrow, 0.12 for lungs, 0 .03 for thyroid, 0.03 for bone surface, and 0.06 for each of the other five organs receiving the highest dose equivalent.

*Government agency* means any executive department, commission, establishment, corporation, wholly or partly owned by the United States of America which is an instrumentality of the United States, or any board, bureau, division, service, office, officer, authority, administration, or other establishment in the executive branch of the Government;

*License*, except where otherwise specified means a license for by-product material issued pursuant to the regulations in this part and parts 31 through 36 and 39 of this chapter;

*Medical use* means the intentional internal or external administration of byproduct material or the radiation therefrom to patients or human research subjects under the supervision of an authorized user as defined in 10 CFR Part 35.

*Microcurie* means that amount of radioactive material which disintegrates at the rate of 37 thousand atoms per second.

*Millicurie* means that amount of radioactive material which disintegrates at the rate of 37 million atoms per second.

*Person* means: (1) Any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, Government agency other than the Commission or the Department, except that the Department shall be considered a person within the meaning of the regulations in this part to the extent that its facilities and activities are subject to the licensing and related regulatory authority of the Commission pursuant to section 202 of the Energy Reorganization Act of 1974 (88 Stat.1244),[1] any State or any political subdivision of or any political entity within a State, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing;

*Physician* means a medical doctor or doctor of osteopathy licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to prescribe drugs in the practice of medicine;

*Podiatrist* means an individual licensed by a State or Territory of the United States, the District of Columbia, or the Commonwealth of Puerto Rico to practice podiatry.

*Principal activities*, as used in this part, means activities authorized by the license which are essential to achieving the purpose(s) for which the license was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

*Production facility* means production facility as defined in the regulations contained in part 50 of this chapter;

*Research and development* means:(1) Theoretical analysis, exploration, or experimentation; or (2) the extension of investigative findings and theories of a scientific or technical nature unto practical application for experimental and demonstration purposes, including the experimental production and testing of models, devices, equipment,materials and processes. “Research and development” as used in this part and parts 31 through 35 does not include the internal or external administration of byproduct material, or the radiation therefrom, to human beings;

*Sealed source* means any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material;

*Site area emergency* means events may occur, are in progress, or have occurred that could lead to a significant release of radioactive material and that could require a response by offsite response organi-

zations to protect persons offsite.

*Source material* means source material as defined in the regulations contained in part 40 of this chapter;

*Special nuclear material* means special nuclear material as defined in the regulations contained in part 70 of this chapter;

*United States,* when used in a geographical sense,includes Puerto Rico and all territories and possessions of the United States;

*Utilization facility* means a utilization facility as defined in the regulations contained in part 50 of this chapter;

[1] The Department facilities and activities identified in section 202 are:

(1) Demonstration Liquid Metal Fast Breeder reactors when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(2) Other demonstration nuclear reactors, except those in existence on January 19, 1975, when operated as part of the power generation facilities of an electric utility system, or when operated in any other manner for the purpose of demonstrating the suitability for commercial application of such a reactor.

(3) Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from licensed activities.

(4) Retrievable Surface Storage Facilities and other facilities authorized for the express purpose of subsequent long-term storage of high-level radioactive waste generated by the Department, which are not used for, or are part of, research and development activities.

[30 FR 8185, June26,1965, as amended at 36 FR 1466, Jan.30, 1971; 37 FR 5746 Mar. 21,1972; 38 FR 29314, Oct.24, 1973; 40 FR 8784, Mar. 3, 1975; 43 FR 6921, Feb. 17, 1978; 45 FR 14200, Mar.5, 1980; 45 FR 18905, Mar. 24, 1980; 48 FR 39037, Aug. 29, 1983; 51 FR 36967, Oct. 16, 1986; 52 FR 8241, Mar. 17, 1987; 53 FR 24044, June 27, 1988; 54 FR 14059, Apr. 7,1989; 58 FR 7736, Feb.9,1993; 59 FR 36034, July 15,1994; 59 FR 61780, Dec.2, 1994; 62 FR 28963, May 28, 1997; 62 FR 39089, July 21, 1997]

### §30.5 Interpretations

Except as specifically authorized by the Commission in writing, no interpretation of the meaning of the regulations in this part and parts 31 through 36 and 39 by any officer or employee of the Commission other than a written interpretation by the General Counsel will be recognized to be binding upon the Commission.

[30 FR 8185, June 26,1965, as amended at 43 FR 6921, Feb.17, 1978; 52 FR 8241, Mar.17, 1987; 58 FR 7736, Feb. 9,1993]

### §30.6 Communications

(a) Unless otherwise specified or covered under the regional,licensing program as provided in paragraph (b) of this section, any communication or report concerning the regulations in parts 30 through 36 and 39 of this chapter and any application filed under these regulations may be submitted to the Commission as follows:

(1) By mail addressed to: Director, Office of Nuclear Material safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

(2) By delivery in person to the Commission's offices to the Director, Office of Nuclear Material Safety and Safeguards at:

(i) 2120 L Street, NW, Washington, DC; or

(ii) 11545 Rockville Pike, Rwo White Flint North, Rockville, Maryland.

(b) The Commission has delegated to the five Regional Administrators licensing authority for selected parts of its decentralized licensing program for nuclear materials as described in paragraph (b)(1) of this section. Any communication, report, or application covered under this licensing program must be submitted as specified in paragraph (b)(2) of this section.

(1) The delegated licensing program includes authority to issue, renew, amend, cancel, modify, suspend, or revoke licenses for nuclear materials issued pursuant to 10 CFR parts 30 through 36, 39, 40, and 70 to all persons for academic, medical, and industrial uses, with the following exceptions:

(i) Activities in the fuel cycle and special nuclear material in quantities sufficient to constitute a critical mass in any room or area. This exception does not apply to license modifications relating to termination of special nuclear material licenses that authorize possession of larger quantities when the case is referred for action from NRC's Headquarters to the Regional Administrators.

(ii) Health and safety design review of sealed sources and devices and approval, for licensing purposes, of sealed sources and devices.

(iii) Processing of source material for extracting of metallic compounds (including Zirconium, Hafnium, Tantalum, Titanium, Niobium, etc.).

(iv) Distribution of products containing radioactive materials to persons exempt pursuant to 10 CFR 32.11 through 32.26.

(v) New uses or techniques for use of byproducts, source, or special nuclear material.

(2) *Submissions*—(i) *Region I.* The regional licensing program involves all federal facilities in the region and non-Federal licensees in the following Region I non-Agreement States and the District of Columbia: Connecticut, Delaware, Maine, Massachusetts, New Jersey, Pennsylvania, and Vermont. All inquiries, communications, and applications for a new license or an amendment or renewal of an existing license specified in paragraph (b)(1) of this section must be sent to: U.S. Nuclear Regulatory Commission, region I, Nuclear Material Section B, 475 Allendale Road, King of Prussia, Pennsylvania 19406.

(ii) *Region II.* The regional licensing program

involves all Federal facilities in the region and non-Federal licensees in the following Region II non-agreement States and territories: Virginia, West Virginia, Puerto Rico, and the Virgin Islands. All inquiries, communications, and applications for a new license or an amendment or renewal of an existing license specified in paragraph (b)(1) of this section must be sent to U.S. Nuclear Regulatory Commission, Region II, Material Licensing / Inspection Branch, Atlanta Federal Center, 61 Forsyth Street, SW, Suite 23t85, Atlanta, GA 30303.

(iii) *Region III*. The regional licensing program involves all federal facilities in the region and all non-Federal licensees in the following Region III non-Agreement States: Indiana, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. All inquiries and communications, and applications for a new license or and amendment to or renewal of an existing license specified in paragraph (b)(1) of this section must be sent to: U.S. Nuclear Regulatory Commission, Region III, Material Licensing Section, 801 Warrenville Road, Lisle, Illinois 60532-4351.

(iv) *Region IV.* The regional licensing program involves all federal facilities in the region and non-federal licensees in the following Region IV non-Agreement States and a territory: Alaska, Hawaii, Montana, Oklahoma, South Dakota, Wyoming, and Guam. All inquiries, communications, and applications for a new license or an amendment to or renewal of an existing license specified in paragraph (b)(1) of this section must be sent to: U.S. Nuclear Regulatory Commission, Region IV, Material Radiation Protection Section, 611 Ryan Plaza Drive, Suite 400, Arlington, texas 76011.

[48 FR 16031, Apr.14, 1983, as amended at 49 FR 19630, May 9,1984; 49 FR 47824, Dec. 7,1984; 50 FR 14693, Apr. 11,1985; 51 FR 36000, Oct. 8,1986; 52 FR 8241, Mar. 17, 1987; 52 FR 38392, Oct. 16, 1987; 52 FR 48093, Dec. 18, 1987; 53 FR 3862, Feb. 10,1988; 53 FR 43420, Dec. 18,1988; 56 FR 7736, Feb. 9, 1993; 58 FR 64111, Dec. 6, 1993; 59 FR 17465, Apr. 13, 1994; 60 FR 24551, May 9,1995; 62 FR 22880, Apr. 28, 1997]

## EXEMPTIONS

### §30.11 Specific exemptions.

(a) The Commission may, upon application of any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part and parts 31 through 36 and 39 of this chapter as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

(b) [Reserved]

(c) The DOE is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 60 of this chapter.

(d) Except as specifically provided in part 61 of this chapter, any licensee is exempt from the requirements of this part to the extent that its activities are subject to the requirements of part 61 of this chapter.

[37 FR 5746, Mar. 21, 1972 , as amended at 39 FR 26279, July 18, 1974; 40 FR 8784, Mar. 3, 1975; 43 FR 6921, Feb. 21,1978; 45 FR 65530, Oct. 3, 1980; 46 FR 13979, Feb. 25, 1981; 47 FR 57480, Dec. 27, 1982; 62 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb. 9, 1993]

### §30.14 Exempt concentrations.

(a) Except as provided in paragraphs (c) and (d) of this section, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in this part and parts 31 through 36 and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns or acquires products or material in concentrations not in excess of those listed in §30.70.

(b) This section shall not be deemed to authorize the import of byproduct material or products containing byproduct material.

(c) A manufacturer, processor, or producer of a product or material in an agreement State is exempt from the requirements for a license set forth in Section 81 of the Act and from the regulations in this part and parts 31, 32, 33, 34, 36, and 39 of this chapter to the extent that he transfers byproduct material contained in a product or material in concentrations not in excess of those specified in §30.70 and introduced into the product or material by a licensee holding a specific license issued by an agreement State, the Commission, or the Atomic Energy Commission expressly authorizing such introduction. This exemption does not apply to the transfer of byproduct material contained in any food, beverage, cosmetic, drug, or other commodity or product designed for ingestion or inhalation by, or application to, a human being.

(d) No person may introduce byproduct material into a product or material knowing or having reason to believe that it will be transferred to persons exempt under this section or equivalent regulations of an Agreement State, except in accordance with a license issued pursuant to §32.11 of this chapter or the general license provided in §150.20 of this chapter.

[30 FR 8185, June 26,1965, as amended at 40 FR 8785, Mar.3,1975; 43 FR 6921, Feb.17, 1978; 52 FR 8241, Mar. 17, 1987; 58 FR 7736, Feb.9, 1993]

### §30.15 Certain items containing byproduct material.

(a) Except for persons who apply byproduct material to, or persons who incorporate byproduct mate-

rial into, the following products, or persons who initially transfer for sale or distribution the following products containing byproduct material, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 20 and 30 through 36 and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns, or acquires the following products:

(1) Timepieces or hands or dials containing not more than the following specified quantities of byproduct material and not exceeding the following specified levels of radiation:

(i) 25 millicuries of tritium per timepiece,

(ii) 5 millicuries of tritium per hand,

(iii) 15 millicuries of tritium per dial (bezels when used shall be considered as part of the dial),

(iv) 100 microcuries of promethium 147 per watch or 200 microcuries of promethium 147 per any other timepiece,

(v) 20 microcuries of promethium 147 per watch hand or 40 microcuries of promethium 147 per other timepiece hand,

(vi) 60 microcuries of promethium 147 per watch dial or 120 microcuries of promethium 147 per other timepiece dial (bezels when used shall be considered as part of the dial),

(vii) The levels of radiation from hands and dials containing promethium 147 willl not exceed, when measured through 50 milligrams per square centimeter of absorber:

(A) For wrist watches, 0.1 millirad per hour at 10 centimeters from any surface,

(B) For pocket watches, 0.1 millirad per hour at 1 centimeter from any surface,

(C) For any other timepiece, 0.2 millirad per hour at 10 centimeters from any surface.

(2) Lock illuminators containing not more than 15 millicuries of tritium or not more than 2 millicuries of promethium 147 installed in automobile locks. The levels of radiation from each lock illuminator containing promethium 147 will not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 50 milligrams per square centimeter of absorber.

(3) Balances of precision containing not more than 1 millicurie of tritium per balance or not more than 0.5 millicurie of tritium per balance part.

(4) Automobile shift quadrants containing not more than 25 millicuries of tritium.

(5) Marine compasses containing not more than 750 millicuries of tritium gas and other marine navigational instruments containing not more than 250 millicuries of tritium gas.

(6) Thermostat dials and pointers containing not more than 25 millicuries of tritium per thermostat.

(7) [Reserved]

(8) Electron tubes: *Provided,* That each tube does not contain more than one of the following specified quantities of byproduct material:

(i) 150 millicuries of tritium per microwave receiver protector tube or 10 millicuries of tritium per any other electron tube;

(ii) 1 microcurie of cobalt-60;

(iii) 5 microcuries of nickel-63;

(iv) 30 microcuries of krypton-85;

(v) 5 microcuries of cesium-137;

(vi) 30 microcuries of promethium -147;

*And provided further,* That the levels of radiation from each electron tube containing byproduct material do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber.[1]

(9) Ionizing radiation measuring instruments containing, for purposes of internal calibration or standardization, one or more sources of byproduct material: *Provided,* That;

(i) Each source contains no more than one exempt quantity set forth in §30.71, Schedule B, and

(ii) Each instrument contains no more than 10 exempt quantities. For purposes of this paragraph (a)(9), an instrument's source(s) may contain either one type or different types of radionuclides and an individual exempt quantity may be composed of fractional parts of one or more of the exempt quantities in §30.71, Schedule B, provided that the sum of such fractions such not exceed unity.

(iii) For purposes of this paragraph (a)(9), 0.05 microcuries of americium-241 is considered an exempt quantity under §30.71, Schedule B.

(10) Spark gap irradiators containing not more than 1 microcurie of cobalt-60 per spark gap irradiator for use in electrically ignited fuel burners having a firing rate of at least 3 gallons per hour (11.4 liters per hour).

(b) Any person who desires to apply byproduct material to, or to incorporate byproduct material into, the products exempted in paragraph (a) of this section, or who desires to initially transfer for sale or distribution such products containing byproduct material, should apply for a specific license pursuant to §32.14 of this chapter, which license states that the product may be distributed by the licensee to persons exempt from the regulations pursuant to paragraph (a) of this section.

[1] For purposes of this paragraph "electron tubes" include spark gap tubes,power tubes, gas tubes including glow lamps, receiving tubes, microwave tubes, indicator tubes, pickup tubes, radiation detection tubes, and any other completely sealed tube that is designed to conduct or control electrical currents.

[31 FR 5316, Apr.2,1966, as amended at 31 FR 14349, Nov.8,1966; 32 FR 785, Jan.24. 1967; 32 FR 6434, Apr.26, 1967; 32 FR 13291, Oct.6, 1967; 34 FR 6651, Apr.18, 1969; 34 FR 19546, Dec.11, 1969; 35 FR 6427, Apr.22, 1970; 35 FR 8820, June 6,1970; 43 FR 2387,

Jan.17, 1978; 43 FR 6921, Feb.17, 1978; 46 FR 26471, May 13,1981; 46 FR 46876, Sept.23, 1981; 52 FR 8241, Mar.17, 1987; 58 FR 7736, Feb.9,1993]

### §30.18 Exempt quantities.

(a) Except as provided in paragraphs (c) and (d) of this section, any person is exempt from the requirements for a license set forth in section 81 of the Act and from the regulations in parts 30 through 34, 36 and 39 of this chapter to the extent that such person receives, possesses, uses, transfers, owns, or acquires byproduct material in individual quantities each of which does not exceed the applicable quantity set forth in §30.71, Schedule B.

(b) Any person who possesses byproduct material received or acquired prior to September 25, 1971 under the general license then provided in §31.4 of this chapter is exempt from the requirements set forth in section 81 of the Act and from the regulations in parts 30 through 34 of this chapter to the extent that such person possesses, uses, transfers, or owns such byproduct material.

(d) No person may, for purposes of commercial distributon, transfer byproduct material in the individual quantities set forth in §30.71 Schedule B, knowing or having reason to believe that such quantities of byproduct material will be transferred to persons exempt under this section or equivalent regulations of an Agreement State, except in accordance with a license issued under §32.18 of this chapter, which license states that the byproduct material may be transferred by the licensee to persons exempt under this section or the equivalent regulations of an Agreement State.

[35 FR 6427, Apr.22,1970, as amended at 36 FR 16898, Aug.26,1971; 43FR 6921, Feb.17,1978; 52 FR 8241, Mar.17.1987; 58 FR 7736, Feb.9,1993]

## LICENSES

### §30.31 Types of licenses.

Licenses for byproduct material are two types: General and specific. Specific licenses are issued to named persons upon applications filed pursuant to the regulations in this part and parts 32 through 36 and 39 of this chapter. General licenses are effective without the filing of applications with the Commission or the issuance of licensing documents to particular persons.

[30 FR 8185, June 26,1965, as amended at 43 FR 6922, Feb.17, 1978; 52 FR 8241, Mar.17,1987; 58 FR 7736, Feb.9, 1993]

### §30.32 Application for specific licenses.

(a) A person may file an application in duplicate on NRC Form 313 “Application for Material License,” in accordance with the instructions in §30.6 of this chapter. Information contained in previous applications, statements or reports filed with the Commission or the Atomic Energy Commission may be incorporated by reference, provided that the reference is clear and specific.

(b) The Commission may at any time after the filing of the original application, and before the expiration of the license, require further statements in order to enable the Commission to determine whether the application should be granted or denied or whether a license should be modified or revoked.

(c) Each application shall be signed by the applicant or or licensee or a person authorized to act for and on his behalf.

(d) An application for license filed pursuant to the regulations in this part and parts 32 through 35 of this chapter will be considered also as an application for licenses authorizing other activities for which licenses are required by the Act, provided that the application specifies the additional activities for which the licenses are requested and complies with regulations of the Commission as to applications for such licenses.

(e) Each application for a byproduct material license, other than a license exempted from part 170 of this chapter, shall be accompanied by the fee prescribed in §170.31 of this chapter, No fee will be required to accompany an application for renewal or amendment of a license, except as provided in §170.31 of this chapter.

(f) An application for a license to receive and possess byproduct material for the conduct of any activity which the Commission has determined pursuant to subpart A of part 51 of this chapter will significantly affect the quality of the environment shall be filed at least 9 months prior to commencement of construction of the plant or facility in which the activity will be conducted and shall be accompanied by any Environmental Report required pursuant to subpart A of part 51 of this chapter.

(g) An application for a specific license to use byproduct material in the form of a sealed source or in a device that contains the sealed source must either—

(1) Identify the source or device by manufacturer and model number as registered with the Commission under §32.210 of this chapter or with an Agreement State; or

(2) Contains the information identified in §32.210 (c).

(h) As provided by §30.35, certain applications for specific licenses filed under this part and parts 32 through 35 of this chapter must contain a proposed decommissioning funding plan or a certification of financial assurance for decommissioning. In the case

of renewal applications submitted before July 27,1990, this submittal may follow the renewal application but must be submitted on or before July 27, 1990.

(i)(1) Each application to possess radioactive materials in unsealed form, on foils or plated sources, or sealed in glass in excess of the quantities in §30.72, "Schedule C- Quantities of Radioactive Materials Requiring Consideration of the Need for and Emergency Plan for Responding to a Release," must contain either:

(i) An evaluation showing that the maximum dose to a person offsite due to a release of radioactive materials would not exceed 1 rem effective dose equivalent or 5 rems to the thyroid; or

(ii) An emergency plan for responding to a release of radioactive material.

(2) One or more of the following factors may be used to support an evaluation submitted under paragraph (i)(1)(i) of this section:

(i) The radioactive material is physically separated so that only a portion could be involved in an accident;

(ii) All or part of the radioactive material is not subject to release during an accident because of the way it is stored or packaged;

(iii) The release fraction in the respirable size range would be lower than the release fraction shown in §30.72 due to the chemical or physical form of the material;

(iv) The solubility of the radioactive material would reduce the dose received;

(v) Facility design or engineered safety features in the facility would cause the release fraction to be lower than shown in §30.72;

(vi) Operating restrictions or procedures would prevent a release fraction as large as that shown in §30.72; or

(vii) Other factors appropriate for the specific facility.

(3) An emergency plan for responding to a release of radioactive material submitted under paragraph (i)(1)(ii) of this section must include the following information:

(i) Facility description. A brief description of the licensee's facility and area near the site.

(ii) Types of accidents. An identification of each type of radio-active material accident for which protective actions may be needed.

(iii) Classification of accidents. A classification system for classifiying accidents as alerts or site area emergencies.

(iv) Detection of accidents. Identification of the means of detecting each type of accident in a timely manner.

(v) Mitigation of consequences. A brief description of the means and equipment for mitigating the consequences of each type of accident,including those provided to protect workers onsite, and a description of the program for maintaining the equipment.

(vi) Assessment of releases. A brief description of the methods and equipment to assess releases of radioactive materials.

(vii) Responsibilities. A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the NRC; also responsibilities for developing, maintaining, and updating the plan.

(viii) Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established. The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the NRC operations center immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.[1]

[1] These reporting requirements do not supercede or release licensees of complying with the requirements under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Pub.L.99-499 or other state or federal reporting requirements.

(ix) Information to be communicated. A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the NRC.

(x) Training. A brief description of the frequency, performance objectives and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instructions and orientation tours the licensee would offer to fire, police, medical and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(xi) Safe shutdown. A brief description of the means of restoring the facilities to a safe condition after an accident.

(xii) Exercises. Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite

offsite response organizations to participate in the biennial exercises. Participation of offsite response organizations in biennial exercises although recommended is not required. Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

(xiii) Hazardous chemicals. A certification that the applicant has met its responsibilities under the Emergency Planning and Community Right-to-Know Act of 1986, title III, Pub.L.99-499, if applicable to the applicant's activities at the proposed place of use of the byproduct material.

(4) The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the licensee's emergency plan before submitting it to the NRC. The licensee shall provide any comments received within the 60 days to the NRC with the emergency plan.

[30 FR 8185, June 26,1965, as amended at 36 FR 145, Jan.6,1971; 37 FR 5747, Mar.21,972; 43 FR 6922, Feb.17,1978; 49 FR 9403, Mar.12,1984; 49 FR 27924, July 9,1984; 52 FR 27786,July 24,1987; 53 FR 24044,June 27,1988; 54 FR 14060,Apr.7,1989]

### §30.33 General requirements for issuance of specific licenses.

(a) An application for a specific license will be approved if:

(1) The application is for a purpose authorized by the Act;

(2) The applicant's proposed equipment and facilities are adequate to protect health and minimize danger to life and property;

(3) The applicant is qualified by training and experience to use the material for the purpose requested in such manner as to protect health and minimize danger to life or property;

(4) The applicant satisfies any special requirements contained in parts 32 through 36 and 39; and

(5) In the case of an application for a license to receive and possess byproduct material for the conduct of any activity which the Commission determines will significantly affect the quality of the environment, the Director of Nuclear Material Safety and Safeguards or his designee, before commencement of construction of the plant or facility in which the activity will be conducted, on the basis of information filed and evaluations made pursuant to subpart A of part 51 of this chapter, has concluded, after weighing the environmental, economic, technical, and other benefits against environmental costs and considering available alternatives, that the action called for is the issuance of the proposed license, with any appropriate conditions to protect environmental values. Commencement of construction prior to such conclusion shall be grounds for denial of a license to receive and possess byproduct material in such plant or facility. As used in this paragraph the term "commencement of construction" means any clearing of land, excavation, or other substantial action that would adversely affect the environment of a site. The term does not mean site exploration, necessary roads for site exploration, borings to determine foundation conditions, or other preconstruction monitoring or testing to establish background information related to the suitability of the site or the protection of environmental values.

(b) Upon a determination that an application meets the requirements of the Act, and the regulations of the Commission, the Commission will issue a specific license authorizing the possession and use of byproduct material (Form NRC 374, "Byproduct Material License").

[30 FR 8185, June 26,1965, as amended at 36 FR 12731, July 7,1971; 37 FR 5747, Mar.21,1972; 39 FR 26279, July 18,1974; 43 FR 6922, Feb.17,1978; 49 FR 9403, Mar.12,1984; 52 FR 8241, Mar.17,1987; 58 FR 7736, Feb.9,1993]

### §30.34 Terms and conditions of licenses.

(a) Each license issued pursuant to the regulations in this part and the regulations in parts 31 through 36 and 39 of this chapter shall be subject to all the provisions of the Act, now or hereafter in effect, and to all valid rules, regulations and orders of the Commission.

(b) No license issued or granted pursuant to the regulations in this part and parts 31 through 36, and 39 nor any right under a license shall be transferred, assigned or in any manner disposed of, either voluntarily or involuntarily, directly or indirectly, through transfer of control of any license to any person, unless the Commission shall, after securing full information, find that the transfer is in accordance with the provisions of the Act and shall give its consent in writing.

(c) Each person licensed by the Commission pursuant to the regulations in this part and parts 31 through 36 and 39 shall confine his possession and use of the byproduct material to the location and purpose authorized in the license. Except as otherwise provided in the license, a license issued pursuant to the regulations in this part and parts 31 through 36 and 39 of this chapter shall carry with it the right to receive, acquire, own, and possess byproduct material. Preparation for shipment and transport of by-

product material shall be in accordance with the provisions of part 71 of this chapter.

(d) Each license issued pursuant to the regulations in this part and parts 31 through 36 and 39 shall be deemed to contain the provisions set forth in section 183b.-d, inclusive, of the Act, whether or not these provisions are expressly set forth in the license.

(e) The Commission may incorporate, in any license issued pursuant to the regulations in this part and parts 31 through 36 and 39, at the time of issuance, or thereafter by appropriate rule, regulation or order, such additional requirements and conditions with respect to the licensee's receipt, possession, use and transfer of byproduct material as it deems appropriate or necessary in order to:

(1) Promote the common defense and security;

(2) Protect health or to minimize danger to life or property;

(3) Protect restricted data;

(4) Require such reports and the keeping of such records, and to provide for such inspections of activities under the license as may be necessary or appropriate to effectuate the purposes of the Act and regulations thereunder.

(f) Licensees required to submit emergency plans by §30.32(i) shall follow the emergency plan approved by the Commission. The licensee may change the approved without Commission approval only if the changes do not decrease the effectiveness of the plan. The licensee shall furnish the change to the appropriate NRC Regional Office specified in §30.6 and to affected offsite response organizations within six months after the change is made. Proposed changes that decrease, or potentially decrease, the effectiveness of the approved emergency plan may not be implemented without prior application to and prior approval by the Commission.

(g) Each licensee preparing technetium-99m radiopharmaceuticals from molybdenum-99/ technetium-99m generators shall test the generator eluates for molybdenum-99 breakthrough in accordance with §35.204 of this chapter. The licensee shall record the results of each test and retain each record fro three years after the record is made.

(h)(1) Each licensee shall notify the appropriate NRC Regional Administrator, in writing, immediately following the filing of a voluntary or involuntary petition for bankruptcy under any chapter of title 11 (Bankruptcy) of the United States Code by or against:

(i) The licensee;

(ii) An entity (as that term is defined in 11 U.S.C. 101(14)) controlling the licensee or listing the license or licensee as property of the estate; or

(iii) An affiliate (as that term is defined in 11 U.S. C. 101(2) of the licensee.

(2) This notification must indicate:

(i) The bankruptcy court in which the petition for bankruptcy was filed; and

(ii) The date of filing of the petition.

[30 FR 8185, June 26,1965, as amended at 38 FR 33969, Dec.10,1973; 43 FR 6922, Feb.17,1978; 48 FR 32328, July 15,1983; 52 FR 1295, Jan.12,1987; 52 FR 8241, Mar.17,1987; 53 FR 19245,May 27,1988; 53 FR 23383, June 22,1988; 54 FR 14061, Apr.7,1989; 58 FR 7736,Feb.9,1993; 59 FR 61780, Dec.2,1994]

### §30.36 Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas.

(a)(1) Except as provided in paragraph (a)(2) of this section, each specific license expires at the end of the day on the expiration date stated in the license unless the licensee has filed an application for renewal under §30.37 not less than 30 days before the expiration date stated in the existing license (or, for those licensees subject to paragraph (a)(2) of this section, 30 days before the deemed expiration date in that paragraph). If an application for renewal has been filed at leats 30 days before the expiration date stated in the existing license (or, for those licensees subject to paragraph (a)(2) of this section, 30 days before the deemed expiration date in that paragraph), the existing license expires at the end of the day on which the Commission makes a final determination to deny the renewal application or, if the determination states an expiration date, the expiration date stated in the determination.

(2) Each specific license that has an expiration date after July 1,1995, and is not one of the licenses described in paragraph (a)(3) of this section, shall be deemed to have an expiration date that is five years after the expiration date stated in the current license.

(3) The following specific licenses are not subject to, or otherwise affected by, the provisions of paragraph (a)(2) of this section:

(i) Specific licenses for which, on February 15, 1996, an evaluation or an emergency plan is required in accordance with §30.32(i);

(ii) Specific licenses whose holders are subject to the financial assurance requirements specified in 10 CFR 30.35 and on February 15, 1996, the holders either:

(A) Have not submitted a decommissioning funding plan or certification of financial assurance for decommissioning; or

(B) Have not received written notice that the decommissioning funding plan or certification of financial assurance for decommissioning is acceptable;

(iii) Specific licenses whose holders are listed in the SDMP List published in NUREG 1444, Supplement 1 (November 1995);

(iv) Specific licenses whose issuance, amendment, or renewal, as of February 15, 1996 is not a

categorical exclusion under 10 CFR 51.22(c)(14) and , therefore, need an environmental assessment or environmental impact statement pursuant to Subpart A of Part 51 of this chapter;

(v) Specific licenses whose holders have not had at least one NRC inspection of licensed activities before February 15, 1996;

(vi) Specific licenses whose holders, as the result of the most recent NRC inspection of licensed activities conducted before February 15, 1996, have been:

(A) Cited for a Severity Level I, II, or III violation in a Notice of Violation;

(B) Subject to and Order issued by the NRC; or

(C) Subject to a Confirmatory Action Letter issued by the NRC.

(vii) Specific licenses with expiration dates before July 1,1995, for which the holders have submitted applications for renewal under 10 CFR 30.37 of this part.

(b) Each specific license revoked by the Commission expires at the end of the day on the date of the Commission's final determination to revoke the license, or on the expiration date stated in the determination, or as otherwise provided by Commission Order.

(c) Each specific license continues in effect, beyond the expiration date if necessary, with respect to possession of byproduct material until the Commission notifies the licensee in writing that the license is teminated. During this time the licensee shall—

(1) Limit actions involving byproduct material to those related to decommissioning; and

(2) Continue to control entry to restricted areas until they are suitable for release in accordance with NRC requirements.

(d) Within 60 days of the occurrence of any of the following, consistent with the administrative directions in §30.6, each licensee shall provide notification to the NRC in writing of such occurrence, and either begin decommissioning its site, or any seperate building or outdoor area that contains residual radioactivity so that the building or outdoor area is suitable for release in accordance with NRC requirements, or submit within 12 months of notification a decommissioning plan, if required by paragraph (g)(1) of this section, and begin decommissioning upon approval of that plan if—

(1) The license has expired pursuant to paragraph (a) or (b) of this section; or

(2) The licensee has decided to permanently cease principal activities, as defined in this part, at the entire site or in any seperate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with NRC requirements; or

(3) No principal activities under the license have been conducted for a period of 24 months; or

(4) No principal activities have been conducted for a period of 24 months in any separate building or outdoor area that contains residual radioactivity such that the building or outdoor area is unsuitable for release in accordance with NRC requirements.

(e) Coincident with the notification required by paragraph (d) of this section, the licensee shall maintain in effect all decommissioning financial assurances established by the licensee pursuant to §30.35 in conjunction with a license issuance or renewal or as required by this section. The amount of the financial assurance must be increased , or may be decreased, as appropriate, to cover the detailed cost estimate for decommissioning established pursuant to paragraph (g)(4)(v) of this section.

(1) Any licensee who has not provided financial assurance to cover the detailed cost estimate submitted with the decommissioning plan shall do so when this rule becomes effective November 24, 1995.

(2) Following approval of the decommissioning plan, a licensee may reduce the amount of the financial assurance as decommissioning proceeds and radiological contamination is reduced at the site with the approval of the Commission.

(f) The Commission may grant a request to extend the time periods established in paragraph (d) if the Commission determines that this relief is not detrimental to the public health and safety and is otherwise in the public interest. The request must be submitted no later than 30 days before notification pursuant to paragraph (d) of this section. The schedule for decommissioning set forth in paragraph (d) of this section may not commence until the Commission has made a determination on the request.

(g)(1) A decommissioning plan must be submitted if required by license condition or if the procedures and activities necessary to carry out decommissioning of the site or separate building or outdoor area have not been previously approved by the Commission and these procedures could increase potential health and safety impacts to workers or to the public, such as in any of the following cases:

(i) procedures would involve techniques not applied routinely during cleanup or maintenance operations;

(ii) Workers would be entering areas not normally occupied where surface contamination and radiation levels are significantly higher than routinely encountered during operation;

(iii) Procedures could result in significantly greater airborne concentrations of radioactive materials than are present during operation; or

(iv) Procedures could result in significantly greater releases of radioactive material to the environment than those associated with operation.

(2) The Commission may approve an alternate

schedule for submittal of a decommissioning plan required pursuant to paragraph (d) of this section if the Commission determines that the alternative schedule is necessary to the effective conduct of decommissioning operations and presents no undue risk from radiation to the public health and safety and is otherwise in the public interest.

(3) Procedures such as those listed in paragraph (g)(1) of this section with potential health and safety impacts may not be carried out prior to approval of the decommissioning plan.

(4) The proposed decommissioning plan for the site or separate building or outdoor area must include:

(i) A description of the conditions of the site or separate building or outdoor area sufficient to evaluate the acceptability of the plan;

(ii) A description of planned decommissioning activities;

(iii) A description of methods used to ensure protection of workers and the environment against radiation hazards during decommissioning;

(iv) A description of the planned final radiation survey; and

(v) An updated detailed cost estimate for decommissioning, comparison of that estimate with present funds ste aside for decommissioning, and a plan for assuring the availability of adequate funds for completion of decommissioning.

(vi) For decommissioning plans calling for completion of decommissioning later than 24 months after plan approval, the plan shall include a justification for the delay based on the criteria in paragraph (i) of this section.

(5) The proposed decommissioning plan will be approved by the Commission if the information therein demonstrates that the decommissioning will be completed as soon as practicable and that the health and safety of workers and the public will be adequately protected.

(h)(1) Except as provided in paragraph (i) of this section, licensees shall complete decommissioning of the site or separate building or outdoor area as soon as practicable but no later than 24 months following the initiation of decommissioning.

(2) Except as provided in paragraph (i) of this section, when decommissioning involves the entire site, the licensee shall request license termination as soon as practicable but no later than 24 months following the initiation of decommissioning.

(i) The Commission may approve a request for an alternative schedule for completion of decommissioning of the site or separate building or outdoor area, and license termination if appropriate, if the Commission determines that the alternative is warranted by consideration of the following:

(1) Whether it is technically feasible to complete decommissioning within the alloted 24-month period;

(2) Whether sufficient waste disposal capacity is available to allow completion of decommissioning within the alloted 24-month period;

(3) Whether a significant volume reduction in wastes requiring disposal will be achieved by allowing short-lived radionuclides to decay; and

(4) Whether a significant reduction in radiation exposure to workers can be achieved by allowing short-lived radionuclides to decay; and

(5) Other site-specific factors which the Commision may consider appropriate on a case-by-case basis, such as the regulatory requirements of other governmental agencies, lawsuits, groundwater treatment activities, monitored natural ground-water restoration, actions that could result in more environmental harm than deferred cleanup, and other factors beyond the control of the licensee.

(j) As the final step in decommissioning, the licensee shall—

(1) Certify the disposition of all licensed material, including accumulated wastes, by submitting a completed NRC Form 314 or equivalent information; and

(2) Conduct a radiation survey of the premises where the licensed activities were carried out and submit a report of the results of this survey, unless the licensee demonstrates in some other manner that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E. The licensee shall, as appropriate—

(i) Report levels of gamma radiation in units of millisieverts (microroentgen) per hour at one meter from surfaces, and report levels of radioactivity, including alpha and beta, in units of megabecquerels (disintegrations per minute or microcuries) per 100 square centimeters—removable and fixed— for surfaces, megabecquerels (microcuries) per milliliter for water, and becquerels (picocuries) per gram for solids such as soils or concrete; and

(ii) Specify the survey instrument(s) used and certify that each instrument is properly calibrated and tested.

(k) Specific licenses, including expired licenses, will be terminated by written notice to the licensee when the Commission determines that:

(1) Byproduct material has been properly disposed;

(2) Reasonable effort has been made to eliminate residual radioactive contamination, if present; and

(3)(i) A radiation survey has been performed which demonstrates that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E; or

(ii) Other information submitted by the licensee is sufficient to demonstrate that the premises are suitable for release in accordance with the criteria for decommissioning in 10 CFR part 20, subpart E.

(4) Records required by §30.51(d) and (f) have been received.

[59 FR 36034, July 15,1994, as amended at 60 FR 38238, July 26,1995; 61 FR 1114, Jan. 16,1996; 61 FR 24673, May 16,1996; 61 FR 29637, June 12,1996; 62 FR 39090, July 21, 1997]

### §30.37 Application for renewal of licenses.

(a) Application for renewal of a specific license must be filed on NRC Form 314 and in accordance with §30.32.

(b) If any licensee granted the extension described in 10 CFR 30.36(a)(2) has a currently pending renewal application for the extended license, that application will be considered withdrawn by the licensee and any renewal fees paid by the licensee for that application will be refunded.

### §30.38 Application for amendment of licenses.

Applications for amendment of a license shall be filed on Form NRC-313 in accordance with §30.32 and shall specify the respects in which the licensee desires its license to be amended and the grounds for amendment.

[49 FR 19625, May 9,1984]

### §30.39 Commission action on applications to renew or amend.

In considering an application by a licensee to renew or amend his license the Commission will apply the applicable criteria set forth in §30.33 and parts 32 through 36 and 39 of this chapter.

[30 FR 8185, June 26,1965, as amended at 43 FR 6922, Feb. 17,1978; 52 FR 8241, Mar.17,1987; 58 FR 7736, Feb. 9,1993]

### §30.41 Transfer of byproduct material.

(a) No licensee shall transfer byproduct material except as authorized pursuant to this section.

(b) Except as otherwise provided in his license and subject to the provisions of paragraphs (c) and (d) of this section, any licensee may transfer byproduct material:

(1) To the Department;

(2) To the agency in any Agreement State which regulates radioactive material pursuant to an agreement under section 274 of the Act;

(3) To any person exempt from the licensing requirements of the Act and regulations in this part, to the extent permitted under such exemption;

(4) To any person in an Agreement State , subject to the jurisdiction of that State, who has been exempted from the licensing requirements and regulations of that State, to the extent permitted under such exemption;

(5) To any person authorized to receive such byproduct material under terms of a specific license or a general license or their equivalents issued by the Atomic Enegy Commission, the Commission, or an Agreement State;

(6) To a person abroad pursuant to an export license issued under part 110 of this chapter; or

(7) As otherwise authorized by the Commission in writing.

(c) Before transferring byproduct material to a specific licensee of the Commission or and Agreement State or to a general licensee who is required to register with the Commission or with an Agreement State prior to receipt of the byproduct material, the licensee transferring the material shall verify that the transferee's license authorizes the receipt of the type, form, and quantity of byproduct material to be transferred.

(d) The following methods for the verification required by paragraph (c) of this section are acceptable:

(1) The transferor may have in his possession, and read, a current copy of the transferee's specific license or registration certificate;

(2) The transferor may have in his possession a written certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of byproduct material to be transferred, specifying the license or registration certificate number, issuing agency and expiration date;

(3) For emergency shipments the transferor may accept oral certification by the transferee that he is authorized by license or registration certificate to receive the type, form, and quantity of byproduct material to be transferred, specifying the license or registration certificate number, issuing agency and expiration date: *Provided,* That the oral certification is confirmed in writing wihtin 10 days;

(4) The transferor may obtain other sources of information compiled by a reporting service from official records of the Commission or the licensing agency of an Agreement State as to the identity of licensees and the scope and expiration dates of licenses and registration; or

(5) When none of the methods of verification described in paragraph (d)(1) to (4) of this section are readily available or when a transferor desires to verify that information received by one of such methods is correct or up-to-date, the transferor may obtain and record confirmation from the Commission or the licensing agency of an Agreement State that the transferee is licensed to receive the byproduct material.

[38 FR 33969, Dec.10, 1973, as amended at 40 FR 8785, Mar.3, 1975; 43 FR 6922, Feb.17, 1978]

## RECORDS, INSPECTIONS, TESTS AND REPORTS

### §30.50 Reporting requirements.

(a) *Immediate report.* Each licensee shall notify the NRC as soon as possible but not later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, explosions, toxic gas releases, etc.).

(b) *Twenty-four hour report.* Ecah licensee shall notify the NRC within 24 hours after the discovery of any of the following events involving licensed material:

(1) An unplanned contamination event that:

(i) Requires access to the contaminated area, by workers or the public , to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area;

(ii) Involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of §§20.1001-20.2401 of 10 CFR part 20 for the material; and

(iii) Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.

(2) An event in which equipment is disabled or fails to function as designed when:

(i) The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;

(ii) The equipment is required to be available and operable when it is disabled or fails to function; and

(iii) No redundant equipment is available and operable to perform the required safety function.

(3) An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.

(4) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:

(i) The quantity of material involved is greater than five times the lowest annual limit on intake specified in appendix B of §§20.1001-20-2401 of 10 CFR part 20 for the material; and

(ii) The damage affects the integrity of the licensed material or its container.

(c) Preparation and submission of reports. Reports made by licensees in response to the requirements of this section must be made as follows:

(1) Licensees shall make reports required by paragraphs (a) and (b) of this section by telephone to the NRC Operations Center.[1] To the extent that the information is available at the time of notification, the information provided in these reports must include:

[1] The commercial telephone number for the NRC Operations center is (301) 816-5100.

(i) The caller's name and call back telephone number.

(ii) A description of the event, including date and time;

(iii) The exact location of the event;

(iv) The isotopes, quantities, and chemical and physical form of the licensed material involved; and

(v) Any personnel radiation exposure data available.

(2) Written report. Each licensee who makes a report required by paragraph (a) or (b) of this section shall submit a written follow-up report within 30 days of the initial report. Written reports prepared pursuant to other regulations may be submitted to fulfill this requirement if the reports contain all of the necessary information and the appropriate distribution is made. These written reports must be sent to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555, with a copy to the appropriate NRC regional office listed in appendix D of 10 CFR part 20. The reports must include the following:

(i) A description of the event, including the probable cause and the manufacturer and model number (if applicable) of any equipment that failed or malfunctioned;

(ii) The exact location of the event;

(iii) The isotopes, quantities, and chemical and physical form of the licensed material involved;

(iv) Date and time of the event;

(v) Corrective actions taken or planned and the results of any evaluations or assessments; and

(vi) The extent of exposure of individuals to radiation or to radioactive materials without identification of individuals by name.

(3) The provisions of §30.50 do not apply to licensees subject to the notification requirements in §50.72. They do apply to those part 50 licensees possessing material licensed under part 30, who are not subject to the notification requirements in §50.72.

[56 FR 40767, Aug.16,1991, as amended at 59 FR 14086, Mar.25,1994]

### §30.51 Records.

(a) Each person who receives byproduct material

pursuant to a license issued pursuant to the regulations in this part and parts 31 through 36 of this chapter shall keep records showing the receipt, transfer, and disposal of the byproduct material as follows:

(1) The licensee shall retain each record of receipt of byproduct material as long as the material is possessed and for three years following transfer or disposal of the material.

(2) The licensee who transferred the material shall retain each record of transfer for three years after each transfer unless a specific requirement in another part of the regulations in this chapter dictates otherwise.

(3) The licensee who disposed of the material shall retain each record of disposal of byproduct material until the Commission terminates each license that authorizes disposal of the material.

(b) The licensee shall retain each record that is required by the regulations in this part and parts 31 through 36 of this chapter or by license condition for the period specified by the appropriate regulation or license condition. If a retention period is not otherwise specified by regulation or license condition, the record must be retained until the Commission terminates each license that authorizes the activity that is subject to the recordkeeping requirement.

(c)(1) Records which must be maintained pursuant to this part and parts 31 through 36 of this chapter may be the original or a reproduced copy or microform if such reproduced copy or microform is duly authenticated by authorized personnel and the microform is capable of producing a clear and legible copy after storage for the period specified by Commission regulations. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records such as letters, drawings, specifications, must include all pertinent information such as stamps, initials, and signatures. The licensee shall maintain adequate safeguards against tampering with and loss of records.

(2) If there is a conflict between the Commission's regulations in this part and parts 31 through 36 and 39 of this chapter, license condition, or other written Commission approval or authorization pertaining to the retention period for the same type of record, the retention period specified in the regulations in this part and parts 31 through 36 and 39 of this chapter for such records shall apply unless the Commission, pursuant to §30.11, has granted a specific exemption from the record retention requirements specified in the regulations in this part or parts 31 through 36 and 39 of this chapter.

(d) Prior to license termination, each licensee authorized to possess radioactive material with a half-life greater than 120 days, in an unsealed form, shall forward the following records to the appropriate NRC regional Office:

(1) Records of disposal of licensed material made under §§20.2002 (including burials authorized before January 28, 1981[1]), 20.2003, 20.2004, 20.2005; and

(2) Records required by §20.2103(b)(4).

(e) If licensed activities are transferred or assigned in accordance with §30.34(b), each licensee authorized to possess radioactive material, with a half-life greater than 120 days, in an unsealed form, shall transfer the following records to the new licensee and the new licensee will be responsible for maintaining these records until the license is terminated:

(1) Records of disposal of licensed material made under §§20.2002 (including burials authorized before January 28,1981[1]), 20.2003, 20.2004, 20.2005; and

(2) Records required by §20.2103(b)(4).

(f) Prior to license termination, each licensee shall forward the records required by §30.35(g) to the appropriate NRC Regional Office.

[41 FR 18301, May 5,1976, as amended at 43 FR 6922, Feb.17,1978; 52 FR 8241, Mar.17, 1987; 53 FR 19245, May 27,1988; 58 FR 7736, Feb.9,1993; 61 FR 24673, May 16,1996]

### §30.52 Inspections.

(a) Each licensee shall afford to the Commission at all reasonable times opportunity to inspect byproduct material and the premises and facilities wherein byproduct material is used or stored.

(b) Each licensee shall make available to the Commission for inspection, upon reasonable notice, records kept by him pursuant to the regulations in this chapter.

[30 FR 8185, June 26,1965]

### §30.53 Tests.

Each licensee shall perform, or permit the Commission to perform, such tests as the Commission deems appropriate or necessary for the administration of the regulations in this part and parts 31 through 36 and 39 of this chapter, including tests of:

(a) Byproduct material;

(b) Facilities wherein byproduct metarial is utilized or stored;

(c) Radiation detection and monitoring instruments; and

(d) Other equipment and devices used in connection with the utilization or storage of byproduct material.

[30 FR 8185, June 26,1965, as amended by 43 FR 6922, Feb.17,1978; 52 FR 8214, Mar.17,1987; 58 FR 7736, Feb.9,1993]

[1]A previous §20.304 permitted burial of small quantities of licensed materials in soil before January 28,1981, without specific Commission authorization. See §20.304 contained in the 10 CFR, parts 0 to 199, edition revised as of January 1, 1981.

## ENFORCEMENT

### §30.61 Modification and revocation of licenses.

(a) The terms and conditions of each license issued pursuant to the regulations in this part and parts 31 through 35 of this chapter shall be subject to amendment, revision or modification by reason of amendments to the Act, or by reason of rules, regulations and orders issued in accordance with the terms of the Act.

(b) Any license may be revoked, suspended or modified, in whole or in part, for any material false statement in the application or any statement of fact required under section 182 of the Act, or because of conditions revealed by such application or statement of fact or any report, record or inspection or other means which would warrant the Commission to refuse to grant a license on an original application, or for violation of, or failure to observe any of the terms and provisions of the Act or of any rule, regulation or order of the Commission.

(c) Except in cases of willfulness or those in which the public health, interest or safety requires otherwise, no license shall be modified, suspended or revoked unless, prior to the institution of proceedings therefor, facts or conduct which may warrant such action shall have been called to the attention of the licensee in writing and the licensee shall have been accorded an opportunity to demonstrate or achieve compliance with all lawful requirements.

[30 FR 8185, June 26,1965, as amended at 35 FR 11460, July 17,1970; 43 FR 6922, Feb.17,1978]

### §30.62 Right to cause the withholding or recall of byproduct material.

The Commission may cause the withholding or recall of byproduct material from any licensee who is not equipped to observe or fails to observe such safety standards to protect health as may be established by the Commission, or who uses such materials in violation of law or regulation of the Commission, or in a manner other than as disclosed in the application therefor or approved by the Commission.

[30 FR 8185, June 26,1965, as amended at 40 FR 8785, Mar.3, 1975]

### §30.63 Violations.

(a) The Commission may obtain an injunction or other court order to prevent a violation of the provisions of—

(1) The Atomic Energy Act of 1954, as amended;

(2) Title II of the Energy Reorganization Act of 1974, as amended; or

(3) A regulation or order issued pursuant to those Acts.

(b) The Commission may obtain a court order for the payment of a civil penalty imposed under section 234 of the Atomic Energy Act:

(1) For violations of—

(i) Sections 53, 57, 62, 63, 81, 82, 101, 103, 104, 107, or 109 of the Atomic Energy Act of 1954, as amended;

(ii) Section 206 of the Energy Reorganization Act;

(iii) Any rule, regulation, or order issued pursuant to the sections specified in paragraph (b)(1)(i) of this section;

(iv) Any term, condition, or limitation of any license issued under the sections specified in paragraph (b)(1)(i) of this section.

(2) For any violation for which a license may be revoked under section 186 of the Atomic Energy Act of 1954, as amended.

[57 FR 55072, Nov.24,1992]

NOTE: The following tables have been condensed to reflect only the radionuclides used in Ronan gaging devices. For a complete list of all radionuclides and their quantities, refer to a current copy of 10 CFR Part 30, Schedule A.

## SCHEDULES

### §30.70 Schedule A—exempt concentrations

**[See footnotes at end of this table]**

Footnotes to Schedule A:

[1]Values are given only for those materials normally used as gases.

[2]μCi / gm for solids.

NOTE 1: Many radioisotopes disintegrate into isotopes which are also radioactive. In expressing the concentrations in Schedule A,

the activity stated is that of the parent isotope and takes into account the daughters.

NOTE 2: For purposes of §30.14 where there is involved a combination of isotopes, the limit for the combination should be derived as follows:

Determine for each isotope in the product the ration between the concentration present in the product and the exempt concentration established in Schedule A for the specific isotope when not in combination. The sum of such ratios may not exceed "1" (i.e., unity).

Example:

$$\frac{\text{Concentration of Isotope A in Product}}{\text{Exempt concentration of Isotope A}} + \frac{\text{Concentration of Isotope B in Product}}{\text{Exempt concentration of Isotope B}} \leq 1$$

[30 FR 8185, June 26,1965, as amended at 35 FR 3982, Mar.3,1907; 38 FR 29314, Oct. 24, 1973; 59 FR 5520, Feb. 7,1994]

## §30.71 Schedule B.

NOTE: The following table has been condensed to reflect only the radionuclides used in Ronan gaging devices. For a complete list of all radionuclides and their quantities, refer to a current copy of 10 CFR Part 30, Schedule B.

| Byproduct material | Microcuries |
|---|---|
| Cesium 137 ( Cs 137) | 10 |
| Cobalt 60 (Co 60) | 1 |
| Americium 241 (Am 241) | 0.05 |

[35 FR 6427, Apr.22, 1970, as amended at 36 FR 16898, Aug.26, 1971; 59 FR 5519, Feb.7,1994]

## Appendix B to Part 30—Quantities of Licensed Material Requiring Labeling

NOTE: The following table has been condensed to reflect only the radionuclides used in Ronan gaging devices. For a complete list of all radionuclides and their quantities, refer to a current copy of 10 CFR Part 30, Appendix B.

| Material | Microcuries |
|---|---|
| Cesium 137 ( Cs 137) | 10 |
| Cobalt 60 (Co 60) | 1 |

NOTE: For purposes of §20.303, where there is involved a combination of isotopes in know amounts, the limit for the combination should be derived as follows: determine, for each isotope in the combination, the ration between the quantity present in the combination and the limit otherwise established for the specific isotope when not in the combination. The sum of such ratios for all the isotopes in the combination may not exceed "1" (i.e., "unity").

| Element (atomic number) | Isotope | Col. 1 Gas concentration μ | Col. 2 Liquid and solid concentration μ |
|---|---|---|---|
| Cesium (55) | Cs131 | — | $1x10^{-4}$ |
| | Cs134m | — | $2x10^{-2}$ |
| | Cs134 | — | $6x10^{-2}$ |
| Cobalt (27) | Co57 | — | $5x10^{-3}$ |
| | Co58 | — | $1x10^{-3}$ |
| | Co60 | — | $5x10^{-4}$ |

[35 FR 6425, Apr.22,1907, as amended at 36 FR 16898, Aug.26,1971; 38 FR 29314, Oct.24,1973; 39 FR 23991, June 28,1974; 45 FR 71763, Oct.30,1980; Redesignated at 56 FR 23391, May 21,1991, and further redesignated at 58 FR 67659, Dec.22,1993]

# PART 31— GENERAL DOMESTIC LIENSES FOR BYPRODUCT MATERIAL

Sec.


AUTHORITY: Secs 81, 161, 183, 68 Stat. 935, 948, 954, as amended (42 U.S.C. 2111,2201,2233); secs 201, as amended, 202, 88 Stat.1242, as amended, 1244 (42 U.S.C. 5841,5842).

Section 31.6 also issued under 274, 73, Stat. 688 (42 U.S.C. 2021).

## §31.1 Purpose and scope.

This part establishes general licenses for the possession and use of byproduct material contained in certain items and a general license for ownership of byproduct material. Part 30 of this chapter also contains provisions applicable to the subject matter of this part.

[35 FR 6428, Apr.22,1970]

## §31.2 Terms and conditions.

(a) The general licenses provided in this part are subject to the provisions of §§30.14(d), 30.34(a) to (e), 30.41, 30.50 to 30.63 and parts 19, 20 , and 21 of this chapter[1] unless indicated otherwise in the language of the general license.

(b) [Reserved]

[38 FR 22220, Aug.17,1973, as amended at 38 FR 33969, Dec.10,1973; 42 FR 28896, June 6,1977; 43 FR 6922, Feb.17,1978; 56 FR 40767, Aug.16,1991]

## §31.5 Certain measuring, gauging or controlling devices.[2]

(a) A general license is hereby issued to commercial and industrial firms and research, educational and medical institutions, individuals in the conduct of their business, and Federal, State or local government agencies to acquire, receive, possess, use or transfer, in accordance with the provisions of paragraphs (b), (c) and (d) of this section, byproduct material contained in devices designed and manufactured for the purpose of detecting, measuring, gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere.

(b) The general license in paragraph (a) of this section applies only to byproduct material contained in devices which have been manufactured or initially transferred and labeled in accordance with the specifications containeed in a specific license issued pursuant to §32.51 of this chapter or in accordance with the specifications contained in a specific license issued by an Agreement State which authorizes distribution of the devices to persons generally licensed by the Agreement State.

(c) Any person who acquires, receives, possesses uses or transfers byproduct material in a device pursuant to the general license in paragraph (a) of this section:

(1) Shall assure that all labels affixed to the device at the time of receipt and bearing a statement that removal of the label is prohibited are maintained thereon and shall comply with all instructions and precautions provided by such labels;

(2) Shall assure that the device is tested for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals or at such other intervals as are specified in the label; however:

(i) Devices containing only krypton need not be tested for leakage of radioactive material, and

(ii) Devices containing only tritium or not more than 100 microcuries of other beta and/or gamma emitting material or 10 microcuries of alpha emitting material and devices held in storage in the original shipping container prior to installation need not be tested for any purpose;

(3) Shall assure that the tests required by paragraph (c)(2) of this section and other testing, installation, servicing, and removal from installation involving the radioactive material, its shielding or containment, are performed:

(i) In accordance with the instructions provided by the labels; or

(ii) By a person holding a specific license pursuant to parts 30 and 32 of this chapter or from an Agreement State to perform such activities;

(4) Shall maintain records showing compliance with the requirements of paragraphs (c)(2) and (c)(3) of this section. The records must show the results of tests. The records must also show the dates of perfromance of, and the names of persons performing, testing, installing, servicing, and removing from the installation radioactive material and its shielding or containment. The licensee shall retain these reccords as follows:

(i) Each record of a test for leakage or radioactive material required by paragraph (c)(2) of this section must be retained for three years after the next required leak test is performed or until the sealed source is transferred or disposed of.

(ii) Each record of a test of the on-off mechanism and indicator required by paragraph (c)(2) of this section must be retained for three years after the next required test of the on-off mechanism and indicator is

performed or until the sealed source is transferred or disposed of.

(iii) Each record that is required by paragraph (c)(3) of this section must be retained for three years from the date of the recorded event or until the device is transferred or disposed of.

(5) Upon the occurrence of a failure of or damage to, or any indication of a possible failure of or damage to, the shielding of the radioactive material or the on-off mechanism or indicator, or upon the detection of 0.005 microcurie or more removable radioactive material, shall immediately suspend operation of the device until it has been repaired by the manufacturer or other person holding a specific license pursuant to parts 30 and 32 of this chapter or from an Agreement State to repair such devices, or disposed of by transfer to a person authorized by a specific license to receive the byproduct material contained in the device and , within 30 days, furnish to the Administrator of the appropriate Nuclear Regulatory Commission, Regional Office listed in appendix D of part 20 of this chapter, a report containing a brief description of the event and the remedial action taken;

(6) Shall not abandon the device containing byproduct material;

(7) Shall not export the device containing byproduct material except in accordance with part 110 of this chapter;

(8) Except as provided in paragraph (c)(9) of this section, shall transfer or dispose of the device containing byproduct material only by transfer to persons holding a specific license pursuant to parts 30 and 32 of this chapter or from and Agreement State to receive the device and within 30 days after transfer of a device to a specific licensee shall furnish to the Director of Nuclear material Safety and Safeguards, U. S. Nuclear regulatory Commission, Washington, DC 20555 a report containing identification of the device by the manufacturer's name and model number and the name and address of the person receiving the device. No report is required if the device is transferred to the specific licensee in order to obtain a replacement device;

(9) Shall transfer the device to another general licensee only:

(i) Where the device remains in use at a particular location. In such case the transferor shall give the transferee a copy of this section and any safety documents identified in the label of the device and within 30 days of the transfer, report to the Director of Nuclear Material Safety and Safeguards,
U.S. Nuclear Regulatory Commission, Washington,
DC 20555, the manufacturer's name and the model number of device transferred, the name and address of the transferee, and the name and/or position of an individual who may constitute a point of contact between the Commission and the transferee; or

(ii) Where the device is held in storage in the original shipping container at its intended location of use prior to initial use by a general licensee.

(10) Shall comply with the provisions of §§20.2201, and 20.2202 of this chapter for reporting radiation incidents, theft or loss of licensed material, but shall be exempt from the other requirements of parts 19,20,and 21 of this chapter.

(d) The general license in paragraph (a) of this section does not authorize the manufacture or import of devices containing byproduct material.

[2] Persons possesseing byproduct material in devices under the general license in §31.5 befroe Jan.15, 1975, may continue to possess , use or transfer that material in accordance with the requirements of §31.5 in effect Jan.14, 1975.

[39 FR 43532, Dec.16,1974, as amended at 40 FR 8785, Mar.3,1975; 40 FR 14085, Mar.28,1975; 42 FR 25721, May 19,1977; 42 FR 28896, June 6,1977; 43 FR 6922, Feb.17,1978; 53 FR 19246, May 27,1988; 56 FR 23471, May 21,1991; 56 FR 61352, Dec.3,1991; 58 FR 67659, Dec.22,1993]

### §31.8 Americium-241 in the form of calibration or reference sources.

(a) A general license is hereby issued to those persons listed below to own, receive, acquire, possess, use and transfer, in accordance with the provisions of paragraphs (b) and (c) of this section, americium-241 in the form of calibration or reference sources:

(1) Any person in a non-Agreement State who holds a specific license issued pursuant to this chapter which authorizes him to receive, possess, use and transfer byproduct material, or special nuclear material; and

(2) Any Government agency, as defined in §30.4 (g) of this chapter, which holds a specific license issued pursuant to this chapter which authorizes it to receive, possess, use and transfer byproduct material, source material, or special nuclear material.

(b) The general license in paragraph (a) of this section applies only to calibration or reference sources which have been manufactured or initially transferred in accordance with the specifications contained in a specific license issued pursuant to §32.57 of this chapter or in accordance with the specifications contained in a specific license issued to the manufacturer by and Agreement State which
authorizes manufacture of the sources for distribution to persons generally licensed by the Agreement State.

(c) The general license in paragraph (a) of this section is subject to the provisions of §§30.14(d), 30.34(a) to (e), and 30.50 to 30.63 of this chapter, and to the provisions of parts 19, 20, and 21, of this chapter. In addition, persons who own, receive, possess, use and transfer one or more calibration or ref-

erence sources pursuant to this general license:

(1) Shall not possess at any one time, at any one location of storage or use, more than 5 microcuries of americium-241 in such sources:

(2) Shall not receive, possess, use or transfer such source unless the source, or the storage container, bears a label which includes the following statement:[1]

The receipt, possession, use and transfer of this source, Model_____, Serial No._____, are subject to a general license and the regulations of the United States Nuclear Regulatory Commission or of a State with which the Commission has entered into an agreement for the exercise of regulatory authority. Do not remove this label.

CAUTION—RADIOACTIVE MATERIAL——
THIS SOURCE CONTAINS AMERICIUM-241. DO NOT TOUCH RADIOACTIVE PORTION OF SOURCE.

_____
(name of manufacturer or initial transferor)

(3) Shall not transfer, abandon, or dispose of such source except by transfer to a person authorized by a license pursuant to this chapter or from an Agreement State to receive the source.

(4) Shall store such source, except when the source is being used, in a closed container adequately designed and constructed to contain americium-241 which might otherwise escape during storage.

(5) Shall not use such source for any purpose other than the calibration of radiation detectors or the standardization of other sources.

(d) This general license does not authorize the manufacture or import of calibration or reference sources containing americium-241.

(e) This general license does not authorize the export of calibration or reference sources containing americium-241.

[1]Sources generally licensed under this section prior to January 19, 1975 may bear labels authorized by the regulations in effect on January 1,1975.

[30 FR 8189, June 26,1965, as amended at 38 FR 2220, Aug.17,1973; 40 FR 8785, Mar.3,1975; 42 FR 28896, June 6,1977; 43 FR 6922, Feb.17, 1978; 56 FR 40767, Aug.16,1991]

### §31.9 General license to own byproduct material.

A general license is hereby issued to own byproduct material without regard to quantity. Notwithstanding any other provision of this chapter, a general license under this paragraph is not suthorized to manufacture, produce, transfer, receive, possess, use, import or export byproduct material, except as authorized in a specific license.

[30 FR 8189, June 26,1965]

# PART 32— SPECIFIC DOMESTIC LICENSES TO MANUFACTURE OR TRANSFER CERTAIN ITEMS CONTAINING BYPRODUCT MATERIAL

**Subpart B—Generally Licensed Items**.



## §32.51 Byproduct material contained in devices for use under §31.5; requirements for license to manufacture or initially transfer.

(a) An application for a specific license to manufacture, or initially transfer devices containing byproduct material to persons generally licensed under §31.5 of this chapter or equivalent regulations of an Agreement State will be approved if:

(1) The applicant satisfies the general requirements of §30.33 of this chapter;

(2) The applicant submits sufficient information relating to the design, manufacture, prototype testing, quality control, labels, proposed uses, installation, servicing, leak testing, operating and safety instructions, and potential hazards of the device to provide reasonable assurance that:

(i) The device can be safely operated by persons not having training in radiological protection;

(ii) Under ordinary conditions of handling, storage, and use of the device, the byproduct material contained in the device will not be released or inadvertently removed from the device, and it is unlikely that any person will receive in 1 year a dose in excess of 10 percent of the annual limits specified in §20.1201(a) of this chapter; and

(iii) Under accident conditions (such as fire and explosion) associated with handling, storage and use of the device, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in Column IV of the table in §32.24.

(3) Each device bears a durable, legible, clearly visible label or labels approved by the Commission which contain in a clearly identified and separate statement:

(i) Instructions and precautions necessary to assure safe installation, operation, and servicing of the device (documents such as operating and service manuals may be identified in the label and used to provide this information);

(ii) The requirements, or lack of requirement, for leak testing, or for testing any on-off mechanism and indicator, including the maximum time interval for such testing, and the identification of the radioisotope, quantity of radioactivity, and the date of determination of the quantity; and

(iii) The information called for in the following statement in the same or substantially similar form:[1]

The receipt, possession, use, and transfer of this device Model_____[2] Serial No._____[2], are subject to a general license or the equivalent and the regulations of the U.S. NRC or of a State with which the NRC has entered into an agreement for the exercise of regulatory authority. This label shall be maintained on the device in a legible condition. Removal of this label is prohibited.

CAUTION——RADIOACTIVE MATERIAL

_____

(Name of manufacturer, or initial transferor.)[2]

(b) In the event that the applicant desires that the device be required to be tested at intervals longer than six months, either for proper operation of the on-off mechanism and indicator, if any, or for leakage of radioactive material of for both, he shall include in this application sufficient information to demonstrate that such longer interval is justified by performance characteristics of the device or similar devices, and by design features which have a significant bearing on the probability or consequences of leakage of radioactive material from the device or failure of the on-off mechanism and indicator. In determining the acceptable interval for the test for leakage of radioactive material, the Commission will consider information which includes, but is not limited to:

(1) Primary containment (source capsule);

(2) Protection of primary containment;

(3) Method of sealing containment;

(4) Containment construction materials;

(5) Form of contained radioactive material;

(6) Maximum temperature withstood during prototype tests;

(7) Maximum pressure withstood during prototype tests;

(8) Maximum quantity of contained radioactive material;

(9) Radiotoxicity of contained radioactive material; and

(10) Operating experience with identical devices or similarly designed and constructed devices.

(c) In the event the applicant desires that the general licensee under §31.5 of this chapter, or under equivalent regulations of an Agreement State, be authorized to install the device, collect the sample to be analyzed by a specific licensee for leakage of radioactive material, service the device, test the on-off mechanism and indicator, or remove the device from installation, the applicant shall include in the application written instructions to be followed by the general licensee, estimated calendar quarter

doses associated with such activity or activities, and the bases for these estimates. The submitted information must demonstrate that performance of this activity or activities by an individual untrained in radiological protection, in addition to other handling, storage, and use of devices under the general license, is unlikely to cause that individual to receive a dose in excess of 10 percent of the annual limits specified in §20.1201(a) of this chapter.

[1]Devices licensed under §32.51 prior to January 19,1975 may bear labels authorized by the regulations in effect on January 1,1975.
[2]The model, serial number, and the name of the manufacturer, or initial transferor may be omitted from this label provided the information is elsewhere specified in labeling affixed to the device.

[39 FR 43533, Dec.16,1974, as amended at 40 FR 8785, Mar.3,1975; 42 FR 25721, May 19,1977; 43 FR 6923, Feb.17,1978; 58 FR 67660, Dec.22,1993; 59 FR 5520, Feb.7,1994]

### §32.51a Same: Conditions of licenses.

Each person licensed under §32.51 shall:

(a) Furnish a copy of the general license contained in §31.5 of this chapter to each person to whom he directly or through an intermediate person transfers byproduct material in a device for use pursuant to the general license contained in §31.5 of this chapter.

(b) Furnish a copy of the general license contained in the Agreement State's regulation equivalent to §31.5 of this chapter, or alternatively, furnish a copy of the general license contained in §31.5 of this chapter, to each person to whom he directly or through an intermediate person transfers byproduct material in a device for use pursuant to the general license of an Agreement State. If a copy of the general license in §31.5 of this chapter is furnished to such person, it shall be accompanied by a note explaining that use of the device is regulated by the Agreement State under requirements substantially the same as those in §31.5 of this chapter.

[39 FR 43533, Dec.16,1974]