Grinnell®
FIRE PROTECTION SYSTEMS COMPANY
835 Sharon Drive
Westlake, Ohio 44145

A tyco INTERNATIONAL LTD. COMPANY

November 04, 1998

Assignment 98-81 Supplement to Submission

S. Lee
United States Nuclear Regulatory Commission
Washington D.C.
Mail Stop T-8F5

Dear Mr. Lee,

I have enclosed the information you requested per the fax you sent to me on 10/29/98. I hope that all the items of concern have been addressed. As a recap, here is a list of the enclosed material along with a brief description if needed.

1. A new copy of the Grinnell Receipt and Shipping of ION Detectors quality procedure with a revised acceptance program with zero defects permissable for sampled lots between 2001 to 100,000 units

2. An environmental assessment of ionization chamber smoke detectors containing Am-241 based upon NUREG/CR-1156. I have provided calculations for

a.) Individual
b.) person installing detectors
c.) individual cleaning and maintenance
d.) warehouse worker
e.) accidental exposure rates from a fire
f.) exposure due to ingestion

3. Justification for the statement in 14 of the original application.

Please allow me a few words to assist you in this review. The "sale" of detectors from Grinnell at 835 Sharon Dr. will be made solely to Grinnell dealers and offices. They will never be sold through retail channels. The detectors are not stand alone devices, they must be wired into a panel which monitors the current draw of the detector. An occupant of a business or industrial building typically contracts with Grinnell for the maintenance and upkeep of the entire fire alarm system which includes the detectors.

It is quite clear from the examples provided in NUREG/CR-1156 that the detectors we will be licensed to distribute will comply with the regulations stated in 32.27. All of the calculations made in 1156 deal with detectors with the source activity of 3 uCi. The LoPro detectors contain 0.9 uCi of Am-241 which provides approximately a 60% reduction in radioactivity.

Thank you,

Reed Timko

Reed Timko

Environmental Assessment

I Dose commitment for an individual

In the normal use and disposal of a single detector, the following activities can be considered typical exposure instances;

Individuals in the fire safety services industry come into contact with ion chamber smoke detectors in many different ways. Marketing and technical training individuals may use the detectors for demonstration purposes. Research and Development engineers come into contact during the design, testing and evaluation processes.

A typical scenario involves a marketing salesman responsible for product introductions and on-sight training at dealer offices. Assume that the marketing salesman gives two presentations a week, for twenty weeks during the year, with the LoPro series detectors mounted on a typical easel display panel. Each presentation lasts one hour, during which the salesman is approximately 1 meter from the ion chamber detector. Using the standard constants supplied in NUREG/CR 1156, the following calculation results in 0.01339 urem/yr which is well below the requirements shown in Column I of the table in 10 CFR 32.28;

$$(A)(r)\ (T)\ (k)$$

where:

A = Average AM-241 activity per detector (uCi)
r = Exposure rate at 1 meter from AM-241 source within an ICSD (8.0×10^{-3} uR/hr-uCi)
T = Time exposed to the detector per year (hrs/yr)
k = Constant relating dose rate in tissue to exposure in air (0.93 urem/uR)
D = Distance in meters from AM-241 source within an ICSD

$$(.9\ \text{uCi})\ (8.0 \times 10^{-3}\ \text{uR/hr-uCi})\ (40\ \text{hrs/yr})\ (0.93\ \text{urem/uR})$$

CALCULATION 1 = 0.2678 urem/yr

II Dose commitment during installation

Grinnell dealer technicians install the LoPro ion smoke detectors in commercial and industrial buildings.

The tasks performed during installation include; mounting the detector base to the structural members of the ceiling (see fig 1), pulling wires from the fire panel to the detector site and

finally inserting the detector with a twisting motion that locks the detector onto the base.

The actual time required to lock the detector onto the base will typically take less than one minute, but for the sake of this exercise, we shall consider the total time exposed to the detector at thirty minutes. While twisting the detector onto the base, the technicians are approximately 5cm from the sealed source. The following exposure rate can be calculated as 1.3392 urem/yr which is well below the requirements shown in Column I or Column II of the table in 10 CFR 32.28;

$$\frac{(.9\ \text{uCi})\ (8.0 \times 10^{-3}\ \text{uR/hr-uCi})\ (.5)\ (0.93\ \text{urem/uR})}{(.05)^2}$$

CALCULATION 2 = 1.3392 urem/yr

If the same technician installed 1000 detectors, the total exposure of 1.33 mrem/yr would still be less than the requirements.

III Dose commitment during cleaning and testing

Grinnell dealer technicians provide service contracts to their customers for routine maintenance of the detectors. These services include cleaning and testing of the ion detectors.

The actual cleaning involves removing dust particles that may accumulate during the year. This activity should take approximately the same time as the worst-case installation exposure as shown in CALCULATION 2. The testing of the detector involves performing a walk test, which requires the technician to inject smoke into the detector with a specified smoke tester. This tester is comprised of a smoke generation section attached to a pole approximately one meter long. It is assumed that the technician will stand directly under each detector for approximately five minutes. If the typical site consists of 100 detectors, this activity can be calculated as 0.05577 urem/yr which is well below the requirements shown in Column I of the table in 10 CFR 32.28;

$$(.9\ \text{uCi})\ (8.0 \times 10^{-3}\ \text{uR/hr-uCi})\ (8.33)\ (0.93\ \text{urem/uR})$$

CALCULATION 3 = 0.05577 urem/yr

It is plainly evident that a technician performing the testing at 10 sites with 100 detectors each would result in a dose commitment of .5577 urem/yr which is well below the requirements listed in Column I or Column II of the table in 10 CFR 32.28.

IV Dose commitment during warehouse workers

The present license application limits the distribution of the LoPro ion chamber smoke detectors to 50,000 per year.

Based upon calculations performed in section 3.2.4.2 of NUREG/CR 1156, the average individual dose is about 0.5 mrem for exposure at three meters from an array containing up to 1000 ICSD's (3 uCi per unit). The LoPro ion chamber detector is 0.9 uCi per unit, therefore; the average individual dose would be .15 mrem.

(.9uCi / 3uCi) (0.5mrem)

CALCULATION 4 =0.15 mrem

Consequently. the storage of 50,000 detectors would produce an average individual dose of 7.5 mrem. This exposure level is well below the requirements specified in Column I or Column II of the table in 10 CFR 32.28

50 x .15 mrem= 7.5 mrem

CALCULATION 5

V Maximum dose commitment from accidents

Grinnell Fire Protections Systems Co. provides a secure warehouse area which includes smoke detectors which are tied to a security panel that automatically notifies the fire department in the event of a fire and a pressurized water sprinkler system which automatically releases water in the event of a fire. However, these fire prevention systems may not necessarily preclude a catastrophic fire. Based upon the calculations presented in NUREG/CR 1156 in section 3.2.7.2.1 for warehouse fires, the following calculations apply at Grinnell. As described in the text, a hundred-fold reduction in Am-241 inhalation would also apply at Grinnell

where:

N = the number of detectors times their respective activity (uCi)
P = 0.1 percent of Am-241 activity is released as airborne particles having a mean diameter of one micron.
C = the volume of air in the warehouse (m^3)

The maximum number of detectors at any give time is 1000 at Grinnell. The cubic volume of the warehouse at Grinnell is 6000 m^3

$$(1000 \times .9)\ (0.001) / 6000$$

CALCULATION 6 $= \underline{0.00015\ uCi/m^3}$

It can be further calculated, that the total inhalation of Am-241 during an eight hour period would be 0.0000144 uCi, based upon the breathing rate of a person at 1.2m^3 /hr.

$$(0.000015)\ (1.2m^3 \times 8hrs)\ (0.01)$$

CALCULATION 7 $= 0.0000144\ uCi$

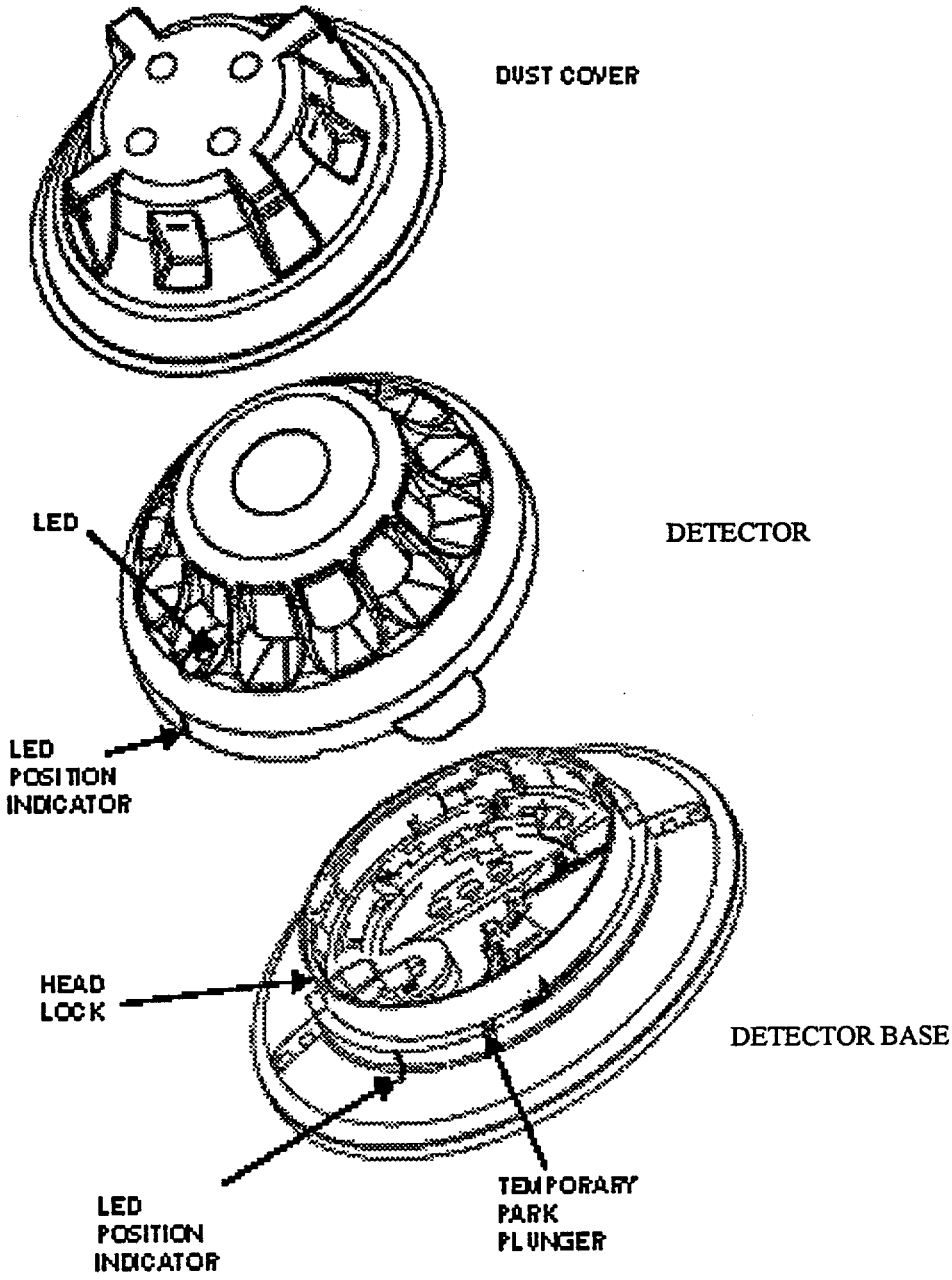
It is clear that the amount of curies calculated based upon the source in the LoPro detector would provide a significant reduction in the 50 year dose commitment table presented on page 3-62 of NUREG/CR-1156 and would be well below the requirements set forth in Column II or Column III of the table in 10CFR 32.28.

It is plainly evident, after examination of the text in NUREG/CR-1156 on page 3-61 concerning the cleanup efforts after a fire, that the total exposure would still be considerably less than the requirements due to the fact that only 0.2% of the source activity would be removable on the exterior and interior of the ICSD mounting areas.

VI. Dose commitment from ingestion of Am-241 source

Possible access to the radioactive foil of the LoPro ion detector is possible only when the detector is mechanically destroyed. Such a case is not likely to happen for the typical citizen because the detector is handled, installed and maintained by Grinnell technicians.

In the unlikely event, say a vandal destroys two detectors and eats both sources, the amount of radiation absorbed by the bones, liver and kidneys would be well below the fifty year dose commitments shown in table 3.13 of NUREG/CR 1156 due to the fact that the tables were calculated based upon two sources containing 2.5 uCi each. The LoPro detectors contain 0/.9 uCi of Am-241. Consequently, the levels would represent an approximate reduction by 36%. Therefore, the dose commitment values would be far less than those sighted in Column III of the table in 10 CFR 32.28.


DUST COVER
LED
DETECTOR
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POSITION
INDICATOR
HEAD
LOCK
DETECTOR BASE
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POSITION
INDICATOR
TEMPORARY
PARK
PLUNGER

Figure 1

Explanation of the justification made for item 14 in the original application date July 20,1998.

14. *Determination that the probabilities with respect to the doses referred to in 32.27 (c) meet criteria of that paragraph.*

The probabilities expressed in determining the dose rates meet the criteria of that paragraph.

The calculation made in the original application was based upon the amount of removable contamination from the results of prototype testing of the Am-241 source rather than the standard formula's used in NUREG/CR-1156. As I read paragraph c of 10 CFR 32.27 and the associated footnotes, I felt that the NRC required a statement concerning probabilities for exposure would be reduced as the failure of the detector increased. I believe, that based upon the prototype testing of the source that was made in 1979 by Amersham and the subsequent prototype testing performed by the Loss Prevention Council and Underwriter Laboratories, that I had indeed shown that the probabilities for an increase in exposure would decrease due to any possible increase in potential failures because the amount of removeable contamination present during the prototype testing of the detector by Amersham was significantly lower than the permitted dose rates found in the table in 10 CFR 32.28.

At this time, I feel that the calculations presented with this supplement, are made with constants that are acceptable to the NRC and the amounts of dose commitments are considerable less than allowed.

Grinnell
FIRE PROTECTION SYSTEMS COMPANY
835 Sharon Drive
Westlake, Ohio

Fax

To:	Seng Lee	**From:**	Reed Timko
Fax:	1-301-415-5369	**Pages:**	(including cover) 3
Phone:	(202) 588-9870	**Date:**	02/17/99
Re:	NRC License	**CC:**	[Click here and type name]

☐ **Urgent** x **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

Dear Seng,

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Thankyou for your efforts in handling our application

Reed Timko

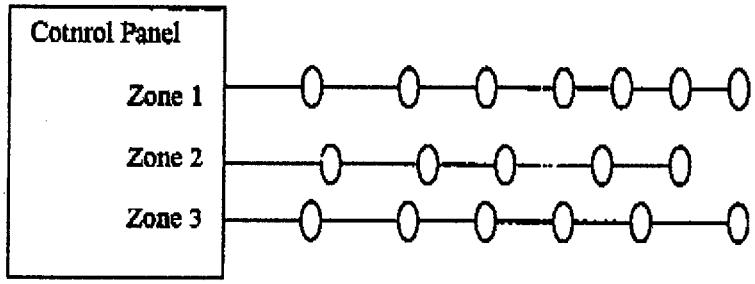
1-440-871-1870 fax

1-440-899-5424 phone

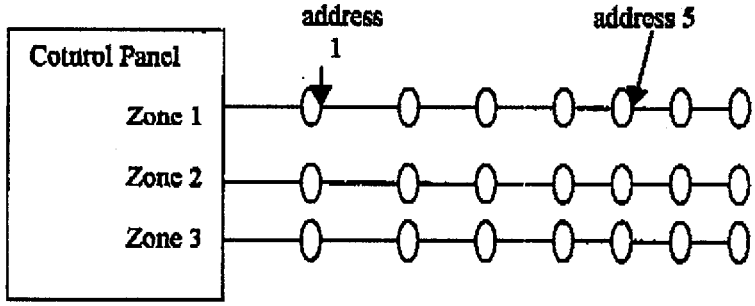
Extract from license

The 612I and 912I (Lo-Pro) series smoke detectors employ an ionization chamber sensing element and is intended for use in commercial/industrial fire detection systems. The 612I is a conventional non-addressable smoke detector, while the 912I is an addressable smoke detector. The detectors are used in ceiling or wall mount applications in plug in bases which are wired to suitable control and indication equipment. These detectors are not intended for sale to the general public for domestic applications.

NON-ADDRESSABLE The 612 Ion detector is used with an electronic control panel that cannot determine the specific location of the detector. The control panel identifies the location in a zone format only. Therefore, the panel can only inidcate if there is a fire in a particular area, ie North East Wing.

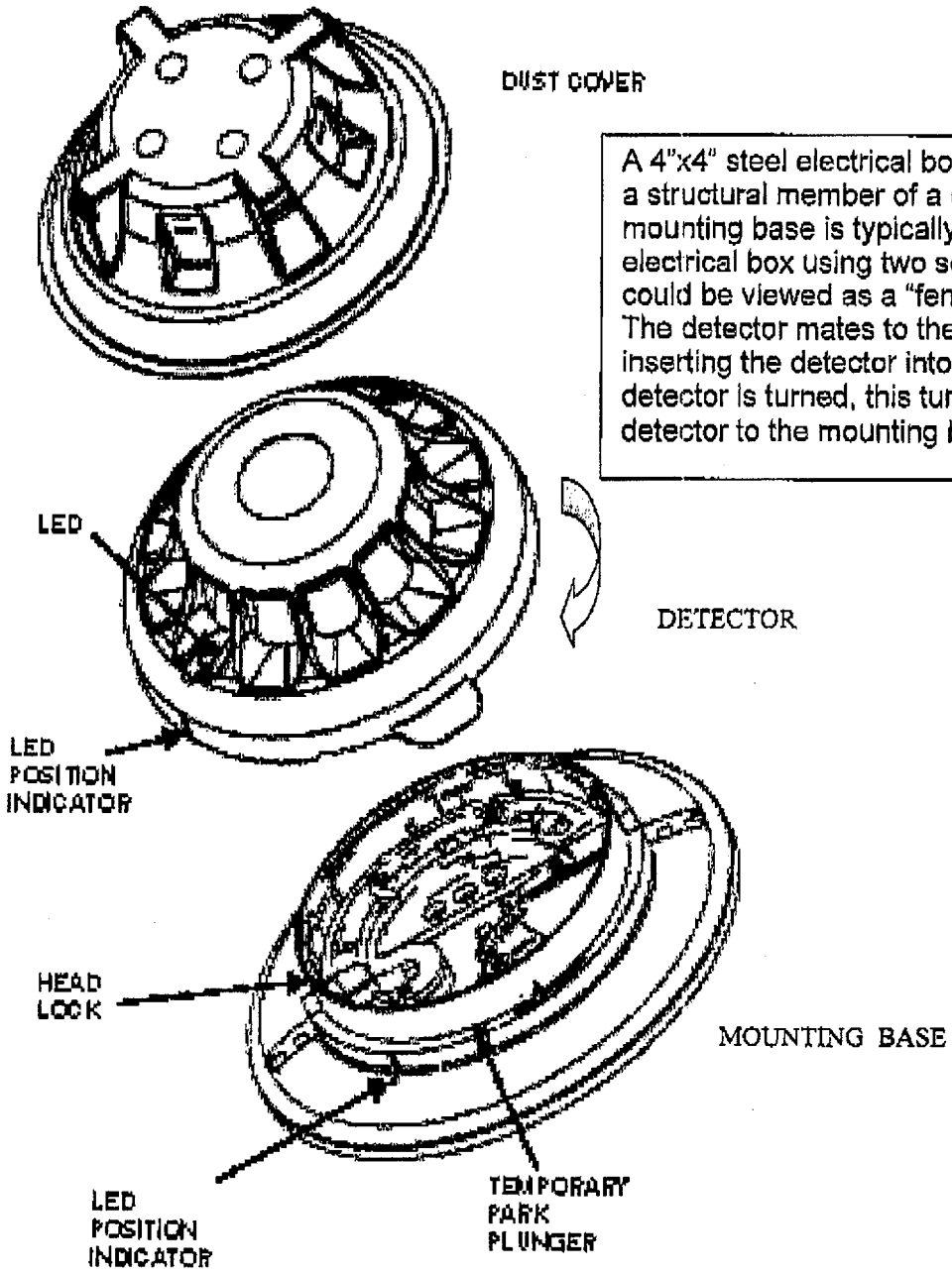


ADDRESSABLE DETECTOR The 912Ion detector is used with an electronic control panel that can determine specifically where a detector is located because the detector's electronic board sends a unique address location in a communication signal. This address location is then programmed into the control panel so that an alarm can be generated which identifies the specific address or location of the detector, ie "COMPRESSOR ROOM.



The non-addressable (612I) and the addressable (912I) detectors contain the same source element. The difference between the two detectors are in the electronic circuit board and the housings. The 912I has connectors imbedded in the plastic so that the "address" can be communicated to the control panel.

page 2 FAX to Seargeé



A 4"x4" steel electrical box (not shown) is secured to a structural member of a ceiling or wall. The mounting base is typically installed onto the steel electrical box using two screws. The mounting base could be viewed as a "female" outlet for the detector. The detector mates to the mounting base. After inserting the detector into the mounting base, the detector is turned, this turning motion secures the detector to the mounting base.

Figure 1

Fax to Sengtee

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
(FAX 301-415-5369)

DATE: 2/17/98 FROM: Seung Lee

PHONE NUMBER: 301-415-5787

TO: Reed Timko TO: _____

FAX NUMBER: 440-871-1870 FAX NUMBER: _____

TO: _____ TO: _____

FAX NUMBER: _____ FAX NUMBER: _____

MESSAGE:

Please respond ASAP. If you have any questions, please call me at 301-415-5787.
Thanks,

NUMBER OF PAGES (INCLUDING COVER SHEET) 2

Please provide the following information to complete your amendment application for NR-776-D-101-E.

1. You stated in the application that the MF series and Nittan detectors are no longer manufactured and the personnel who filed the documents are no longer with the company. Therefore, I'll convert current NR-776-D-101-E into inactive status and issue new registration certificate for Lo-Pros series 612I and 912I detectors.

2. Please explain the terms for "addressable smoke detector" and "non-addressable smoke detector."

3. Please provide more detailed explanation for "... in plug in bases." What kind of plug is used? The drawing does not show the plug.

TRANSMISSION REPORT

01.01.2040 00:00

301 415 5369

DATE TIME	DURATION	REMOTE ID	MODE	PAGES	RESULT
01.01 00:00	00'38"	4408711870	ECM	2	O.K.

Grinnell®
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835 Sharon Drive
Westlake, Ohio 44145

A tyco INTERNATIONAL LTD. COMPANY

November 04, 1998

Assignment 98-81 Supplement to Submission

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Thank you,

Reed Timko

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Environmental Assessment

I Dose commitment for an individual

In the normal use and disposal of a single detector, the following activities can be considered typical exposure instances;

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$$(A)(r)\ (T)\ (k)$$

where:

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CALCULATION 1 = 0.2678 urem/yr

II Dose commitment during installation

Grinnell dealer technicians install the LoPro ion smoke detectors in commercial and industrial buildings.

The tasks performed during installation include; mounting the detector base to the structural members of the ceiling (see fig 1), pulling wires from the fire panel to the detector site and

finally inserting the detector with a twisting motion that locks the detector onto the base.

The actual time required to lock the detector onto the base will typically take less than one minute, but for the sake of this exercise, we shall consider the total time exposed to the detector at thirty minutes. While twisting the detector onto the base, the technicians are approximately 5cm from the sealed source. The following exposure rate can be calculated as 1.3392 urem/yr which is well below the requirements shown in Column I or Column II of the table in 10 CFR 32.28;

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If the same technician installed 1000 detectors, the total exposure of 1.33 mrem/yr would still be less than the requirements.

III Dose commitment during cleaning and testing

Grinnell dealer technicians provide service contracts to their customers for routine maintenance of the detectors. These services include cleaning and testing of the ion detectors.

The actual cleaning involves removing dust particles that may accumulate during the year. This activity should take approximately the same time as the worst-case installation exposure as shown in CALCULATION 2. The testing of the detector involves performing a walk test, which requires the technician to inject smoke into the detector with a specified smoke tester. This tester is comprised of a smoke generation section attached to a pole approximately one meter long. It is assumed that the technician will stand directly under each detector for approximately five minutes. If the typical site consists of 100 detectors, this activity can be calculated as 0.05577 urem/yr which is well below the requirements shown in Column I of the table in 10 CFR 32.28;

$$(.9\ \text{uCi})\ (8.0 \times 10^{-3}\ \text{uR/hr-uCi})\ (8.33)\ (0.93\ \text{urem/uR})$$

CALCULATION 3 = 0.05577 urem/yr

It is plainly evident that a technician performing the testing at 10 sites with 100 detectors each would result in a dose commitment of .5577 urem/yr which is well below the requirements listed in Column I or Column II of the table in 10 CFR 32.28.

IV Dose commitment during warehouse workers

The present license application limits the distribution of the LoPro ion chamber smoke detectors to 50,000 per year.

Based upon calculations performed in section 3.2.4.2 of NUREG/CR 1156, the average individual dose is about 0.5 mrem for exposure at three meters from an array containing up to 1000 ICSD's (3 uCi per unit). The LoPro ion chamber detector is 0.9 uCi per unit, therefore; the average individual dose would be .15 mrem.

(.9uCi / 3uCi) (0.5mrem)

CALCULATION 4 =0.15 mrem

Consequently. the storage of 50,000 detectors would produce an average individual dose of 7.5 mrem. This exposure level is well below the requirements specified in Column I or Column II of the table in 10 CFR 32.28

50 x .15 mrem= 7.5 mrem

CALCULATION 5

V Maximum dose commitment from accidents

Grinnell Fire Protections Systems Co. provides a secure warehouse area which includes smoke detectors which are tied to a security panel that automatically notifies the fire department in the event of a fire and a pressurized water sprinkler system which automatically releases water in the event of a fire. However, these fire prevention systems may not necessarily preclude a catastrophic fire. Based upon the calculations presented in NUREG/CR 1156 in section 3.2.7.2.1 for warehouse fires, the following calculations apply at Grinnell. As described in the text, a hundred-fold reduction in Am-241 inhalation would also apply at Grinnell

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The maximum number of detectors at any give time is 1000 at Grinnell. The cubic volume of the warehouse at Grinnell is 6000 m^3

$$(1000 \times .9)\ (0.001) / 6000$$

CALCULATION 6 $= \underline{0.00015\ uCi/m^3}$

It can be further calculated, that the total inhalation of Am-241 during an eight hour period would be 0.0000144 uCi, based upon the breathing rate of a person at 1.2m^3 /hr.

$$(0.000015)\ (1.2m^3 \times 8hrs)\ (0.01)$$

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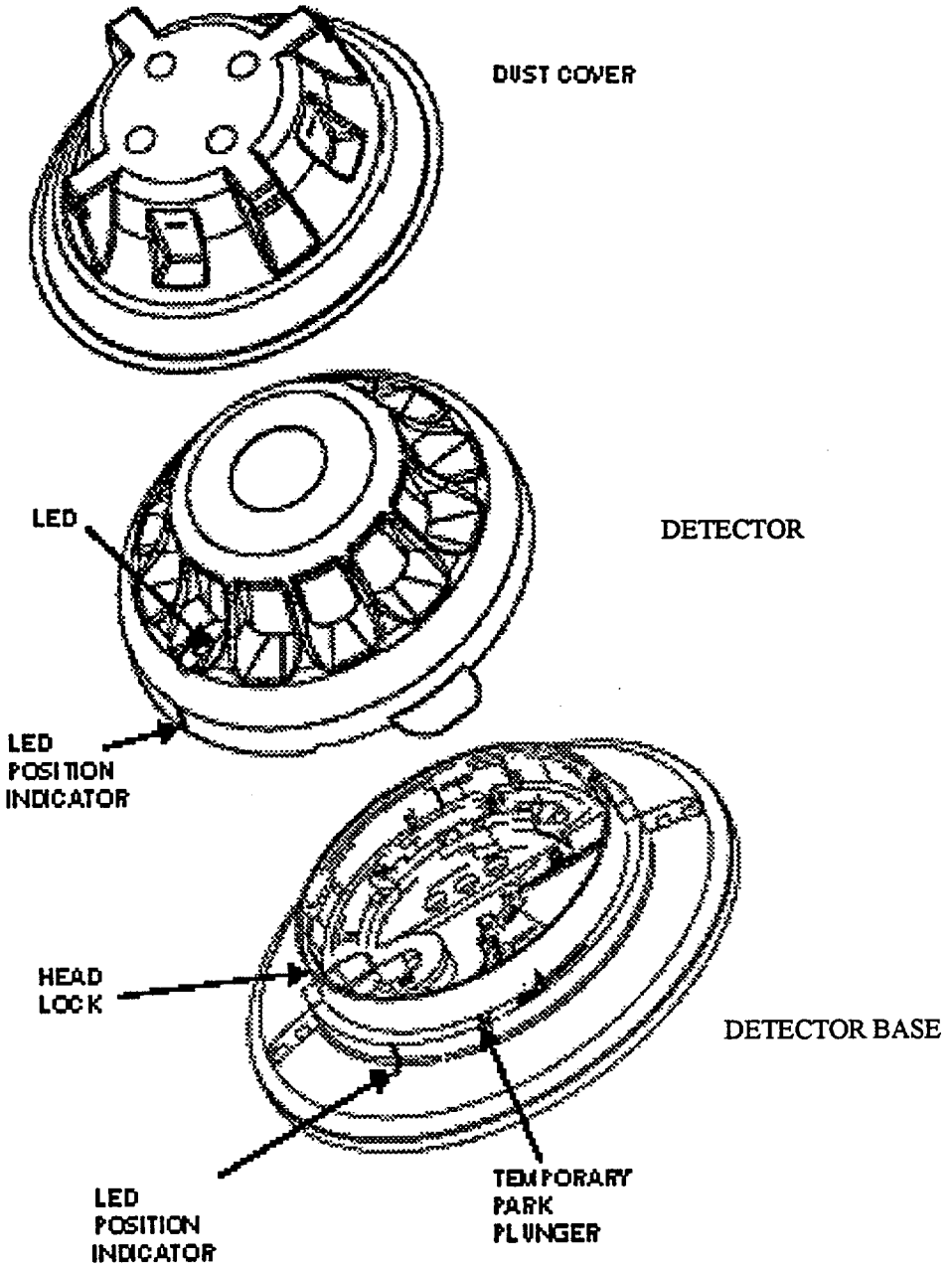
DUST COVER
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Figure 1

Explanation of the justification made for item 14 in the original application date July 20,1998.

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Fax

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Fax:	1-301-415-5369	**Pages:**	(including cover) 3
Phone:	(202) 588-9870	**Date:**	02/17/99
Re:	NRC License	**CC:**	[Click here and type name]

☐ **Urgent** x **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

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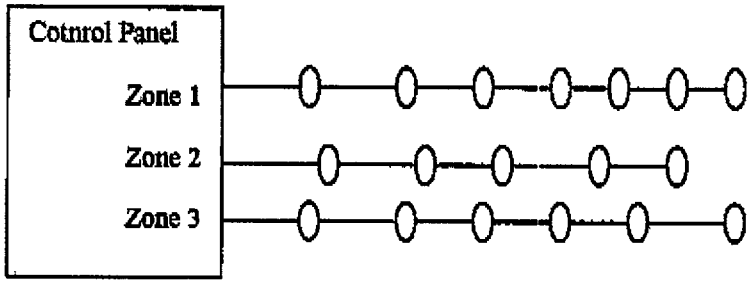
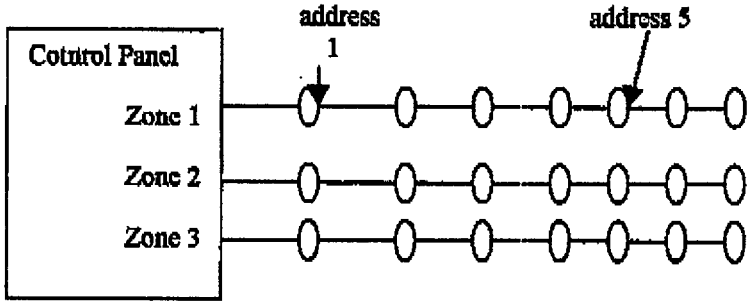
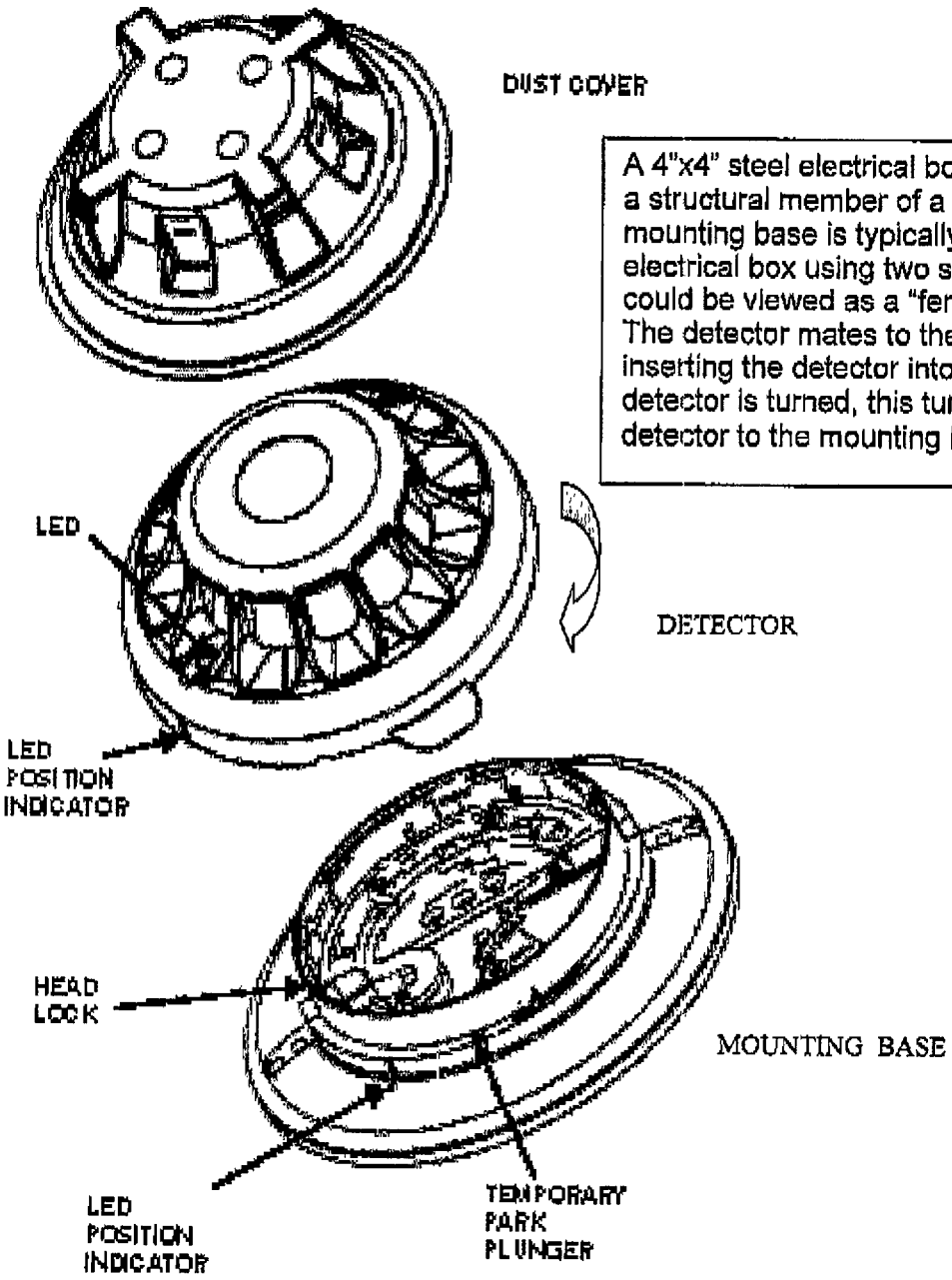


ADDRESSABLE DETECTOR The 912Ion detector is used with an electronic control panel that can determine specifically where a detector is located because the detector's electronic board sends a unique address location in a communication signal. This address location is then programmed into the control panel so that an alarm can be generated which identifies the specific address or location of the detector, ie "COMPRESSOR ROOM.



The non-addressable (612I) and the addressable (912I) detectors contain the same source element. The difference between the two detectors are in the electronic circuit board and the housings. The 912I has connectors imbedded in the plastic so that the "address" can be communicated to the control panel.

page 2 FAX to Seay Lee



A 4"x4" steel electrical box (not shown) is secured to a structural member of a ceiling or wall. The mounting base is typically installed onto the steel electrical box using two screws. The mounting base could be viewed as a "female" outlet for the detector. The detector mates to the mounting base. After inserting the detector into the mounting base, the detector is turned, this turning motion secures the detector to the mounting base.

Figure 1

Fax to Sengtee

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

NUCLEAR REGULATORY COMMISSION
DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY
(FAX 301-415-5369)

DATE: 10/29/98 FROM: Seung Lee

PHONE NUMBER: 301-415-5787

TO: Mr. Reed Timko TO: _____

FAX NUMBER: 1-440-871-1870 FAX NUMBER: _____

TO: _____ TO: _____

FAX NUMBER: _____ FAX NUMBER: _____

MESSAGE:

Enclsoed info. need to evaluate your application. please Call me if you have any questions.

NUMBER OF PAGES (INCLUDING COVER SHEET) 2

1. Provide environment assessment of ionization chamber smoke detectors containing Am-241 based on NUREG/CR-1156 (enclosed). Please refer to Chapter 3. As a minimum, provide whole body dose and hand dose in any one year in normal use for the following:
   a. Individual
   b. Person installing detectors as an occupant
   c. Individual in cleaning detectors, if needed
   d. Warehouse worker
   e. Maximum personnel dose from accidents (e.g., fire, flood, etc.) with exposure rate and cleaning up time required.
   f. Dose commitment resulting from the intake of radioactive material.
   g. Justification for the statement in 14 saying "The probabilities expressed in determining the dose rates meet the criteria of that paragraph."

2. Regulatory Guide 6.9, Appendix C, contains Lot Tolerance Percent Defective (LTPD) tables that have been modified slightly to reflect the NRC policy that no defects of these devices are acceptable from a health and safety standpoint. Therefore, the acceptance number of defects, for all lot sizes, has been changes to zero (0). Currently, your program specifies an acceptance number of one (1) defect per 75 unit sampled lots between 2,001 and 100,000 units. This is not considered acceptable. Please review and provide a revised program that is equivalent to the specifications contained in Appendix C.

3. The wipe test requirement that Grinnell performs prior to distribution of the products is missing in shipping section on page 3 of 3 from Receipt & Shipping of ION Detectors.