UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
CHIEF ADMINISTRATIVE OFFICER

December 12, 2008

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DNMS

Mr. Arthur T. Howell, III
U.S. Nuclear Regulatory Commission Region IV
Director
Division of Nuclear Materials Safety
612 E. Lamar Blvd., Suite 400
Arlington, Texas 76011-4125

SUBJECT: CONFIRMATORY ACTION LETTER 4-08-003
(NRC LICENSE 05-11997-01; DOCKET 030-03746)

Dear Mr. Howell:

This letter is in response to Confirmatory Action Letter (CAL) 4-08-003 issued to the National Oceanic and Atmospheric Administration (NOAA) by the NRC on November 12, 2008.

NOAA has taken aggressive steps to address identified items and has made significant progress on each of the identified actions. We appreciate the assistance provided by your staff in explaining regulatory interpretation and methods that might be reasonable to address specific items. We specifically would like to thank Mr. Roberto Torres, who has assisted us in understanding expectations for the Research and Development License amendment currently under development, and Mr. Michael Vasquez, who has advised us on how to assure ongoing operations involving movements of customized gas chromatographs so as to avoid unnecessary concerns.

The CAL specifically required four actions (#1, 3, 4, and 5) to be completed within 30 days of the issuance of that letter. NOAA has successfully completed each of those four items, and you will find enclosed the responses to each action summarized.

Of note are actions which have been completed at NOAA Idaho Falls facility. At that location all materials subject to Specific License authority have been disposed of through an authorized disposal vendor. All remaining items at that location now fall within the purview of General License provisions, and our license amendment will request removal of that location from the Specific License.

Currently, we are on schedule to provide notification to NRC of completion of the remaining two actions (Item #2 and 6) on the schedule provided in the CAL. We will provide specific notification in writing if for unforeseen reasons completion of those items might be delayed.

If you have any questions or comments regarding this letter or the enclosures, please contact John Schneider, the Deputy Director for Research and the Earth System Research Laboratory at (303) 497-4646.

Sincerely,

William F. Broglie

cc:
Dr. Alexander E. MacDonald
Mr. John Schneider
Dr. Steve Fine
Dr. A.R. Ravishankara
Dr. James Butler
Ms. Rhonda Carpenter
Mr. Paul Fetherston – City of Boulder, Colorado
Mr. Joe Vranka – State of Colorado
Mr. David Jones - Idaho Radiation Control Program Director

Enclosures (5)

Enclosure 1

NOAA Response to NRC on CAL 4-08-003 of Nov 12, 2008
Actions and Responses

Specific responses to actions identified in the CAL 4-08-003 issued to NOAA by the NRC under license 05-11997-01, Docket 030-03746, dated November 12, 2008.

Action 1: Within 30 days of the date of this letter, NOAA will either: (a) provide to the NRC staff for review and approval and interim written safety basis for continued operation and use of electron capture detectors contained in custom-made gas chromatographs currently in use by NOAA under this license; or (b) cease operation of all electron capture detectors contained in custom-made gas chromatographs and place them in storage such until such a time that your license may be amended to authorize operations of these devices.

Response to Action 1: NOAA has chosen to provide a safety basis for your staff's review and approval. That safety basis document is found as Enclosure 2 to this package and includes a review of all pertinent operational parameters for these electron capture devices and a review of systems and checks we use to assure those operating parameters are not violated.

Action 2: This action is due 45 days from issuance of the CAL and will be responded to separately by that date.

Action 3: Within 30 days of the date of this letter, NOAA will provide the NRC with a complete accounting of all licensed material (except polonium-210), custom made gas chromatographs, and mass spectrometers that contain radioactive material under this NRC license. Specifically, NOAA will provide the current manufacturers name, model number, and serial number for each electron capture detector containing licensed material as well as each gas chromatograph or mass spectrometer containing licensed material other than Polonium-210. In addition, for each electron capture device and gas chromatograph combination, NOAA will provide the operational status (e.g., in use, in transit, in storage, etc.), and the current location where the licensed material is used or stored in NRC's jurisdiction.

Response to Action 3: Enclosure 3 to this letter includes an inventory of all electron capture detectors, gas chromatographs, and mass spectrometers containing licensed materials and includes all specific items for each unit listed in the action.

Action 4: Within 30 days of the date of this letter, NOAA will submit to the NRC a written report of it's assessment of compliance with 10 CFR 20.1801, "Security of stored material," and 10 CFR 20.1802, "Control of material not in storage," at it's Idaho Falls, Idaho, field office and other locations, as applicable, within NRC's jurisdiction. For any items of non-compliance identified, with written report shall provide a description of the issue, as well as the actions taken of planned to restore compliance, including the schedule to correct the conditions.

Response to Action 4: A written report of compliance with plans to restore compliance where necessary with the regulations referred to in this action is found in enclosure 4.

Action 5: Within 30 days of the letter, NOAA will submit to the NRC a written report of it's assessment of compliance with radioactive labeling requirements, as specified in 10 CRF Part 20, Subpart J – Precautionary Procedures, at all locations where radioactive material is used or stored under this license. For any items of non-compliance identified, the written report shall provide a description of the issue, as will as the actions taken or planned to restore compliance, including the schedule to correct the conditions.

Response to Action 5: A written report of compliance with plans to restore compliance where necessary with the regulations referred to in this action is found in enclosure 4.

Action 6: This action is due January 15, 2009 and will be responded to separately by that date.

Enclosure 2

Safety Basis for Continued Operations of Custom-Made ECD type Gas Chromatographs

NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

James W. Elkins, editor, E-mail: james.w.elkins@noaa.gov

Version 1.2

1.0 Introduction

1.1 Define Purpose and Use of Custom ECD Ovens

NOAA is involved in world-class research on ozone depleting, climate or greenhouse, and air quality trace gases that are all important to the health and well being of the citizens of the United States. Large depletions of stratospheric ozone can cause increased incidents of fatal skin cancer. Increases in the greenhouse gases can cause more suffering through increased numbers of heat stokes in individuals and changes to climate that may not be reversed easily. Increases of atmospheric trace gases resulting in air pollution can cause more heart and lung problems for American citizens. NOAA, along with NASA, is responsible for producing an assessment of stratospheric ozone depletion every 3-4 years by the 1990 Clean Air Act. NOAA data on these climate gases were included in the report of the Intergovernmental Panel for Climate Change (IPCC), which shared the 2007 Nobel Peace Prize with former Vice President Al Gore.

The electron capture detector (ECD) is one of the most sensitive detectors made for atmospheric trace gases containing oxygen, sulfur, fluoride, chlorine, bromine, and iodine atoms. When the ECD is coupled to a gas chromatograph (GC) to separate trace gases from air, this detection method (GC-ECD) is unique for detecting low atmospheric levels of trace gases in the parts-per-billion (ppb, 1 part in 10^9) and parts-per-trillion (ppt, 1 part in 10^{12}) ranges. For example, our detection limit for sulfur hexafluoride, a greenhouse gas used in the distribution of electrical power, is 100 parts-per-quadrillion (ppq or 1 part in 10^{15}). This fantastic sensitivity is result of the efficient production of ionizing radiation that leads to electron capture or sensitive chemical ionization created by the Nickel-63, beta source in the ECD. The non-radioactive ECD-mode of a commercial photo-ionization detector does not come close in sensitivity for the halocarbons and many other trace gases, so it not an option for research now. NOAA/ESRL scientists are responsible for measuring over 50 trace gases that are involved in international agreements, including the Montreal and Kyoto Protocols.

NOAA/ESRL began using commercial ECDs in custom-made gas chromatographs in order to save space and weight in field applications. Instruments used to make measurements from balloons and aircraft must be small and lightweight. Research on how to develop small, reliable GC's with multiple ECD detectors carried over to NOAA's surface sampling programs in which multi-detector GC's were built for use at remote field sites. Further, because these measurements required extremely good measurement precision, NOAA/ESRL scientists began constructing research-grade instruments that exceeded the capabilities of commercial instruments.

1.2 Design Aspects of Commercial ECD ovens

We use commercial electron capture detectors, but we redesign the detector's oven and disconnect it from the commercial column oven. The manufacturers specifications and requirements for their ECD operation are defined from their instrumental manuals [Shimadzu, 1982; Hewlett Packard, 1985;Valco, 1991]. All detectors, except the Shimadzu ECD, can be operated at maximum of 400 °C (see Table 1). The Shimadzu must be operated no higher than 350 °C. We need to operate most of our detectors between 330 and 400 °C to achieve maximum sensitivity for atmospheric concentrations of the halocarbons, sulfur gases (SF_6, COS), carbon monoxide, methane, hydrogen, and nitrous oxide. Some

Table 1 Manufacturer's Specifications and Requirements for their ECDs.

ECD model	Nickel-63 (mCi)	Amount of Ni^{63} (mg)	Max. Temp (° C)
Valco	5	85	400
Shimadzu	10	170	350
Hewlett Packard (HP)*	15	250	400
Shimadzu	10	170	350
Hewlett Packard (HP)*	15	250	400

*Agilent Technologies is the successor company after HP was split up and reorganized in 2000. The HP and Agilent detectors are almost identical.

detectors are operated at lower temperatures (60-250 °C) for a few specific purposes (e.g. atmospheric organic nitrates, CFC substitutes, etc).

As a example of the maximum temperature requirement, the Hewlett Packard manual goes further and states "In the extremely unlikely event that both the oven and the ECD-heated zone should go into thermal runaway (maximum, uncontrolled heating in excess of 400°C) at the same time, and that the ECD remains exposed to this condition for more than 12 hours, take the following steps: (1) After turning off the main power and allowing the instrument to cool, cap the ECD inlet and exhaust vent openings. Wear disposable plastic gloves and observe normal safety precautions. (2) Return the cell for exchange following the directions included with the form general license certification (HP Pub. No. 43-5954-7621, HP part number 19233-90750).

But the manual goes on to state, "even in this very unusual situation, radioactive material is unlikely to escape the cell. Permanent damage to the Nickel-63 plating within the cell is possible, however, so the cell must be returned for exchange". Valco's manual states that "it has been demonstrated that Nickel-63 is chemically stable at temperatures up to at least 500 °C, which exceeds the maximum operating temperature of the ECD 140BN" [*Valco* 1991].Control of ECD temperature is the most critical parameter in terms of safety. Measures to control and limit ECD temperature vary among commercial instrument manufacturers. Hewlett-Packard and Agilent monitor the temperature of the nearby column oven to make indirectly sure that the ECD does not exceed 400 °C. Both Shimadzu and Valvo use a second temperature sensor to monitor the ECD so it does not exceed the maximum allowable temperature. Once the maximum temperature threshold is met, the ECD heater is disabled resulting in ECD cooling.

1.3 Design Aspects of NOAA/ESRL Custom ECD Ovens

NOAA custom GC's include ECDs installed in custom-made heated zones. These zones consist of a metal enclosure containing the ECD, a resistive heating device, a temperature sensor (RTD), insulation, a thermal relay (also called a manually resettable thermostat), and a temperature controller. Drawings are provided of the inside assembly of the NOAA/ERSL custom ovens in Appendix A. The design permits holes for heater cartridges and RTDs. Drawings of the outside can which is sealed at 1 atmosphere during the ECD use is shown in Appendix B. The temperatures of the ECDs are maintained by off the shelf Proportional-Integral-Derivation controller (PID controller) that can maintain a desired temperature to within +/- 0.1 to 0.2 °C at a set temperature of 350 °C. The PID controller is commonly used in critical industrial control systems. The PID controller corrects for the error between a measured temperature and a set-point for the detector temperature by calculating a correction to the measured temperature. The proportional value calculates the reaction to the current error, the integral value calculates the reaction to the sum of recent errors (a history), and the derivative error calculates the reaction based on the rate at which the error has been changing. A tuning algorithm will calculate the optimum value of each PID parameter to maintain constant temperature. Not all of the commercial detectors listed in Table 1 use PID control for temperature, which we feel is a safety improvement other those without complete PID control.

2.0 Safety Features

2.1 Radiological Risks

The radiological risks can be defined, as near term and long term, in terms of the possibility of developing cancer later. The risks for commercial ECDs are the same as our custom ECD oven gas chromatographs. There are MSDS sheets from various manufacturers of Nickel-63 sources that detail fundamental physical parameters, human exposure limits, and what to do during an accident (See Appendix C). The MSDS gives emergency information on a source in a breached or open cell, mark the area with Radioactive Danger Area Tape, and stop all activities near the damaged source until Radiation Safety Officers (RSOs) arrive. Agilent has defined the near term radiological risks from a 15 mCi of Nickel-63 plated on a platinum foil for various interactions with the source by human activity (See Appendix D). In summary, Agilent has calculated that "persons working with an unshielded source of 15 mCi of Nickel-63 at a distance of 16 cm from the source would require continuous exposure of 1,471 hours to obtain the annual public dose rate of 100 mrem". Agilent calculates "A person receives a level of less than 0.00001% of the values listed below when the source is within an unopened detector housing."

2.2 Non-Radiological Risks

Nickel itself is a toxic metal that can cause problems in the human body, however the amount of nickel present in the ECDs is at milligram levels (see Table 1). In a diluted amount (0.00001%) from the sealed source, nickel poses no risk to humans.

2.2 Venting of ECD exhaust

Valco recommends venting the ECD exhaust out a fume hood, window, or outside vent. HP and Agilent recommend attaching a short vent line from the ECD exhaust. They recommend checking gas flows with this line. Shimadzu has no information on venting. Our understanding from venting the exhaust is more for contamination from high concentrations of samples rather than normal exhaust of the ECD. Since we are measuring trace quantities of common atmospheric gases, we vent the exhaust away from the user.

2.3 *Safety features of the NOAA/ESRL Custom ECD ovens*

According the manufacturer's manual, the Valco and Hewlett Packard ECD's temperature must not exceed 400 °C, and the temperature of the Shimadzu must not exceed 350 °C. We have triple redundancy to prevent the ECD's temperature from exceeding their manufacturing operating limits. First, we have an "off-the-shelf "manually resettable thermostat that turns off the heater current when the temperature of the top of a can on the ECD oven's temperature exceeds a temperature limit (50, 75, or 90 °C). The outside temperature trip point of the thermostat is selected based on the ECD type, insulation, and its location in each instrument. Second, each "off-the-shelf" PID temperature controller has an electronic shut off of the heating circuit when the temperature sensor of the ECD (high temperature RTDs) goes into a failure mode. Third, the PID temperature controllers can monitor the rate of the temperature gradient changes too much in a certain period of time (called "loop break"). If the RTD fails and reads a nonsense value, then the heater circuit will open and allow no current to the heater. The original manufacturer only has double redundancy on their gas chromatographs, so we are exceeding the manufacturer's number of safeguards with one of each category of mechanical, sensor failure, and software (rate of temperature change) override failsafe.

3.0 Operation and Maintenance

The procedures described here pertain to a specific type of ECD heated zone in a cylindrical metal "can" defined as the custom ECD oven. This is the most common type of heated zone and is used in all but two of our operational custom GC applications. The exceptions are two ECD ovens used for low temperature detection (90° C) of organic nitrates in the atmosphere. Their ECD oven is constructed differently, where the wattage of the heater is limited to operations well below 400 °C. These procedures are similar to those we would apply to other types of heated zones, or cans, but there will be slight differences depending on the instrument configuration. None of these differences would be significant in terms of radiation safety.

3.1 Assembly

Assembly of ECD ovens ("cans") is described in the Chromatograph for Atmospheric Trace Species (CATS) manual for Shimadzu and Valco ECDs. Briefly, the procedure involves connecting 1/16" stainless steel tubing from the three ECD ports (inlet, outlet, and makeup) to bulkhead connectors on the inside of the can lid. Electrical connections are soldered to the anode and cathode wires on the ECD (Appendix A). The anode is connected to an SMA connector which serves as the electrical feed-through to the front face of the can. The cathode is connected to a grounding point inside the can or to the SMA connector. The ECD itself is mounted inside the can using a triangular mounting plate, or by using the 1/16" tubing to form a semi-rigid mount. Two halves of an aluminum collar with ¼" holes along the axis are mounted around the body of the ECD and used to hold the RTD and the resistive heater. The RTD and heater can also be mounted into the ECD body. A 1/16" purge line is connected to one port on the can lid. The other purge port is left open. The purge flow consists of 3-5 cc/min nitrogen and serves to keep the interior of the can free of oxygen to reduce oxidation of the electrical connections at high temperature. Whether or not there is flow or not through the ECD is not a radioactive safety issue. The electrical connections for the heater and RTD are wired to a feed-through connection on the lid of the can.

After all connections have been made, 40-psig nitrogen is plumbed to the ECD inlet with the other ports capped. Snoop (soap and water) is used to test for gas leaks at the three ECD ports and at the bulkhead connections on the can lid. If leaks are found, fittings should be tightened or replaced until no leaks are present. The ECD is then wrapped with insulation and inserted into the can. The can lid is then attached with machine screws. The can is then labeled with the ECD model, serial number, and radioisotope caution label.

The ECD can be tested in either a GC or on the bench-top. The thermal relay is tested by applying heat to the face using a heat gun, while monitoring the electrical contacts with a digital voltmeter. The contacts should move to open circuit at the correct temperature. Reset the thermal relay using the manual reset button, and wire the relay through the heater cartridge and install the relay on the face of the can. The temperature control system can now be tested. The can is purged of air using nitrogen prior to heating. The ECD is plumbed with appropriate carrier gas (N_2 or Ar/CH_4) and the can should be connected to a PID temperature controller. Consult the CATS manual for proper settings on the controller. The sensor type (typically a 100-Ohm RTD) needs to be entered into the controller software. Check that the RTD reads a reasonable value at ambient temperature. Then set the operating temperature to 100 °C and observe the ECD temperature. It should increase slowly and begin to control as it reaches the set point. If the temperature does not control, proceed with troubleshooting. If the temperature is controlled but oscillates more than a few tenths of a °C, the PID parameters of the temperature controller may need to be tuned. Ultimately the temperature controller should be stable to within ± 0.1-0.2 °C. Consult the CATS manual for typical settings and consult the controller manual for instructions on tuning. If the controller is functioning correctly, set the temperature set point to the desired operating temperature and observe the heating cycle. If the controller operates correctly at the desired temperature, the ECD is ready for use.

3.2 Routine Operation

ECDs assembled in custom-made heated zones should perform well for several years without maintenance. Typical procedures for routine checks on GCs operated at long-term monitoring sites include a daily check on ECD operating temperature and other GC parameters (see CATS daily check sheet). Engineering data, including ECD temperature, are logged by software on varying time scales. These data are used primarily for troubleshooting purposes.

3.3 Troubleshooting

A procedure for troubleshooting the control of the heated zone temperature is outlined in the CATS manual. Briefly, this procedure involves checking the thermal relay or thermostat, checking the resistance of the heater cartridge, and the resistance of the RTD. If these systems appear to be operational, then a spare temperature controller can be installed in place of the suspect controller. Here one must be careful to initialize the controller with the same parameters used in the old one. If the controller is not operating correctly and the problem is not obvious, the heater circuit should be disabled by disconnecting the circuit at the thermal relay or disconnecting the controller until the problem is solved. A faulty or suspect heated zone should not be left “powered up”.

In the unlikely event that the ECD overheats without tripping the thermal relay or thermostat (defined as ECD temperature exceeding the manufacturer’s rated temperature, other than in a transient manner), the power to the ECD heater should be disconnected, either by turning the GC off or by disabling the heater circuit. If the system was logging data at the time of suspected overheat, check the data record to examine the recorded ECD temperature. If the record shows a sustained temperature more than 5% higher than the maximum allowable, the ECD should not be used until a radiation leak is ruled out. Contact the Deputy Radiation Safety Officer and inform him/her that you would like to test an ECD for radiation leakage. Use a wipe test kit and return the kit to the Deputy Radiation Safety Officer for analysis. Following a wipe test, close the access doors of the GC and place “Caution” tape around the instrument until the wipe test results are known.

If the wipe test results indicate a radiation leak, the ECD should be considered hazardous. Follow the instructions in section 3.6 “*Replacing an ECD that has failed a wipe test*” to remove the entire can from the GC. Contact the Deputy Radiation Safety Officer for instructions on how to package the ECD for shipment to Boulder. The package should be labeled as hazardous and kept in a locked location prior to shipping. If the ECD is located at 325 Broadway, Boulder, inform the Deputy Radiation Safety Officer and arrange to have the can removed from the instrument and returned to the manufacturer. See Section 3.6 if the unit is not in Boulder, Colorado.

If the initial wipe test of the ECD exhaust is negative, reconnect the power and follow the trouble shooting procedures to check the operation of the thermal controls. The ECD should not be operated until the cause of the overheating has been determined and addressed.

3.4 Maintenance

The most common reasons for replacing an ECD are 1) poor performance (poor sensitivity or electronic noise, 2) failure of the RTD and 3) failure of the heater unit. Due to the demand for high precision, ECDs are typically not replaced without good reason.

3.5 Replacing an ECD that has not failed a wipe test

The ECD and the can lid should, in most cases, be considered a functional unit. The ECD and the can lid should be kept together. This way, the tubing and electronic connections to the can lid will remain intact, and the labeling will stay with the ECD. The following instructions are also in the CATS manual. To remove the ECD, reduce the controller set point temperature or disconnect the relay and allow the ECD to cool to room temperature. Disconnect all tubing and cap the inlets. Disconnect the electrical connection. Remove the thermal relay and the screws that attach the can lid to can base. Gently pull the ECD and lid away from the rest of the can. Installation of a new ECD attached to a can lid is basically the reverse of the above.

In rare cases the ECD may need to be removed from the can lid. This procedure is basically the reverse of the assembly procedure. However, gloves should be worn for this procedure since it will expose surfaces that are "upstream" of those regularly wipe tested. If the ECD is removed from the can lid, a radiation caution label should be attached to the ECD.

3.6 Replacing an ECD that has failed a wipe test

If the ECD is located in the field, the entire can (lid and body) should be removed from the GC, if possible. This will limit exposure to internal surfaces that might be contaminated. It is required that you wear gloves for this procedure. Turn off the power to the GC and allow the ECD to cool to room temperature. Disconnect all tubing to the ECD and cap the inlets. Disconnect the electrical connections and remove the thermal relay. Remove the mounting bolts from the can and remove the can from the GC. Place the entire can in a box and mark with caution tape. Place the box in a locked drawer or cabinet and contact the Deputy Radiation Safety Officer for instructions on how to return the ECD to Boulder.

4.0 Shipping Documentation

ECDs may be shipped as an excepted radioactive instruments and articles (Appendix E – 49 CFR 173.424), on commercial passenger aircraft under the UN2911. Please see appendix F - 49 CFR 173.421 for more information on shipping.

5.0 Summary

The biggest concern for the operation of commercial ECDs is to ensure that the temperature does not exceed its maximum operating temperature. The custom ECD ovens are made as safe as possible with two to three layers of redundancy to the temperature controllers. The exhaust ports of the ECDs must also be wipe tested every 6 months to assure that the source is not leaking at a level less than 0.005 microcurie (μCi). There will be authorized users of ECDs at NOAA/ESRL and these users are on the license. There are also secondary users that operate the instruments on a day to day basis, and require less training than an authorized users. At the NOAA/ESRL sites, there is a Radiation Safety Officer and two Deputy Radiation Safety Officers. All correspondence between the NRC and NOAA will be conducted with the NOAA/ESRL Radiation Safety Officer or designate (typically the deputies). An ECD safety PowerPoint slide course has been given to all users including warehouse people, scientists, and employees at the field sites (See Appendix G). More formal training is in progress at this time. The NOAA/ESRL RSO will make sure that all users have completed ECD Safety Training, maintain inventory of all sources, and make sure that wipe test are performed every six months on operational instruments.

References:

Shimadzu [1982], Gas Chromatograph GC-Mini 2 with Electron Capture Detector, Instruction Manual, Shimadzu Corporation, Analytical Instrument Plant, Kyoto, Japan, part #221-20502A, pp. 46.

Valco [1991], Model 140BN Electron Capture Instruction Manual, Valco Instruments Co, Inc. (VICI), Houston, Texas, USA pp. 41.

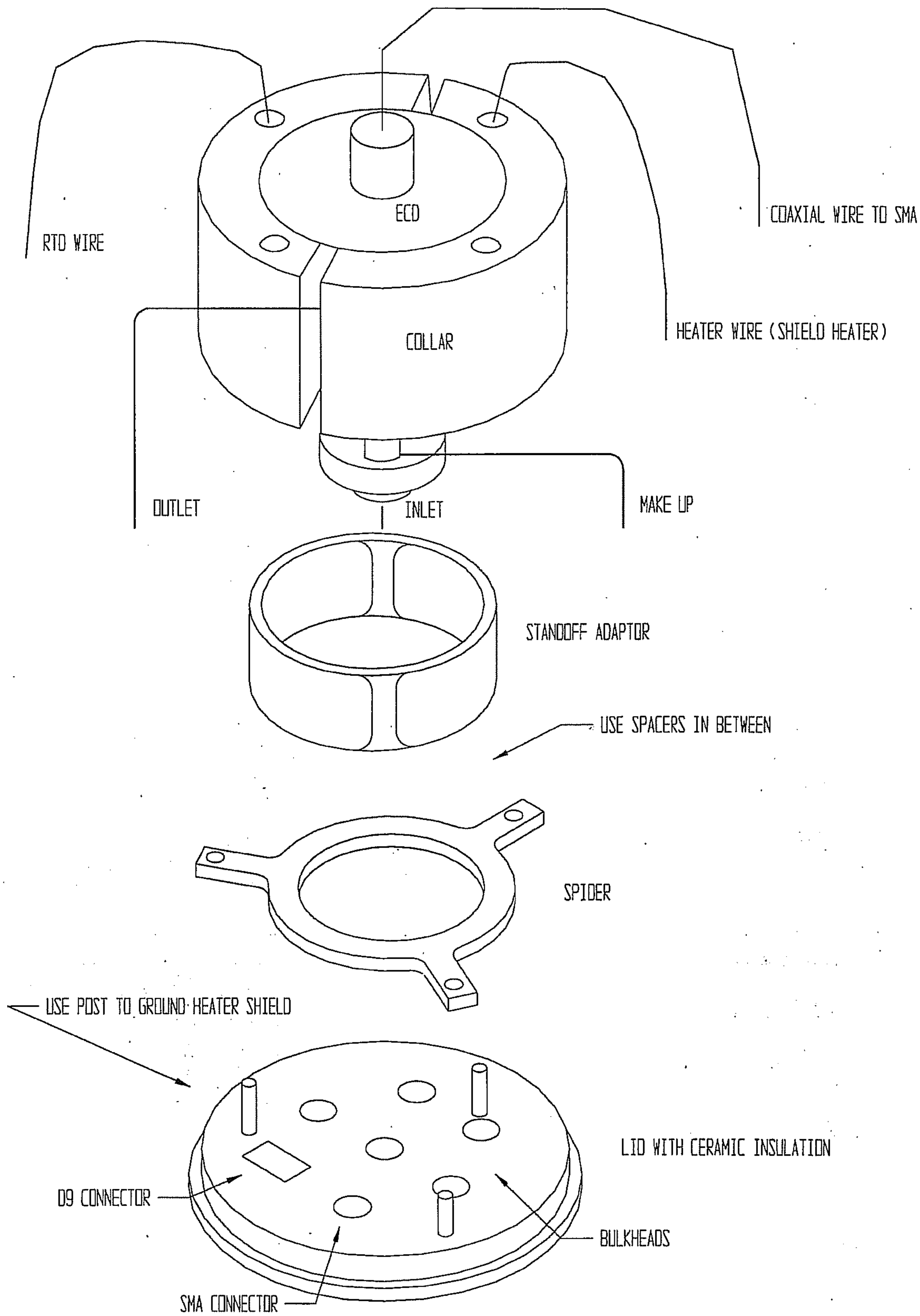
Hewlett Packard [1985], HP5890A Gas Chromatograph Reference Manual Volume II, Section 15, Hewlett Packard, Inc. Palo Alto, California, USA, part#05890-60300.

List of Appendices.

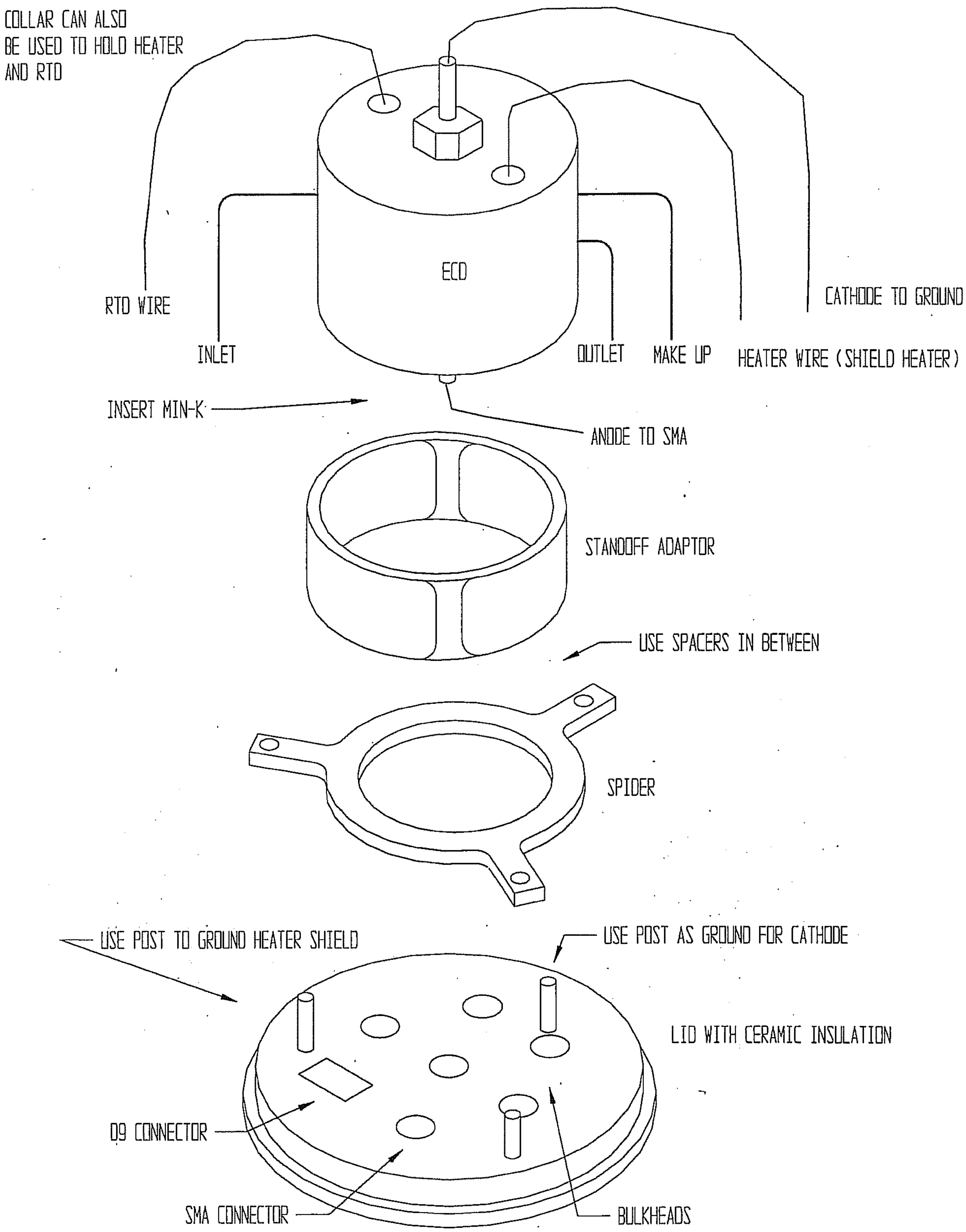
Appendix A to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

NOAA/ESRL custom oven inside can adapters for heater and RTD.

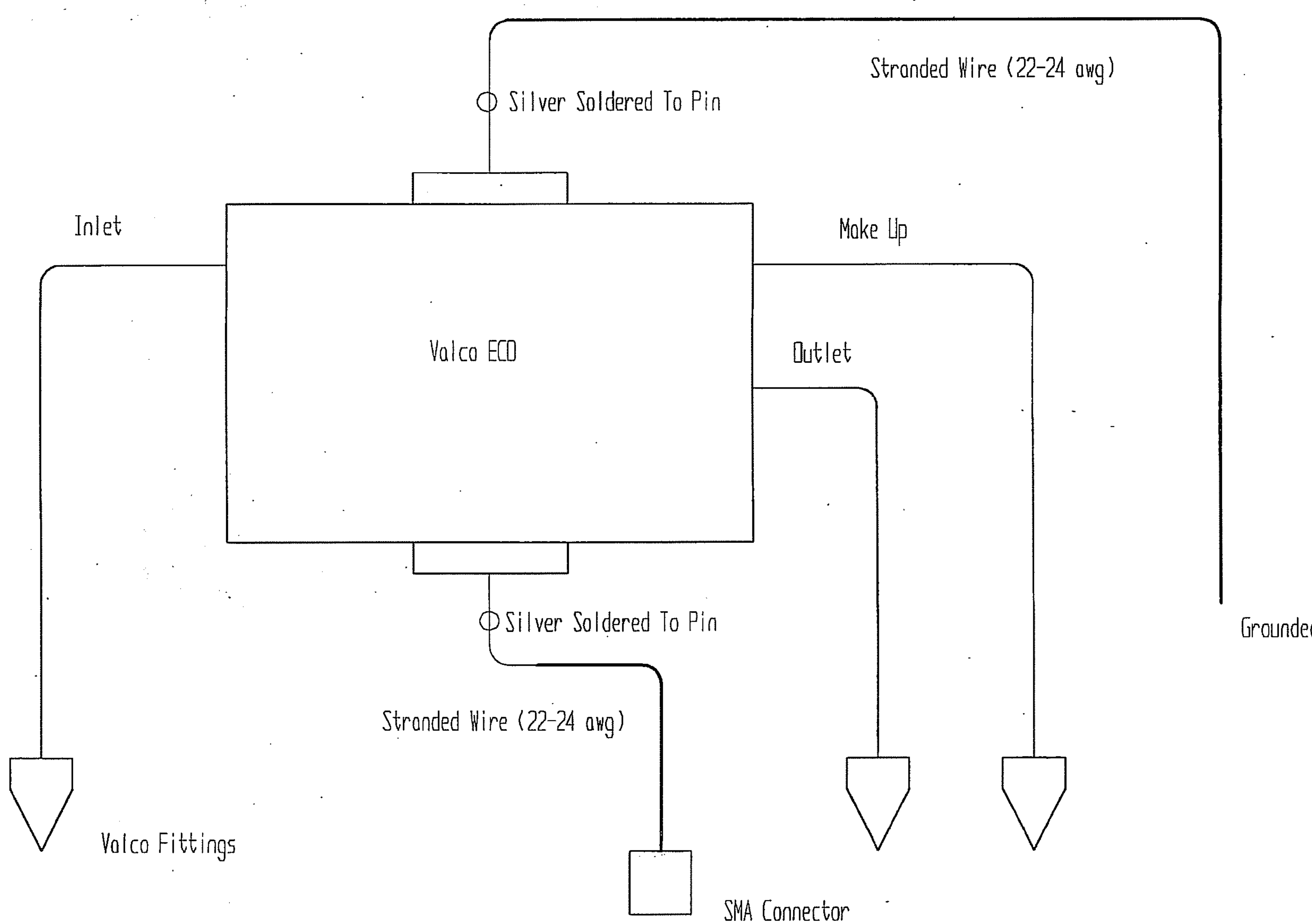
SHIMADZU ECD ASSEMBLY



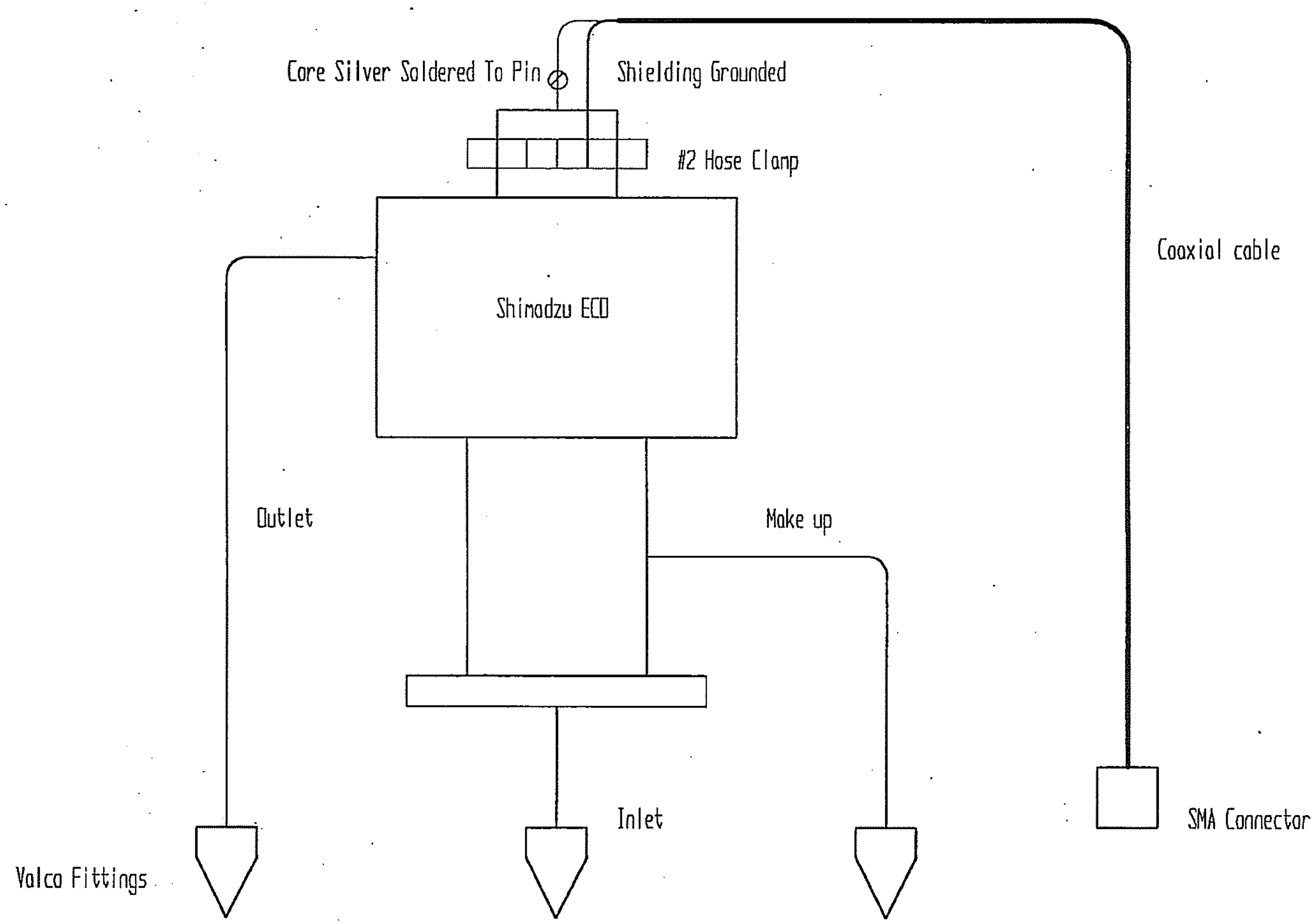
VALCO ECD ASSEMBLY



VALCO ECD SCHEMATIC

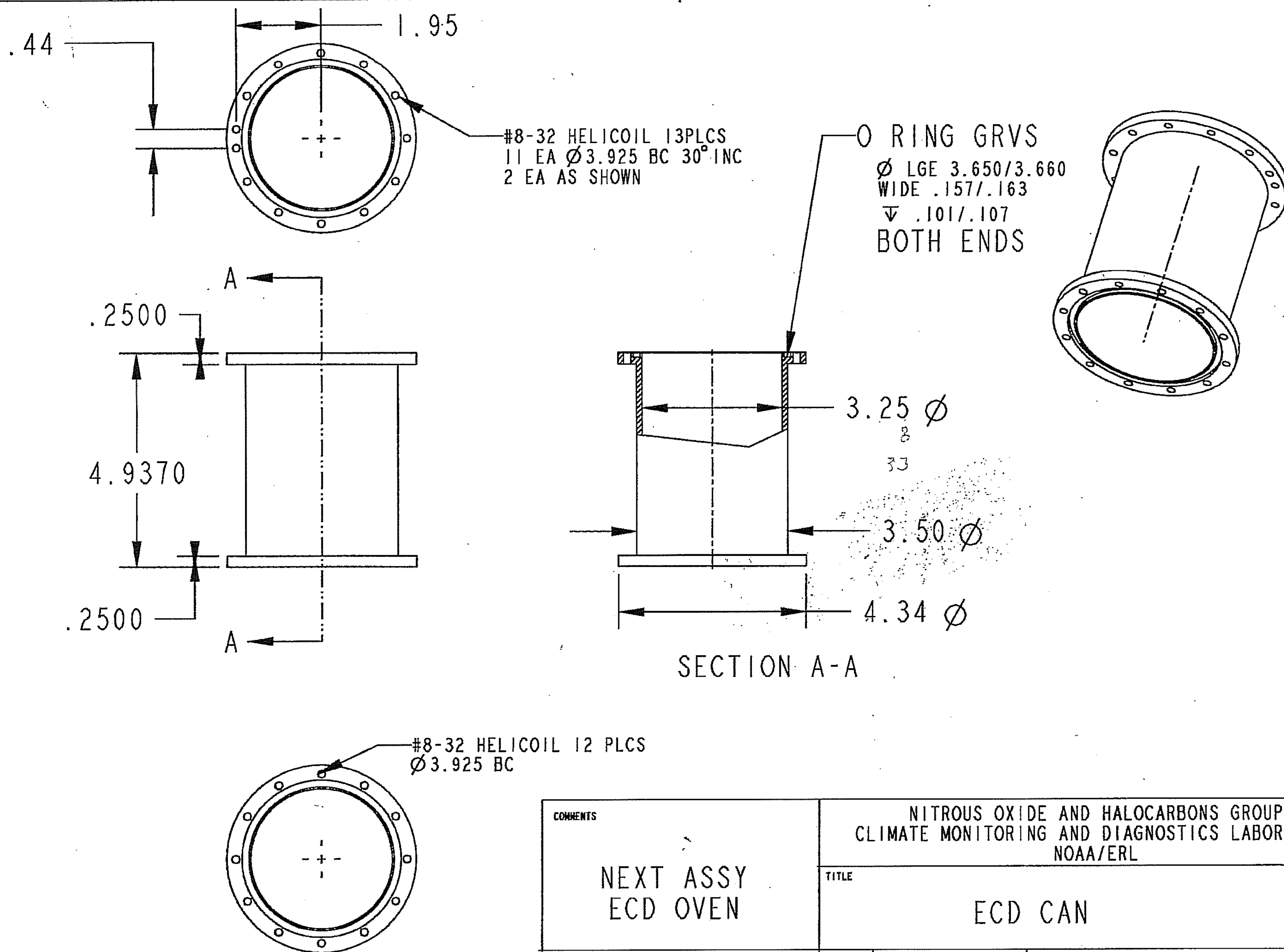


SHIMADZU ECD SCHEMATIC



Appendix B to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

NOAA/ESRL custom oven outside can.



COMMENTS NEXT ASSY ECD OVEN	NITROUS OXIDE AND HALOCARBONS GROUP CLIMATE MONITORING AND DIAGNOSTICS LABORATORY NOAA/ERL
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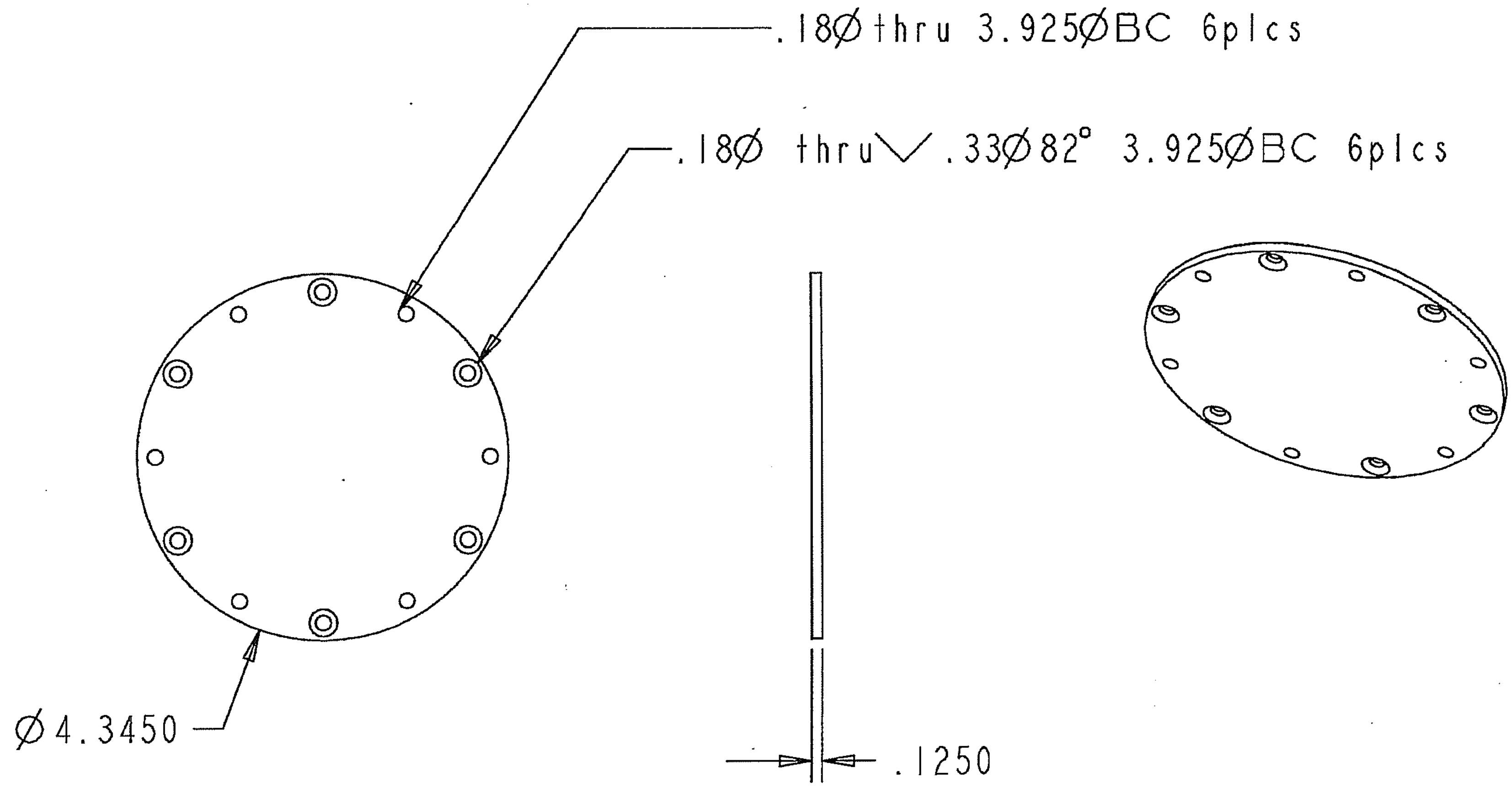
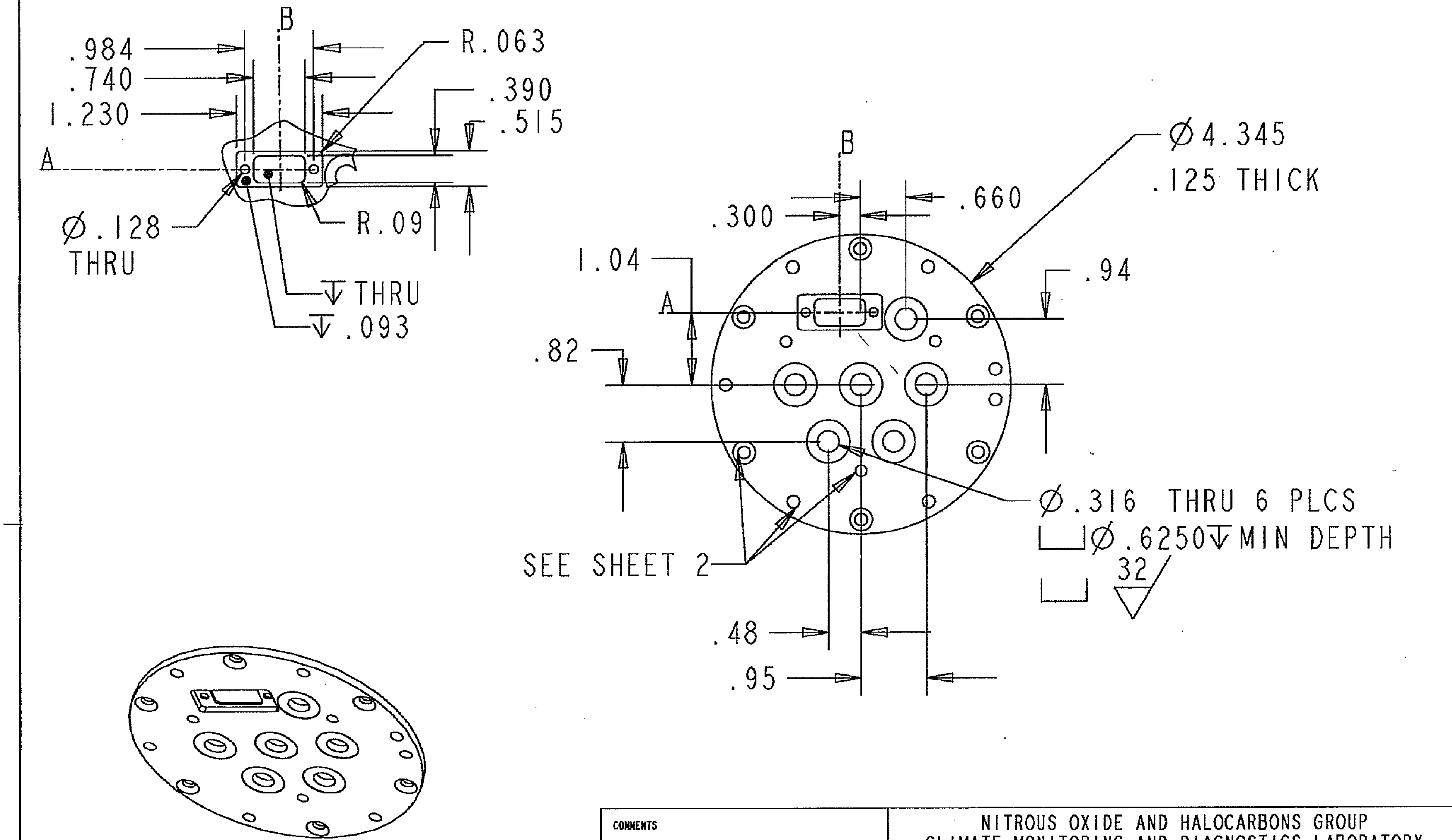
MATERIAL 6061 AL	SIZE A DWG NO REV
FINISH ANODIZE BLK	



COMMENTS	NITROUS OXIDE AND HALOCARBONS GROUP CLIMATE MONITORING AND DIAGNOSTICS LABORATORY NOAA/ERL
NEXT ASSY ECD OVEN	TITLE ECD BOTTOM
MATERIAL 6061 AL	SIZE A / DWG NO / REV
FINISH BLK ANODIZE	



COMMENTS NEXT ASSY ADAPTOR SUB	NITROUS OXIDE AND HALOCARBONS GROUP CLIMATE MONITORING AND DIAGNOSTICS LABORATORY NOAA/ERL
	TITLE ECD TOP
MATERIAL 304 SS	SIZE A · DWG NO · REV
FINISH	SHEET 1 OF 2

Appendix C to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

MSDS for Nickel-63

Radioactive Material Safety Data Sheet

This data sheet presents information on radioisotopes only. This document is not subject to WHMIS requirements.
For information on chemical compounds incorporating this radionuclide, see the relevant Material Safety Data Sheet.

Nickel-63

Part 1 – Radioactive Material Identification

Common Names:	Nickel-63	**Chemical Symbol:**	Ni-63or ^{63}Ni
Atomic Number:	28	**Mass Number:**	63 (35 neutrons)
Chemical Form:	Nickel metal	**Physical Form:**	Nickel-63 is electroplated on one face of a thin nickel foil.

Part 2 – Radiation Characteristics

Physical half-life: 100.1 years **Specific Activity (GBq/g):** 2,190

Principle Emissions	^{E}Max (keV)	^{E}eff (keV)	Dose Rate (mSv/h/GBq at 1cm)	Shielding Required
Beta* (β)	65.9 (100%)	17	228[a]	-
Gamma (γ) / X-Rays	-	-	-	-
Alpha (α)	-	-	-	-
Neutron (n)	-	-	-	-

* Where Beta radiation is present, Bremsstrahlung radiation will be produced. Shielding may be required.
Note: Only emissions with abundance greater than 10% are shown.
[a] *The Health Physics and Radiological Health Handbook*, Scintra, Inc., Revised Edition, 1992

Progeny: Copper-63 (Cu-63)

Part 3 – Detection and Measurement

Methods of detection (in order of preference)

1. A radiation survey meter equipped with a thin-window, energy-compensated Geiger Mueller detector.
2. A radiation contamination monitor equipped with a Geiger Mueller pancake detector.
3. A radiation survey meter equipped with a plastic scintillator detector.

Dosimetry

Whole Body ☐ Skin ☑ Extremity ☑ Neutron ☐

Internal:	Sealed sources pose no internal radiation hazard. However, in the event of loss of containment by the sealed source, all precautions should be taken to prevent inhalation or ingestion of the material.
Critical Organ(s):	not known at this time;
Annual dose limits:	*Non-nuclear energy workers:* 1mSv per year *Nuclear energy workers:* a) 50 mSv in one year b) 100 mSv total over five years *Pregnant nuclear energy workers:* 4 mSv over the balance of the pregnancy

Part 4 – Preventive Measures

Always use the principles of time, distance and shielding to minimize dose

Engineering Controls:	Sealed radioactive sources used in industrial applications should always be within a protective source housing to minimize radiation dose and to protect the source capsule from damage.
Personal Protective Equipment (*for normal handling of unsealed sources only. Always wear disposable gloves, safety glasses, personal protective equipment and clothing as appropriate to the material handled).* No special PPE required.	
Special Storage Requirements:	None

Part 5 – Control Levels

Oral Ingestion	Inhalation	
ALI (kBq)	ALI (kBq)	DAC (Bq/ml)
333,000	74,000	2.59×10^{-2}
Exemption Quantity (EQ):	10,000,000	

Part 6 – Non-Radiological Hazards

Identified as a potential carcinogen. In large doses, it has been known to cause cumulative lung damage and dermatitis.

OSHA Permissible Exposure Limit (PEL)
1 mg/m3 TWA

Part 7 - Emergency Procedures

The following is a guide for first responders. The following actions, including remediation, should be carried out by qualified individuals. In cases where life-threatening injury has resulted, ***first*** *treat the injury,* ***second*** *deal with personal decontamination.*

Personal Decontamination Techniques

- Wash well with soap and water and monitor skin
- Do not abrade skin, only blot dry
- Decontamination of clothing and surfaces are covered under operating and emergency procedures

Spill and Leak Control

- Alert everyone in the area
- Confine the problem or emergency (includes the use of absorbent material)
- Clear area
- Summon Aid

Damage to Sealed Radioactive Source Holder

- Evacuate the immediate vicinity around the source holder
- Place a barrier at a safe distance from the source holder (min. 5 meters)
- Identify area as a radiation hazard
- Contact emergency number posted on local warning sign

Suggested Emergency Protective Equipment

- Gloves
- Footwear Covers
- Safety Glasses
- Outer layer or easily removed protective clothing (as situation requires)

This information was prepared by:

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Appendix D to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

Radiation Hazard of Agilent Technologies ECD Cell excepted packages prepared for shipment under the provisions of §173.421, §173.424, §173.426, or §173.428 must be certified as being acceptable for transportation by having a notice enclosed in or on the package, included with the packing list, or otherwise forwarded with the package. This notice must include the name of the consignor or consignee and one of the following statements, as appropriate:

(1) "This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910";

(2) "This package conforms to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910";

(3) "This package conforms to the conditions and limitations specified in 49 CFR 173.426 for radioactive material, excepted package-articles manufactured from natural or depleted uranium, or natural thorium, UN2910"; or

(4) "This package conforms to the conditions and limitations specified in 49 CFR 173.428 for radioactive material, excepted package-empty package, UN2910."

(b) An excepted package of Class 7 (radioactive) material that is classed as Class 7 and is prepared for shipment under the provisions of §173.421, §173.423, §173.424, §173.426, or §173.428 is not subject to the requirements of this subchapter, except for—

(1) Sections 171.15, 171.16, 174.750 and 176.710 of this subchapter, pertaining to the reporting of incidents and decontamination, when transported by a mode other than air;

(2) Sections 171.15, 171.16, and 175.700(b) of this subchapter pertaining to the reporting of incidents and decontamination when transported by aircraft; and

(3) The training requirements of subpart H of part 172 of this subchapter and, for materials that meet the definition of a hazardous substance or a hazardous waste, the shipping paper requirements of subpart C of part 172 of this subchapter.

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173–244, 61 FR 20751, May 8, 1996; 62 FR 51561, Oct. 1, 1997; 63 FR 52849, Oct. 1, 1998]

§ 173.423 Requirements for multiple hazard limited quantity Class 7 (radioactive) materials.

(a) Except as provided in §173.4, when a limited quantity radioactive material meets the definition of another hazard class or division, it must be—

(1) Classed for the additional hazard;

(2) Packaged to conform with the requirements specified in §173.421(a)(1) through (a)(5) or §173.424(a) through (g), as appropriate; and

(3) Offered for transportation in accordance with the requirements applicable to the hazard for which it is classed.

(b) A limited quantity Class 7 (radioactive) material which is classed other than Class 7 in accordance with this subchapter is excepted from the requirements of §§173.422(a), 172.203(d), and 172.204(c)(4) of this subchapter if the entry "Limited quantity radioactive material" appears on the shipping paper in association with the basic description.

§ 173.424 Excepted packages for radioactive instruments and articles.

A radioactive instrument or article and its packaging is excepted from the specification packaging, shipping paper and certification, marking and labeling requirements of this subchapter and requirements of this subpart, if:

(a) Each package meets the general design requirements of §173.410;

(b) The activity of the instrument or article does not exceed the relevant limit listed in table 7 in §173.425;

(c) The total activity per package does not exceed the relevant limit listed in table 7 in §173.425;

(d) The radiation level at 10 cm (4 in) from any point on the external surface of any unpackaged instrument or article does not exceed 0.1 mSv/hour (10 mrem/hour);

(e) The radiation level at any point on the external surface of a package

Appendix E to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

49 CFR 173.424 Excepted packages for radioactive instruments and articles.

bearing the article or instrument does not exceed 0.005 mSv/hour (0.5 mrem/hour), or, for exclusive use domestic shipments, 0.02 mSv (2 mrem/hour);

(f) The nonfixed (removable) radioactive surface contamination on the external surface of the package does not exceed the limits specified in § 173.443(a);

(g) Except as provided in § 173.426, the package does not contain more than 15 grams of uranium-235; and

(h) The package is otherwise prepared for shipment as specified in § 173.422.

§ 173.425 Table of activity limits—excepted quantities and articles.

The limits applicable to instruments, articles, and limited quantities subject to exceptions under §§ 173.421 and 173.424 are set forth in table 7 as follows:

TABLE 7—ACTIVITY LIMITS FOR LIMITED QUANTITIES, INSTRUMENTS, AND ARTICLES

Nature of contents	Instruments and articles		Limited quantity package limits [1]
	Limits for each instrument or article [1]	Package limits [1]	
Solids:			
Special form	10^{-2} A_1	A_1	10^{-3} A_1
Normal form	10^{-2} A_2	A_2	10^{-3} A_2
Liquids:			
Tritiated water:			
<0.0037 TBq/L (0.1 Ci/L)			37 TBq (1,000 Ci)
0.0037 TBq to 0.037 TBq/L (0.1 Ci to 1.0 Ci/L).			3.7 TBq (100 Ci)
>0.037 TBq/L (1.0 Ci/L)			0.037 TBq (1.0 Ci)
Other Liquids	10^{-3} A_2	10^{-1} A_2	10^{-4} A_2
Gases:			
Tritium [2]	2×10^{-2} A_2	2×10^{-1} A_2	2×10^{-2} A_2
Special form	10^{-3} A_1	10^{-2} A_1	10^{-3} A_1
Normal form	10^{-3} A_2	10^{-2} A_2	10^{-3} A_2

[1] For mixtures of radionuclides see § 173.433(d).

[2] These values also apply to tritium in activated luminous paint and tritium adsorbed on solid carriers.

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173–244, 61 FR 20751, May 8, 1996; 63 FR 52849, Oct. 1, 1998; 65 FR 58630, Sept. 29, 2000; 66 FR 45383, Aug. 28, 2001]

§ 173.426 Excepted packages for articles containing natural uranium or thorium.

A manufactured article in which the sole Class 7 (radioactive) material content is natural or unirradiated depleted uranium or natural thorium and its packaging is excepted from the specification packaging, shipping paper and certification, marking, and labeling requirements of this subchapter and requirements of this subpart if:

(a) Each package meets the general design requirements of § 173.410;

(b) The outer surface of the uranium or thorium is enclosed in an inactive sheath made of metal or other durable protective material;

(c) The conditions specified in § 173.421(a) (2), (3) and (4) are met; and

(d) The article is otherwise prepared for shipment as specified in § 173.422.

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended by Amdt. 173–244, 61 FR 20752, May 8, 1996]

§ 173.427 Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO).

(a) In addition to other applicable requirements specified in this subchapter, low specific activity (LSA) materials and surface contaminated objects (SCO), unless excepted by paragraph (d) of this section, must be packaged in accordance with paragraph (b) or (c) of this section and must be transported in accordance with the following conditions:

(1) The external dose rate must not exceed an external radiation level of 10 mSv/h (1 rem/h) at 3 m from the unshielded material;

(2) The quantity of LSA and SCO material in any single conveyance must

Appendix F to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

Additional requirements for excepted packages containing Class 7 (radioactive) materials.

(1) Before initial filling and during periodic inspection and test, packagings must be cleaned in accordance with American National Standard N14.1.

(2) Packagings must be designed, fabricated, inspected, tested and marked in accordance with—

(i) American National Standard N14.1 (2001, 1995, 1990, 1987, 1982, 1971) (incorporated by reference, see § 171.7 of this subchapter) in effect at the time the packaging was manufactured;

(ii) Specifications for Class DOT–106A multi-unit tank car tanks (§§ 179.300 and 179.301 of this subchapter); or

(iii) Section VIII, Division I of the ASME Code (incorporated by reference, see § 171.7 of this subchapter), provided the packaging —

(A) Was manufactured on or before June 30, 1987;

(B) Conforms to the edition of the ASME Code in effect at the time the packaging was manufactured;

(C) Is used within its original design limitations; and

(D) Has shell and head thicknesses that have not decreased below the minimum value specified in the following table:

Packaging model	Minimum thickness; millimeters (inches)
1S, 2S	1.58 (0.062)
5A, 5B, 8A	3.17 (0.125)
12A, 12B	4.76 (0.187)
30B	7.93 (0.312)
48A, F, X, and Y	12.70 (0.500)
48T, O, OM, OM Allied, HX, H, AND G.	6.35 (0.250)

(3) Uranium hexafluoride must be in solid form.

(4) The volume of solid uranium hexafluoride, except solid depleted uranium hexafluoride, at 20 °C (68 °F) may not exceed 61% of the certified volumetric capacity of the packaging. The volume of solid depleted uranium hexafluoride at 20 °C (68 °F) may not exceed 62% of the certified volumetric capacity of the packaging.

(5) The pressure in the package at 20 °C (68 °F) must be less than 101.3 kPa (14.8 psia).

(b) Packagings for uranium hexafluoride must be periodically inspected, tested, marked and otherwise conform with the latest incorporated edition of ANSI N14.1 (incorporated by reference, *see* § 171.7 of this subchapter).

(c) Each repair to a packaging for uranium hexafluoride must be performed in accordance with the latest incorporated edition of ANSI N14.1 (incorporated by reference, see § 171.7 of this subchapter).

[Amdt. 173–244, 60 FR 50307, Sept. 28, 1995, as amended at 67 FR 61014, Sept. 27, 2002]

§ 173.421 Excepted packages for limited quantities of Class 7 (radioactive) materials.

(a) A Class 7 (radioactive) material whose activity per package does not exceed the limits specified in § 173.425 and its packaging are excepted from the specification packaging, marking, labeling and, if not a hazardous substance or hazardous waste, the shipping paper and certification requirements of this subchapter and requirements of this subpart if:

(1) Each package meets the general design requirements of § 173.410;

(2) The radiation level at any point on the external surface of the package does not exceed 0.005 mSv/hour (0.5 mrem/ hour);

(3) The nonfixed (removable) radioactive surface contamination on the external surface of the package does not exceed the limits specified in § 173.443(a);

(4) The outside of the inner packaging or, if there is no inner packaging, the outside of the packaging itself bears the marking "Radioactive";

(5) Except as provided in § 173.426, the package does not contain more than 15 grams of uranium-235; and

(6) The material is otherwise prepared for shipment as specified in accordance with § 173.422.

(b) A limited quantity of Class 7 (radioactive) material that is a hazardous substance or a hazardous waste, is not subject to the provisions in § 172.203(d) or § 172.204(c)(4) of this subchapter.

§ 173.422 Additional requirements for excepted packages containing Class 7 (radioactive) materials.

(a) Except for materials subject to the shipping paper requirements of subpart C of part 172 of this subchapter,

Appendix G to NOAA/ESRL Safety Basis for Custom Radioactive ECD Ovens

Powerpoint training for ECD safety.

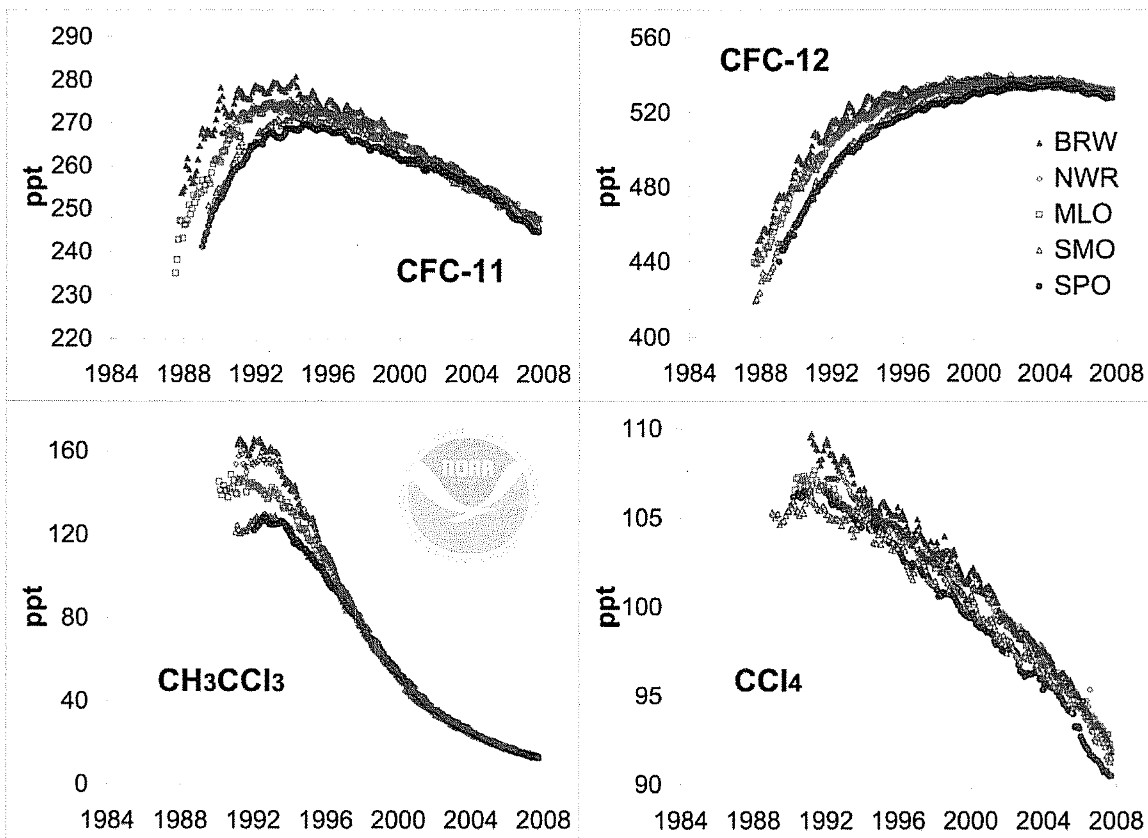
Safety Of Radioactive Electron Capture Detectors (ECDs)

James W. Elkins, NOAA/ESRL
Contact information: 1 303 497 6224; E-mail: james.w.elkins@noaa.gov

Version 1.2, December 10, 2008

Why do we use ECDs?

Answer: NOAA has reporting responsibility to Congress for the U.S. Clean Air Act for compounds regulated by the Montreal Protocol (and it works).



Radiation 101

- Radioactive radiation is everywhere. Colorado has one of the highest backgrounds in the USA, >120 millirems per year (mrems/yr), because of our uranium mines, granite rocks, and high altitude enhancement of cosmic rays.
- We get an additional 40 mrems/yr from food and 200 mrems/yr from radon in air. Medical exposure is another 40-70 mrems/yr. US average total yearly exposure is about 360 mrems/yr, but Colorado is 420 mrems/yr. An opened 15 mCi ECD source yields 6 mrems/yr if you are 6 inches away from it. A sealed source yields µrems/yr.
- OSHA threshold = 100mrems/hr, serious blood problems occur >10,000 mrems/hr, with serious injury or death at >450000 mrems/hr.

Electron Capture Detectors (ECDs)

- Are in one the most commonly used analytical instrument, the Electron Capture Detector Gas Chromatograph (ECD-GC); NOAA/ESRL has over 140 ECDs.
- ECD uses Nickel-63 isotope on a platinum foil, emits high velocity electrons.
- Half Life of Nickel-63=92-101 years
- Radiation depends on manufacturer, 5-15 millicuries

Units of radioactivity: Source and Human Exposure Terms

- Source: 1 Ci = 3.7E10 Bq or electrons emitted per second.
- Smoke detector has a strength of 1 microcurie.
- ECDs (5-20 millicuries) are 5,000-20,000 times more radioactive than a smoke detector. But, it is sealed, but never open an ECD.
- Human exposure: 1 smoke detector exposure for a year is 0.008 mrems where rem = roentgen equivalent for man and roentgen = ergs (energy) of x-ray radiation per gram of tissue. ECDs are wiped tested for leaking radiation once every 6 months; if it passes the wipe test, the ECD has a leak of less < 0.005 microcurie. So, 1 ECD exposure for a year is 200 times safer than the total source of a smoke detector.

Major Types of radioactive radiation

- Alpha (fast moving Helium nucleus, 2 protons/ 2 neutrons), exposure can be serious because of mass (4 amu), stopped by single sheet of paper. Twenty times more dangerous for human exposure.
- Beta (fast moving electrons with 0 amu), ECD radioactivity with 67 keV energy is converted into harmless thermal electron by 10-16 inches of air or one sheet of aluminum foil.
- Gamma (high frequency radiation), X-rays, most serious, stopped by thick lead sheets.

How does the ECD work in a GC?

What is a Gas Chromatograph?

Separation and Detection (Electron Capture Detector, ECD) of Unknowns (one channel)

GC ECD

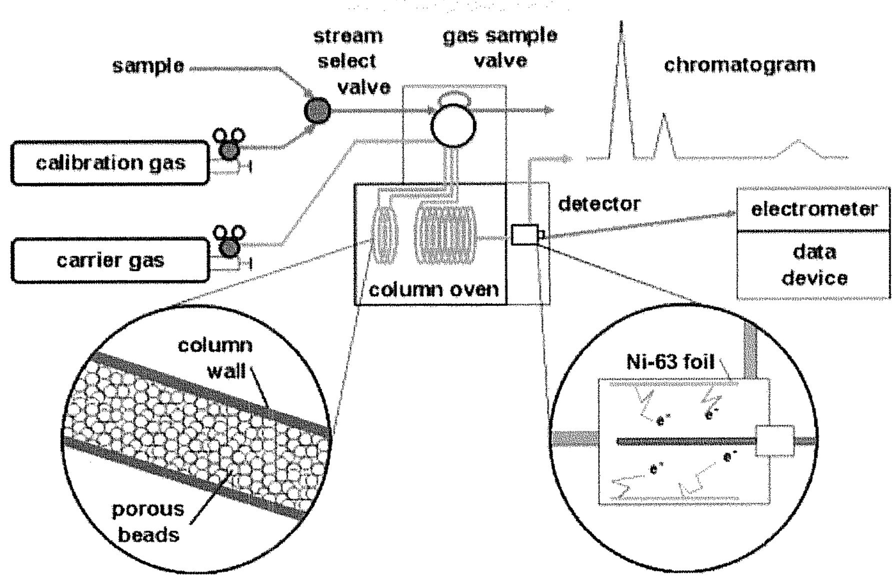
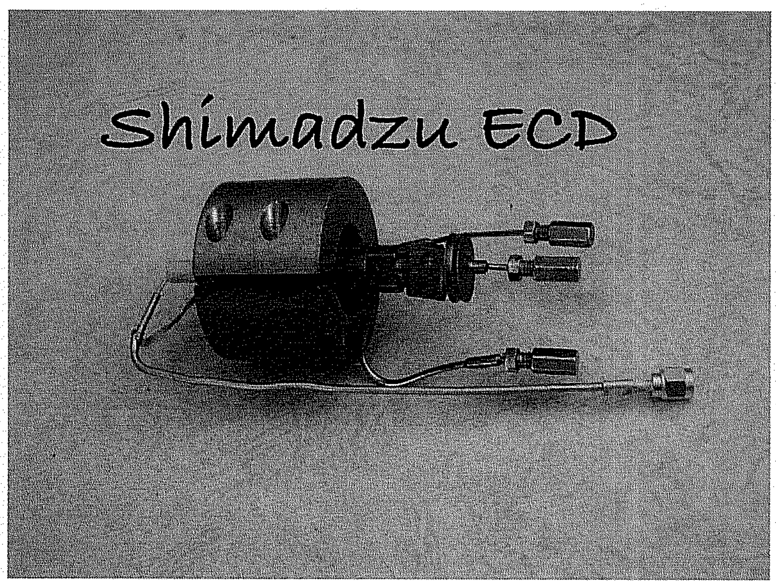
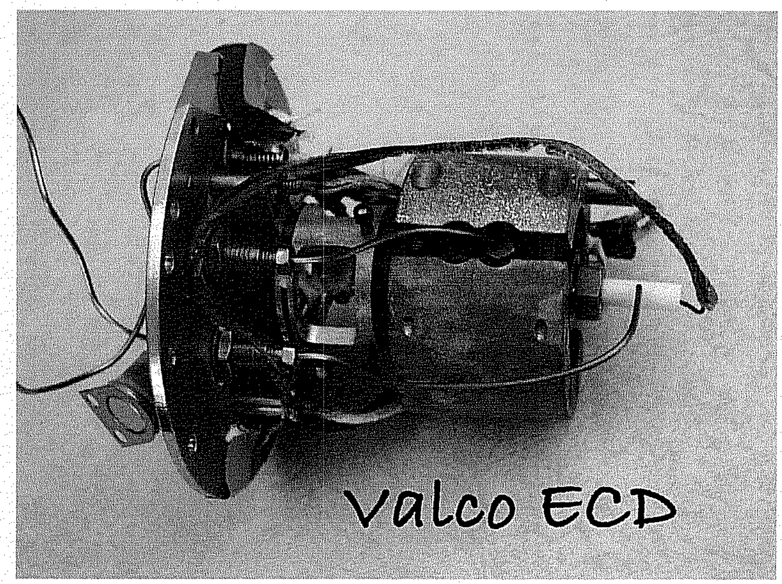


Diagram courtesy of Thayne Thompson

Typical ECD cells (~1” diameter, 1” long)

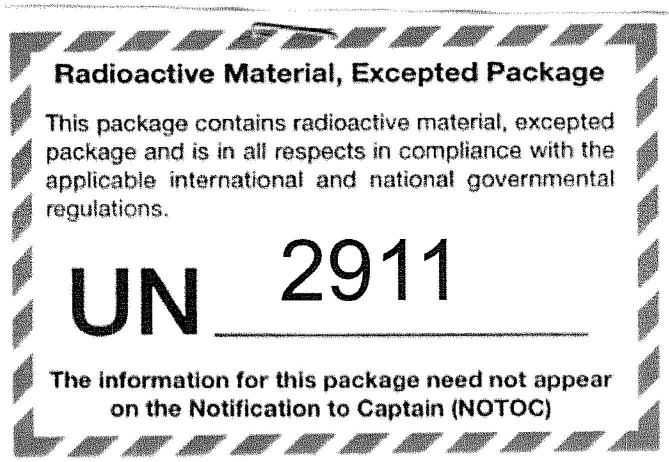




Station staff: Wipe tests must be done every 6 months on working ECDs. Wipe tests are done before shipping and after shipment to final destination. The test sheets should be wiped on the exhaust port on the outside of the can or ECD. Unused ECDs are stored in a locked cabinet in David Skaggs Research Center in Boulder, CO.

New Air Freight Shipping Labels Required for the Outside of the Box

New shipping labels for ECDs are required by US Department of Transportation (US DOT) and other international organizations. Use UN 2911 for ECDs. Contact Jim Elkins for stickers.



Summary

- ECDs are sealed radioactive sources with little or no danger to you and the public. They are wipe tested for radioactivity twice a year, before shipment, and after arrival.
- If in doubt on any radioactive issue, contact your Radiation Safety Official (NOAA/Rhonda Carpenter, 303 497-3912).
- Never ever throw a radioactive source away in the trash, contact your RSO immediately for proper deposal.
- If an ECD cell is breached (smashed by heavy object), then don't touch it and tape off area. Call your RSO immediately. Never open the sealed source up, it is dangerous.
- New shipping label is required for air freight, contact the NOAA Certified Hazardous Material Traffic Manager (George Angel, 303 497-3670).

Enclosure 3

Inventory of Electron Capture Detectors, Gas Chromatographs, and Mass Spectrometers containing radioactive material under license excluding Polonium-210

NOAA ESRL
Earth Systems Research Laboratory
Source Inventory - Global Monitoring Division
NRC License 05-11997-01

	Facility	Room #	ECD Manufaturer	GC Model	ECD Model	ECD Extra Info	GC Serial #	Detector Serial #	Radionuclide	Activity mCi	Maximium Temp	Operational Temp	Operational Status	Security Method
1	DSRC	1D704	Valco Instrument Co	Custom GC	140BN		Custom GC	N603-255.05	Ni-63	5	400	330	In Use	Locked Room
2			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1071B	Ni-63	10	350	330	In Use	Locked Room
3			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1078	Ni-63	10	350	330	In Use	Locked Room
4			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1073	Ni-63	10	350	310	In Use	Locked Room
5	DSRC	1D709	Hewitt Packard/Agilent Technologies	6890	G1530A	option 231	US00020367	K4410	Ni-63	15	400	340	In Use	Locked Room
6	DSRC	2D704A	Hewitt Packard/Agilent Technologies	6890N	G1540N	option 231	US10326037	U5701	Ni-63	15	400	N/A	Storage in GC	Locked Room
7	DSRC	2D602	Hewitt Packard/Agilent Technologies	5890II	19235		3020A29919	M1844	Ni-63	15	400	350	In Use	Locked Room
8			Hewitt Packard/Agilent Technologies	5890II	19235		3020A29919	M1950	Ni-63	15	400	350	In Use	Locked Room
9			Shimadzu Corp	GC-8A	ECD-8		42374	500304-SS561	Ni-63	10	350	350	In Use	Locked Room
10			Hewitt Packard/Agilent Technologies	5890II	G1533		3033A31981	K5636	Ni-63	15	400	350	In Use	Locked Room
11			Hewitt Packard/Agilent Technologies	5890II	G1533		3033A31981	YA838	Ni-63	13	400	350	In Use	Locked Room
12	DSRC	2D604	Hewitt Packard/Agilent Technologies	6890A	G1530A	option 231	US00043604	U3289	Ni-63	15	400	N/A	Storage in GC	Locked Room
13			Hewitt Packard/Agilent Technologies	6890A	G1530A	option 231	US00043604	U4608	Ni-63	15	400	N/A	Storage in GC	Locked Room
14			Shimadzu Corp	Mini-2E	ECD-2	Mini-2E	10019A	SS382	Ni-63	10	350	N/A	Storage in GC	Locked Room
15			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS923	Ni-63	10	350	N/A	Storage in GC	Locked Room
16			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1074	Ni-63	10	350	N/A	Storage in GC	Locked Room
17			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1080	Ni-63	10	350	N/A	Storage in GC	Locked Room
18			Valco Instrument Co	Custom GC	140BN		Custom GC	N583-251.33	Ni-63	5	400	N/A	Storage in GC	Locked Room
19	DSRC	2D605	Hewitt Packard/Agilent Technologies	6890A	G1530A	option 231	US00002265	K1937	Ni-63	15	400	350	In Use	Locked Room
20			Hewitt Packard/Agilent Technologies	6890A	G1530A	option 231	US00024677	K4994	Ni-63	15	400	350	In Use	Locked Room
21			Hewitt Packard/Agilent Technologies	6890N	G1540N	option 231	US10326011	U5698	Ni-63	15	400	N/A	Storage in GC	Locked Room
22			Hewitt Packard/Agilent Technologies	7890A	G3440A	option 130	US10834027	U14040	Ni-63	15	400	N/A	Storage in GC	Locked Room
23	DSRC	GA504	Valco Instrument Co	Custom GC	140BN		Custom GC	N719-15.22	Ni-63	5	400	N/A	Intermittant Use	Locked Room
24			Valco Instrument Co	Custom GC	140BN		Custom GC	N568-251.12	Ni-63	5	400	N/A	Intermittant Use	Locked Room
25			Valco Instrument Co	Custom GC	140BN		Custom GC	N592-251.41	Ni-63	5	400	N/A	Intermittant Use	Locked Room
26			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS951	Ni-63	10	350	N/A	Intermittant Use	Locked Room
27	DSRC	2D608	Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1217	Ni-63	10	350	350	Intermittant Use	Locked Room
28			Valco Instrument Co	Custom GC	140BN		Custom GC	T1217	Ni-63	5	400	350	Intermittant Use	Locked Room
29	DSRC	GA504	Hewitt Packard/Agilent Technologies	Custom GC	G1533	60550	Custom GC	K5403	Ni-63	15	400	50	Intermittant Use	Locked Room
30			Hewitt Packard/Agilent Technologies	Custom GC	G1533	60550	Custom GC	K5404	Ni-63	15	400	N/A	Intermittant Use	Locked Room
31			Valco Instrument Co	Custom GC	140BN		Custom GC	N440-279.28	Ni-63	5	400	N/A	Intermittant Use	Locked Room
32			Valco Instrument Co	Custom GC	140BN		Custom GC	N586-251.34	Ni-63	5	400	N/A	Intermittant Use	Locked Room
33			Valco Instrument Co	Custom GC	140BN		Custom GC	N745-15.43	Ni-63	5	400	350	Intermittant Use	Locked Room
34			Valco Instrument Co	Custom GC	140BN		Custom GC	N749-15.44	Ni-63	5	400	N/A	Intermittant Use	Locked Room
35			Valco Instrument Co	Custom GC	140BN		Custom GC	N775-15.91	Ni-63	5	400	350	Intermittant Use	Locked Room
36			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1037	Ni-63	10	350	350	Intermittant Use	Locked Room
37			Hewitt Packard/Agilent Technologies	5890	19235		2518A05470	L1006	Ni-63	15	400	N/A	Storage in GC	Locked Room
38			Hewitt Packard/Agilent Technologies	5890	G1533		2518A05470	L4288	Ni-63	15	400	N/A	Storage in GC	Locked Room
39	DSRC	GA503	Hewitt Packard/Agilent Technologies	5890	19235		2518A05468	L0991	Ni-63	15	400	N/A	Storage in GC	Locked Cabinet
40			Hewitt Packard/Agilent Technologies	5890	19235		2518A05468	L0995	Ni-63	15	400	N/A	Storage in GC	Locked Cabinet
41			Shimadzu Corp	GC-8A	ECD-8		43325-mlo	500248-SS422	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
42			Shimadzu Corp	GC-8A	ECD-8		76547	SS482	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
43			Shimadzu Corp	GC-9A	ECD-9		77958	SS515	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
44			Shimadzu Corp	Mini-2E	ECD-2	Mini-2E	60049-spo	SS604	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
45			Shimadzu Corp	GC-9A	ECD-9		77958	604201-SS836	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
46			Shimadzu Corp	Mini-2E	ECD-2	Mini-2E	30082A-spo	SS900	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
47			Hewitt Packard/Agilent Technologies		G2397	65505	detector	U4925	Ni-63	15	400	N/A	Storage in GC	Locked Cabinet
48			Hewitt Packard/Agilent Technologies		G2397	65505	detector	U4926	Ni-63	15	400	N/A	Storage in GC	Locked Cabinet
49			Shimadzu Corp	Mini-2E	ECD-2	Mini-2E	detector	SS942	Ni-63	10	350	N/A	Storage in GC	Locked Cabinet
50	DSRC	RD124	Valco Instrument Co		140BN		detector	N841-15.168	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
51		(Storage)	Shimadzu Corp		ECD-2	Mini-2E	detector	SS941	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
52			Valco Instrument Co		140BN		detector	251.08	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
53			Shimadzu Corp		ECD-8		87524	500217-SS410	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
54			Shimadzu Corp		ECD-8		65462-nwr	500218-SS413	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
55			Shimadzu Corp		ECD-8		65456	500221-SS423	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
56			Shimadzu Corp		ECD-8		43143-smo	500225-SS420	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
57			Shimadzu Corp		ECD-2	Mini-2E	detector	601828-SS607	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
58							detector	H0714	Ni-63	15	400	N/A	Storage detector only	Locked Cabinet
59			Hewitt Packard/Agilent Technologies		19235	69536	detector	K6387	Ni-63	10	400	N/A	Storage detector only	Locked Cabinet
60			Hewitt Packard/Agilent Technologies		19235	69536	detector	K6417	Ni-63	10	400	N/A	Storage detector only	Locked Cabinet
61			Hewitt Packard/Agilent Technologies		19235		2518A05471-smo	L0996	Ni-63	15	400	N/A	Storage detector only	Locked Cabinet

NOAA ESRL
Earth Systems Research Laboratory
Source Inventory - Global Monitoring Division
NRC License 05-11997-01

	Facility	Room #	ECD Manufaturer	GC Model	ECD Model	ECD Extra Info	GC Serial #	Detector Serial #	Radionuclide	Activity mCi	Maximium Temp	Operational Temp	Operational Status	Security Method
62			Valco Instrument Co		140BN		detector	N364-258.19	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
63			Valco Instrument Co		140BN		detector	N419-7507.3	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
64			Valco Instrument Co		140BN		detector	N493-300.37	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
65			Valco Instrument Co		140BN		detector	N494-300.38	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
66			Valco Instrument Co		140BN		cats-std	N720-15.21	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
67			Valco Instrument Co		140BN		detector	N759-15.68	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
68			Valco Instrument Co		140BN		detector	N774-15.9	Ni-63	5	400	N/A	Storage detector only	Locked Cabinet
69			Shimadzu Corp		ECD-2	Mini-2E	detector	SS103	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
70			Shimadzu Corp		ECD-8		detector	SS1038	Ni-63	5	350	N/A	Storage detector only	Locked Cabinet
71			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1039	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
72			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1040	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
73			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1071	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
74			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1072	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
75			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1077	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
76			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1079	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
77			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1083	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
78			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1084	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
79			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1085	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
80			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1087	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
81			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1102	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
82			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1216	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
83			Shimadzu Corp		ECD-2	Mini-2E	detector	SS204	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
84			Shimadzu Corp		ECD-8		detector	SS376	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
85			Shimadzu Corp		ECD-9		detector	SS514	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
86			Shimadzu Corp		ECD-2	Mini-2E	detector	SS830	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
87			Shimadzu Corp		ECD-2	Mini-2E	detector	SS847	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
88			Shimadzu Corp		ECD-2	Mini-2E	detector	SS848	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
89			Shimadzu Corp		ECD-2	Mini-2E	detector	SS949	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
90			Shimadzu Corp		ECD-2	Mini-2E	detector	SS950	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
91			Shimadzu Corp		ECD-2	Mini-2E	detector	SS952	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
92			Shimadzu Corp		ECD-2	Mini-2E	detector	SS953	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
93			Shimadzu Corp		ECD-2	Mini-2E	detector	SS954	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
94			Shimadzu Corp		ECD-2	Mini-2E	detector	SS955	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
95			Shimadzu Corp		ECD-2	Mini-2E	detector	SS956	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
96			Shimadzu Corp		ECD-2	Mini-2E	detector	SS959	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
97			Shimadzu Corp		ECD-2	Mini-2E	detector	SS960	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
98			Shimadzu Corp		ECD-8		detector	SS961	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
99			Shimadzu Corp		ECD-2	Mini-2E	detector	SS963	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
100			Hewitt Packard/Agilent Technologies		G2397	65500	detector	U0049	Ni-63	10	400	N/A	Storage detector only	Locked Cabinet
101			Hewitt Packard/Agilent Technologies		G2397	65505	detector	U1574	Ni-63	15	400	N/A	Storage detector only	Locked Cabinet
102			Valco Instrument Co		140BN		detector	N566-251.11	Ni-63	5	400	N/A	Intermittant Use	Locked Cabinet
103			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1070	Ni-63	10	350	N/A	Intermittant Use	Locked Cabinet
104			Shimadzu Corp		ECD-2	Mini-2E	detector	SS1075	Ni-63	10	350	N/A	Storage detector only	Locked Cabinet
	City	State/Country												
105	Barrow	AK	Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1089	Ni-63	10	350	265	In Use	
106			Valco Instrument Co	Custom GC	140BN		Custom GC	N565-251.10	Ni-63	5	400	350	In Use	
107			Valco Instrument Co	Custom GC	140BN		Custom GC	N726-15.19	Ni-63	5	400	350	In Use	
108			Valco Instrument Co	Custom GC	140BN		Custom GC	N736-15.34	Ni-63	5	400	350	In Use	
109	Cape Matatula	Am. Samoa	Valco Instrument Co	Custom GC	140BN		Custom GC	N758-15.66	Ni-63	5	400	350	In Use	
110			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1076	Ni-63	10	350	350	In Use	
111			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1082	Ni-63	10	350	350	In Use	
112			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1086	Ni-63	10	350	265	In Use	
113	Mauna Loa	HI	Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1081	Ni-63	10	350	350	In Use	
114			Valco Instrument Co	Custom GC	140BN		Custom GC	N730-15.23	Ni-63	5	400	350	In Use	
115			Valco Instrument Co	Custom GC	140BN		Custom GC	N739-271.45	Ni-63	5	400	350	In Use	
116			Valco Instrument Co	Custom GC	140BN		Custom GC	N755-15.49	Ni-63	5	400	265	In Use	
117	Niwot Ridge	CO	Valco Instrument Co	Custom GC	140BN		Custom GC	N834-15.0275	Ni-63	5	400	350	In Use	
118			Valco Instrument Co	Custom GC	140BN		Custom GC	N597-251.46	Ni-63	5	400	350	In Use	
119			Valco Instrument Co	Custom GC	140BN		Custom GC	N850-15.0276	Ni-63	5	400	350	In Use	
120			Valco Instrument Co	Custom GC	140BN		Custom GC	N926-15.0289	Ni-63	5	400	265	In Use	
121	South Pole *	Antarctica *	Valco Instrument Co	Custom GC	140BN		Custom GC	N439-279.27	Ni-63	5	400	350	In Use	
122			Valco Instrument Co	Custom GC	140BN		Custom GC	N756-15.50	Ni-63	5	400	350	In Use	
123			Valco Instrument Co	Custom GC	140BN		Custom GC	N757-15.65	Ni-63	5	400	350	In Use	
124			Valco Instrument Co	Custom GC	140BN		Custom GC	N760-15.69	Ni-63	5	400	265	In Use	
125	Summit	Greenland	Valco Instrument Co	Custom GC	140BN		Custom GC	N492-300.36	Ni-63	5	400	335	In Use	
126			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1105	Ni-63	10	350	340	In Use	

NOAA ESRL
Earth Systems Research Laboratory
Source Inventory - Global Monitoring Division
NRC License 05-11997-01

	Facility	Room #	ECD Manufaturer	GC Model	ECD Model	ECD Extra Info	GC Serial #	Detector Serial #	Radionuclide	Activity mCi	Maximium Temp	Operational Temp	Operational Status	Security Method
127			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS1036	Ni-63	10	350	350	In Use	
128			Shimadzu Corp	Custom GC	ECD-2	Mini-2E	Custom GC	SS962	Ni-63	10	350	350	In Use	
129	Brazil		Hewitt Packard/Agilent Technologies	6890	G1533	60550	US00027040	K4858	Ni-63	15	400		In Use	
	Reported to NRC as missing		Hewitt Packard/Agilent Technologies	HP5890	19235	Micro ECD	2518A05469	L1231	Ni-63	15	400			
			Hewitt Packard/Agilent Technologies	HP5890	19235	Micro ECD	2518A05469	L1941	Ni-63	15	400			
			Hewitt Packard/Agilent Technologies	HP5890II	19235	Micro ECD	2518A05471	M2087	Ni-63	15	400			
	SS289 officially removed from list 198[illegible]		Shimadzu Corp	Mini-2E	ECD-2	Mini-2E	20038A-spo	SS289	Ni-63	10	350			

This is to certify the above sources are present and sccounted for.

DATE: 18 November 2008 NAME: Michael O'Neill

** Detectors are in an inactive status, so they were not wipe tested
* Logistics allow only testing once a year.

Catagories: In Use, Storage, Intermittant Use, Calibration/Testing

In Use - Currently Collecting Data
Intermittant Use - Field Mission specific operations causing varible operational status
Calibration/Testing - Occationally collecting data for instrument calibration

DSRC - David Skaggs Research Center
325 Broadway
Boulder, CO 80305
GC - Gas Chromatograph
ECD - Electron Capture Detector

Mailing addresses available upon request for all sites outside CONUS

NOAA ESRL
Earth Systems Research Laboratory
Source Inventory - Chemical Science Division
NRC License 05-11997-01

	Facility	Room #	ECD Manufaturer	GC Model	ECD Model	ECD Extra Info	GC Serial #	Detector Serial #	Radionuclide	Activity mCi	Maximium Temp	Operational Temp	Operational Status
1	DSRC	1A206	Shimadzu Corp	GC-14A	ECD-14			604205-SS837	Ni-63	10	400	40	In Storage
2		1A206	Shimadzu Corp	GC-14A	ECD-14			604988-SS935	Ni-63	10	400	40	In Storage
3		1A206	Bill Kuster - NOAA		custom			BK1	Ni-63	10	350	300	In Storage
4		1A206	Bill Kuster - NOAA		custom			BK2	Ni-63	10	350	300	In Storage
5		1A206	Bill Kuster - NOAA		custom			BK3	Ni-63	10	350	300	In Storage
6		1A206	Bill Kuster - NOAA		custom			BK4	Ni-63	15	350	300	In Storage
7		1A206	Valco Instrument Co		140BN			N443	Ni-63	5	400	40	In Storage
8		1A206	Valco Instrument Co		140BN			N578	Ni-63	5	400	40	In Storage
9		1A206	Shimadzu Corp	Mini-2E	ECD-2	AirPAN		SS1239	Ni-63	10	350	40	In Storage
10		1A206	Shimadzu Corp	Mini-2E	ECD-2			SS539	Ni-63	10	350	40	In Storage
11	China	Beijing	Shimadzu Corp	Mini-2E	ECD-2			GroundPAN	Ni-63	10	350	40	In Use
12	Portugal	Pico Island, Azores	Shimadzu Corp	Mini-2E	ECD-2			SS1104	Ni-63	10	350	40	In Use

This is to certify the above sources are present and sccounted for.

DATE: 13 November 2008 NAME: Ann Middlebrook

** Detectors are in an inactive status, so they were not wipe tested

Catagories: In Use, Storage, Intermittant Use, Calibration/Testing

In Use - Currently Collecting Data
Intermittant Use - Field Mission specific operations causing varible operational status
Calibration/Testing - Occationally collecting data for instrument calibration

DSRC - David Skaggs Research Center
325 Broadway
Boulder, CO 80305
GC - Gas Chromatograph
ECD - Electron Capture Detector

NOTE: #1-#6 to be disposed of.
#11 Beijing China - Peking University
#12 Pico Island, Azores Portugal. PICO-NARE Research Station

Address:

Departement of Environmental Sciences
College of Environmental Sciences
Peking University
Haidian District, Beijing 100871
China
Attn: Dr. Jianbo Zhang

Address:

PICO-NARE Research Station
Pico Island, Azores Portugal
Operated by:
Professor Paulo Fialho
Grupo de Química e Física da Atmosfera
Centro do Clma, Meteorologia e Mudanças Globais
IMAR - Instituto do Mar
Universidade dos Açores
PT9701-851 Terra Chá
Portugal

NOAA ARL
Air Resources Laboratory
Source Inventory - Idaho Falls, Idaho
NRC License 05-11997-01

	Facility	Room #	ECD Manufaturer	GC Model	ECD Model	ECD Extra Info	GC Serial #	Detector Serial #	Radionuclide	Activity mCi	Maximium Temp	Operational Temp	Operational Status
1	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	NA				21258	Hydrogen-3	200			In Storage
2	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-90-408				21259	Hydrogen-3	200			In Use
3	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-90-409				10252	Hydrogen-3	200			In Use
4	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-90-405				10959	Hydrogen-3	200			In Use
5	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-413				10256	Hydrogen-3	200			In Use
6	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-419				10251	Hydrogen-3	200			In Use
7	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-417				10253	Hydrogen-3	200			In Use
8	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-411				10250	Hydrogen-3	200			In Use
9	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-415				10257	Hydrogen-3	200			In Use
10	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-418				10958	Hydrogen-3	200			In Use
11	Idaho Falls, Idaho	GC Lab	ScienTech Inc.	TGA# ST-93-412				10255	Hydrogen-3	200			In Use
12	Idaho Falls, Idaho	GC Lab	ScienTech Inc.					21260	Hydrogen-3	200			In Storage
13	Idaho Falls, Idaho	GC Lab	ScienTech Inc.					10254	Hydrogen-3	200			In Storage
14	Idaho Falls, Idaho	GC Lab	Rydock					None	Hydrogen-3	200			In Storage
15	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N211	Nickel-63	5	400		In Use
16	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N207	Nickel-63	5	400		In Use
17	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N208	Nickel-63	5	400		In Storage
18	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N209	Nickel-63	5	400		In Use
19	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N210	Nickel-63	5	400		In Use
20	Idaho Falls, Idaho	GC Lab	VICI Valco Instruments Co. Inc.	Custom	140BN			N206	Nickel-63	5	400		In Storage
21	Idaho Falls, Idaho	GC Lab	Hewlett Packard		18713A			H2468	Nickel-63	15			In Storage
22	Idaho Falls, Idaho	GC Lab	Scientific Repair, Inc (SRI)		8690-0020, N-1001			E0146	Nickel-63	5			In Storage

This is to certify the above sources are present and sccounted for.

DATE: 13 November 2008 NAME: Roger Carter

** Detectors are in an inactive status, so they were not wipe tested

Catagories: In Use, Storage, Intermittant Use, Calibration/Testing

In Use - Currently Collecting Data
Intermittant Use - Field Mission specific operations causing varible operational status
Calibration/Testing - Occationally collecting data for instrument calibration

Idaho Falls - Air Resources Laboratory
Field Research Division
1750 Foote Drive
Idaho Falls, Idaho 83402
GC - Gas Chromatograph
ECD - Electron Capture Detector

Enclosure 4

A written report on an assessment of NOAA's compliance with 10 CRF 21.1801 and 10CRF 20.1802 and planned corrective actions where applicable.

A Report on Action 4 of the NRC CAL (4-08-003) dated November 12, 2008
Prepared by Russ Schnell, Mike O'Neill, Ann Middlebrook, and Roger Carter
December 10, 2008

NRC CAL Action 4: Within 30 days of the date of this letter, NOAA will submit to the NRC a written report of its assessment of compliance with 10 CFR 20.1801, "Security of stored material," and 10 CFR 20.1802, "Control of material not in storage," at its Idaho Falls, Idaho, field office and other locations, as applicable, within NRC's jurisdiction. For any items of noncompliance identified, the written report shall provide a description of the issue, as well as the actions taken or planned to restore compliance, including the schedule to correct the conditions.

Regulations Cited:

10 CFR 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.

10 CFR 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.

Issue for Both Regulations:

Authorized persons having access to the locations in Boulder are currently are the Radiation Safety Officer, the Global Monitoring Division (GMD) and Chemical Sciences Division (CSD) Area Safety Representatives, the Group Chief and employees of the HATS Group, the CSD Radiation Group, authorized GSA facilities personnel and the Directors of ESRL GMD and CSD or their authorized designates who have had the radiation safety training.

Personnel authorized to access licensed materials must be formally trained in radiation safety and security of these devices. Timeline: Radiation safety and security training began on December 9, 2008 and is anticipated to be completed for all personnel by January 31, 2009.

Assessment of Stored Material:

The only location with stored material that falls under the NRC Specific License (#05-11997-01) is the DSRC building at 325 Broadway, Boulder, CO 80305. The current inventory of all stored licensed materials at this location was physically checked on December 2, 2008. The inventory states there are 102 stored devices, 16 of which have intermittent use. On this date, all of these devices were secured either in a locked cabinet (55 devices in room RD124), a locked drawer (10 devices in room 1A206), 4 locked rooms (33 devices in rooms GA503, GA504, 2D604, and 2D704A), or 2 unlocked rooms with authorized personnel present (4 devices in rooms 2D605 and 2D608). Stored devices are permitted in unlocked rooms as long as they are under constant surveillance.

A full inventory review was performed at the Air Resources Laboratory Field Research Division in Idaho Falls, ID on November 18, 2008. ARL had a total of 22 devices at the time of inventory. Of that inventory 6 devices are stored in a locked metal cabinet in the gas chromatograph laboratory. Two devices were stored in instruments located in the locked gas chromatograph laboratory. On November 24, 2008, the two devices stored in instruments were picked up by Qal-Tek Associates for disposal leaving a total of 6 devices in storage and 14 in use.

The following steps to ensure security of the stored licensed materials have been instituted and/or planned for implementation:

1) The current storage locations for the licensed material in Boulder are locked and controlled by key access by authorized personnel. Timeline: Key-locked the doors to all rooms containing licensed material and posted signage to keep doors locked when unoccupied were completed November 12, 2008. Until stored material is placed into a new, secured storage location (see number 2 below), the current storage rooms are locked unless occupied by authorized personnel. Monitoring the security of these locked rooms is ongoing.
2) The future storage location for the GMD radioactive material will be a dedicated, secure storage room (GD424) soon to be accessible by keypad only. Access will be controlled by authorized issuance of keypad codes once the personnel have been trained, including incidental workers. Timeline: Keypad will be installed for room GD424 and all stored licensed material will be relocated there by December 23, 2008.
3) In Idaho Falls, the gas chromatograph laboratory is locked with a keypad entry and is kept locked unless someone is actively working in the lab. All personnel in the Idaho office had access to this lab via keypad and all have been appropriately trained on this equipment. Timeline: Keypad on the door was already in place November 12, 2008.

<u>Assessment of Material Not in Storage:</u>

There are 8 locations including field sites with material not in storage that fall under the NRC Specific License (#05-11997-01): the DSRC building at 325 Broadway, Boulder, CO 80305, Barrow (AK), Niwot Ridge (CO), Mauna Loa (HI), Cape Matatula (American Samoa), Summit (Greenland), Sao Paolo (Brazil), and the ARL Field Research Division in Idaho Falls (ID). Furthermore, there are times when this material is in temporary field locations including aboard aircraft and balloons. Since these devices are "In Use", they are installed in operating instruments as shown in the inventory. Note that the South Pole field site has 4 devices in use and is under the jurisdiction of NSF by a MOU from the NRC (FR Doc. 99–24058 Filed 9–14–99).

The current inventory of all licensed materials not in storage at DSRC was physically checked on December 2, 2008. The inventory states that 12 devices are in use. At the time of the audit, all of these devices were secured either in 2 locked rooms (5 devices in rooms 1D704 and 1D709) or 2 unlocked rooms with authorized personnel present (7 devices in rooms 2D602 and 2D605). There are also 16 devices with intermittent use at the DSRC, 2 of which are in the locked cabinet (room RD124) and the rest are in custom equipment that are deployed on aircraft or balloons for field studies (see section below on Material in Mobile Platforms). Devices in use or with intermittent use are permitted in unlocked rooms as long as they are under constant surveillance.

The 14 devices in use at the Air Resources Laboratory Field Research Division in Idaho Falls, ID are in instruments located in the locked gas chromatograph laboratory. As mentioned for the stored material there, all personnel in the Idaho office had access to this lab via keypad and all have been appropriately trained on this equipment. No additional action is required in the ARL facility in Idaho.

The field sites have a total of 21 devices in use: 4 in Barrow, 4 at Mauna Loa, 4 in American Samoa, 4 at Niwot Ridge, 4 in Greenland, and 1 in Brazil. Access to the field site in Greenland is controlled by aircraft containing only 3 personnel at a time. No additional action is required at that site.

The following steps to ensure security of the licensed materials not in storage have been instituted and/or planned for implementation:

1) The laboratories for licensed material currently in use in instruments in Boulder, Barrow, Mauna Loa, American Samoa, and Niwot Ridge are locked and controlled by key access by authorized personnel. Timeline: Key-locked the doors to all rooms containing licensed material and posted signage to keep doors locked when unoccupied were completed November 12, 2008. Until security methods are in place for individual detectors and instruments (see number 2 below), the current locations are locked unless occupied by authorized personnel. Monitoring the security of these locked rooms is ongoing.
2) Operating instruments containing licensed material in the above locations (see 1 above) will have the access panel to the licensed source locked with a padlock or PC cable lock and the instrument locked to a lab bench with an appropriate PC cable lock. Only authorized personnel will receive lock combinations. With these security upgrades in place it is planned that the laboratories with licensed sources will not require to be locked during normal working hours. Timeline: The PC cable locking will be completed by January 31, 2009.
3) When licensed material is exchanged in an instrument during repair or maintenance, the licensed material will immediately be put into the secure storage room (GD424). The radiation safety officer or his designate will be responsible for facilitating the move and storage. Timeline: This procedure will be implemented after the completion of the secured storage room on December 23, 2008.
4) The precise location and security of the device in Brazil are unknown. Timeline: Investigate the possibility of transferring this device to Brazilian colleagues by January 31, 2009.

Assessment of Material Not in Storage – Equipment Used on Mobile Platforms or During Shipment:

Additional procedures must be implemented to secure aircraft and balloon-borne licensed material when deployed at aircraft operation field sites or carried on aircraft and balloons.

Note: The fact that the instruments are enclosed in metal shells and bolted to racks or framing within the aircraft means that the sources are essentially "locked" in place. The time and effort required to remove licensed sources from an instrument mounted in a balloon or aircraft configuration would be substantial as it is difficult for even highly trained personnel to remove the instruments from the enclosures, racks or framing. These tasks typically take on the order of an hour for a pair of trained persons, and would take much longer for an untrained person.

Aircraft are kept locked when not staffed, and balloon packages are stored in locked facilities or guarded by security personnel. On balloon flights the instrument packages, which weigh about 1,000 lbs., have their location closely monitored in the air by GPS. The descending balloon package is followed by a light aircraft or helicopter and ground vehicles, and is under constant surveillance as the instruments package is recovered by the ground crews.

The following steps to ensure security of the licensed materials used on mobile platforms have been instituted and/or planned for implementation:

1) When instruments containing licensed sources are installed aboard aircraft and balloons, they shall be bolted in place by aircraft-rated machine screws and secured within an

aircraft rack or framing. The licensed sources within the instrument are contained inside metal heated zones ("cans") which are themselves bolted to the inner framing of the instrument. Timeline: Security aboard aircraft is already in place.

2) Instruments to be installed on aircraft or in balloon packages will be kept locked to a bench or table prior to installation and when removed from an aircraft or balloon installation. Engineering may be required to lock instruments to a temporary laboratory surface. Timeline: Some equipment is currently in the field. The target date for completion is July 1, 2009.
3) Aircraft or balloon instruments containing licensed material, when not in flight and not being attended to by authorized personnel, will have the instrument access panel that provides access to the licensed source secured with a locking device. These devices will need to be designed specifically for each instrument. These security devices will be removed prior to flight. Timeline: Some equipment is currently in the field. The target date for completion is July 1, 2009.

The following steps to ensure security of the licensed materials during shipment have been instituted and/or planned for implementation:

1) A hazardous material transportation certified and bonded shipper must be used. Timeline: Procedure will be implemented by January 31, 2009.
2) Until picked up by the shipper, the package containing the device must remain in a secured room with access by authorized personnel. Timeline: Procedure will be implemented by January 31, 2009.
3) If transported by NOAA personnel or contractor, this person must be trained in the required security and transportation of these devices. Timeline: Procedure will be implemented by January 31, 2009.

Enclosure 5

A written report on an assessment of NOAA's compliance with 10 CRF 20 Subpart J and planned corrective actions where applicable.

A Report on Action 5 of the NRC CAL (4-08-003) dated November 12, 2008
Prepared by Russ Schnell, Mike O'Neill, and Ann Middlebrook
December 10, 2008

NRC CAL Action 5: Within 30 days of the date of this letter, NOAA will submit to the NRC a written report of its assessment of compliance with radioactive labeling requirements, as specified in 10 CRF Part 20, Subpart J – Precautionary Procedures, at all locations where radioactive material is used or stored under this license. For any items of noncompliance identified, the written report shall provide a description of the issue, as well as the actions taken or planned to restore compliance, including the schedule to correct the conditions.

Regulations Cited:
10 CFR 20.1901 Caution signs
10 CFR 20.1902 Posting requirements
10 CFR 20.1903 Exceptions to posting requirements
10 CFR 20.1904 Labeling containers
10 CFR 20.1905 Exemptions to labeling requirements
10 CFR 20.1906 Procedures for receiving and opening packages

Appendix C to Part 20--Quantities of Licensed Material Requiring Labeling

Radionuclide	Abbreviation	Quantity (μCi)
Nickel-63	Ni-63	100

Assessment of Radioactive Posting Requirements:

10 CFR 20.1903(c) states, "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 from the surface of the source container or housing does not exceed 0.005 rem (0.05 mSv) per hour."

Issue: The licensed material possessed by NOAA does not exceed 0.005 rem in a single location. To be conservative, a sign will be posted on the secure storage room (GD424) when stored material is relocated there.

Timeline: A caution sign will be posted on the storage room by December 23, 2008.

Assessment of Radioactive Labeling Requirements:

Issue: Some of the licensed material contained in electron capture detectors (ECDs) are not labeled adequately or consistently.

NOAA will label all ECD sources that are not installed in heated zones with appropriate labels attached to the source. Sources that are installed in heated zones or cans will be labeled externally on the can or enclosure. Due to the difficulty in disassembling the heated zones or cans the contained sources will not be labeled until they require repair work performed in Boulder. In situations where a label constitutes a fire hazard, labels will consist of metal tags thin wired to the can. Both the source and cans will be labeled.

Each label will state:
A. Caution, Radioactive Material;
B. Shall contain the radiation symbol in black
C. Radionuclide; Manufacturer's estimated activity; Date of purchase;
D. ECD manufacturer's name, model number and serial number.

Timeline: The licensed sources in Boulder will be labeled by January 31, 2009. The field licensed sources by March 31, 2009. No action is required at the Idaho facility as all devices still retain the labels provided by the manufacturer.

Assessment of Procedures for Receiving and Opening Packages:

Issue: Procedures are written but not implemented for receiving and opening packages.

Timeline: Procedures will be implemented by January 31, 2009.