Sentex Systems, Inc.

373 Route 46 West
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Fairfield, NJ 07004
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R. Hogan

65 FR 3259
Jan. 20, 2000
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RULES & DIR. BRANCH
US NRC

January 17,2000

U S NRC
Chief, Rules, Review and Directive Branch
Mail Stop T6-D59
Washington, DC 20555-0001

Re: Comments on Draft NUREG 6-1717

Dear Sirs,

Section 4.3 of this draft deals with Electron Capture Detectors (ECD). Please note, identical configuration is also used for Argon Ionization Detector(AID), or Micro Argon Ionization Detector (MAID). Our company is manufacturing this detector under NRC License 29-20512-02G. This detector uses the same components and configuration of the ECD. The description of this operation is enclosed. The only differences are:

1. The polarization voltage is about 1500 volts
2. The signal polarity is reversed.

The detector had been introduced in the late 1960's. Our company re-engineered it, and uses it primarily in remote operations. I therefore, ask that you add this detector to the category of the ECD since it is the same detector. We normally call our detector AID/ECD or MAID/MCED.

Respectfully,

Dr. Amos Linenberg
President/Technical Director

NRC FORM 374

U.S. NUCLEAR REGULATORY COMMISSION

Amendment No. 03

CORRECTED COPY

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Sentex Systems, Incorporated	In accordance with dated January 15, 1999,
	3. License number 29-20512-02G is amended in its entirety to read as follows:
2. 373 Route 46West Building E, 1st Floor Fairfield, New Jersey 07004	4. Expiration date July 31, 2001
	5. Docket No. 030-32141 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Hydrogen 3	A. See Condition 10	A. Not applicable
B. Nickel 63	B. See Condition 10	B. Not applicable

9. Authorized use:

A. and B. Pursuant to 10 CFR 32.57, the licensee is authorized to distribute the devices containing licensed material as specified in Condition 10 of this license, to persons generally licensed pursuant to 10 CFR 31.5 or the equivalent provisions of the regulations of an Agreement State.

CONDITIONS

10. Each device distributed pursuant to the terms and conditions of this license shall be in accordance with the following table:

Device Model	Isotope	Maximum Activity Per Source or Foil
50319 Series electron capture detector	Hydrogen 3	150 millicuries

NRC FORM 374A U.S. NUCLEAR REGULATORY COMMISSION

License Number
29-20512-02G

Docket or Reference Number
030-32141

Amendment No. 03

MATERIALS LICENSE
SUPPLEMENTARY SHEET

CORRECTED COPY

Device Model	Isotope	Maximum Activity Per Source or Foil
50319 Series electron capture detector	Nickel 63	15 millicuries

11. The licensee may distribute material from facilities located at 373 Route 46 West, Building E, 1st Floor, Fairfield, New Jersey.

12. The Radiation Safety Officer for this license is Amos Linenberg, Ph.D.

13. This license does not authorize possession or use of licensed material.

14. Any proposed changes in packaging, labelling, shielding, or instructions for use and storage shall be submitted for review to the Nuclear Materials Safety Branch, U.S. Nuclear Regulatory Commission, Region I, 475 Allendale Road, King of Prussia, Pennsylvania 19406 and approval of the changes shall be received by the licensee prior to implementing the changes.

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Letter dated February 4, 1991
B. Letter dated April 30, 1991
C. Letter dated July 2, 1991
D. Letter dated November 22, 1991
E. Letter dated September 16, 1992

For the U.S. Nuclear Regulatory Commission

Date March 2, 1999

By ***Original signed by John R. McGrath***

John R. McGrath
Nuclear Materials Safety Branch 2
Division of Nuclear Materials Safety
Region I
King of Prussia, Pennsylvania 19406

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SENTEX SYSTEMS, INC.

Technical Application Note 107
Detector Description

Sentex Systems, Inc offers five different detectors for use with our GC systems. These include the Argon Ionization Detector (AID), Electron Capture Detector (ECD), Photoionization Detector (PID), Thermal Conductivity Detector (TCD) and the Micro Argon Ionization/Micro Electron Capture Detector (MAID/MECD).

The Technical Application Note describes the principle of each detector and provides a comparison of them.

Argon Ionization Detector (AID)/Micro Argon Ionization Detector (MAID)

In the presence of radiation emitted by Tritium (H^3), Argon (Ar) atoms will be excited to a higher electronic energy state (Ar*), with an energy of 11.7 eV.

$$Ar \xleftrightarrow{H^3} Ar^* \ (11.7\ eV)$$

When an organic molecule enters the detector, the Ar* exitons will collide with the molecules, causing ionization of the organic molecule:

$Ar^* + RH \longleftrightarrow Ar + RH^+ + e^-$ (where RH is an organic molecule)

An organic molecule will be ionized if its ionization potential (IP) is less than the energy of the Ar* exitons (11.7 eV).

When high voltage is applied to the detector, a current is produced, which is amplified and measured. The current represents the concentration level of the organic molecules in the detector cell.

Electron Capture Detector (ECD)/Micro Electron Capture Detector (MECD)

In the presence of radiation emitted by Tritium, Argon (Ar) or Helium (He) is ionized as follows:

$$He \xleftrightarrow{H^3} He^+ + e^-$$

$$Ar \xleftrightarrow{H^3} Ar^+ + e^-$$

When a low potential is applied, a current is established, which is called a "standing current".

When a molecule with an affinity for electrons (such as halogenated organic compounds) enters the detector, the molecule will "capture" one of the free electrons and become negatively charged.

$RX + e^- \longleftrightarrow RX^-$ where RX is the halogenated compound.

The negatively charged molecule will now be attracted to the positive electrode. However, because of the relative high mass of the molecule, it will move very slowly. The electrode will actually see a decrease in negative charges reaching it due to the reduction in the electrons flow. This will correspond to a decrease in the signal coming from the detector resulting in negative peaks. This detector is selective only to chlorinated or other similar compounds.

Photoionization Detector (PID)

The PID utilizes ultraviolet (UV) radiation to ionize organic molecules. The energy emitted by the PID can reach to 10.6 eV. Therefore, any organic molecule that has an ionization potential or 10.6 eV or less will be detected with the PID. The reaction takes p0lace as follows:

$$RH \xleftrightarrow{UV\ 10.6\ eV} RH^+ + e^-$$

When voltage is applied to the detector, a current is produced, which is amplified and measured. The current represents the concentration level of organic molecules in the detector cell.

Thermal Conductivity Detector (TCD)

The TCD, although not sensitive, responds to atmosphere gases, which cannot be detected by other detectors. It can also detect all hydrocarbons. It operates on the basis of the difference in thermal conductivity of a hot wire when gases flow across the wire. High purity Helium is the recommended carrier gas for this detector. The TCD can normally detect analysis concentration levels as low as 50 to 100 PPM. The TCD is capable of percent level analysis of many gases.

Micro Argon Ionization/Micro Electron Capture Detector (MAID/MECD)

The Sentex-designed MAID, can also operate as an MECD. The addition of electronics and controls allows this MAID to be switched to an MECD. Thus *Sentex can provide one detector that can be operated as an MAID or an MECD,* as described above.

The MAID and MECD are similar to the AID/ECD, but are designed for use with capillary columns.

Comparison of Detectors

Both the AID and the PID are very sensitive detectors. The AID, however, has an ionizing potential greater than the PID. Because of this difference, the AID is sensitive to a broader range of organic compounds.

The PID is very insensitive to compounds such as Chloroform, Carbon Tetrachloride and Trichloroethane. *Instruments using the PID often add an ECD, which can detect those compounds. Therefore, two detectors are needed.* The MAID or the AID has sufficient energy to detect all compounds, and does not need an additional detector (like in the case of the PID). In addition, the AID can be converted to an ECD without changing the power supply or the amplifier.

SENTEX SYSTEMS, INC.

DETECTOR SELECTION CHART

DETECTOR	IONIZ. ENERGY	MODE OF DETECTION	COMPOUNDS DETECTED DETECTABILITY	INSENSITIVE	SENSITIVITY	SPECIAL REQUIREMENTS
Argon Ionization Detector (AID)	11.7 eV	Ionization via collision of excited argon atoms with organic molecule	Aliphatic, aromatic hydrocarbons, halogenated compounds (chloroform, carbon tet., halomethane, and halomethane compounds		1 ppb benzene	None
Micro Argon Ionization Detector (MAID) Designed for Capillary Columns	11.7 eV	Ionization via collision of excited argon atoms with organic molecule	Aliphatic, aromatic hydrocarbons, halogenated compounds (chloroform, carbon tet., halomethane, and halomethane compounds		1 ppb benzene	Argon Gas
Electron Capture Detector (ECD)	N/A	Decrease in current due to affinity for electrons of molecules being detected	Halogenated and nitro compounds (PCB's, pesticides)		ppt levels SF_6	None
Micro Electron Capture Detector (MECD) Designed for Capillary Columns	N/A	Decrease in current due to affinity for electrons of molecules being detected	Halogenated and nitro compounds (PCB's, pesticides)		ppt levels SF_6	Argon Gas Helium Gas Nitrogen Gas
Photo-ionization Detector (PID)	Up to 10.6 eV	Ionization by UV energy	Alipathic aromatic Hydrocarbons	Insensitive to halo methanes and halo ethanes	1 ppb benzene	Argon Gas Helium Gas Nitrogen Gas
Thermal Conduct. Detector (TCD)	N/A	Difference in conductivity between reference gas & target gas	All gases		200 ppm and up	Helium