Cly to amend

FORM NRC-313 I (3-80) 10 CFR 30

U.S. NUCLEAR REGULATORY COMMISSION

APPLICATION FOR BYPRODUCT MATERIAL LICENSE
INDUSTRIAL

See attached instructions for details.

Completed applications are filed in duplicate with the Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety, and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555 or applications may be filed in person at the Commission's office at 1717 H Street, NW, Washington, D. C. or 7915 Eastern Avenue, Silver Spring, Maryland.

1. APPLICATION FOR: *(Check and/or complete as appropriate)*

~~30 - 1450~~ 7

X	a. NEW LICENSE
	b. AMENDMENT TO: LICENSE NUMBER 03120
	c. RENEWAL OF: LICENSE NUMBER L 08165

2. APPLICANT'S NAME *(Institution, firm, person, etc.)*

Tennessee Valley Authority
Division of Energy Demonstrations & Tech.

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

FTS 858-5681 (615) 751-5681

3. NAME AND TITLE OF PERSON TO BE CONTACTED REGARDING THIS APPLICATION

John B. Brellenthin Gary MacDonald

TELEPHONE NUMBER: AREA CODE – NUMBER EXTENSION

FTS 858-5681 (615) 751-5681

4. APPLICANT'S MAILING ADDRESS *(Include Zip Code)*
(Address to which NRC correspondence, notices, bulletins, etc., should be sent.)

1110 Chestnut Street Tower II
Chattanooga, TN 37401

5. STREET ADDRESS WHERE LICENSED MATERIAL WILL BE USED *(Include Zip Code)*

Paradise Steam Plant, Coal Washing Facility
Drakesboro, KY 42337

(IF MORE SPACE IS NEEDED FOR ANY ITEM, USE ADDITIONAL PROPERLY KEYED PAGES.)

6. INDIVIDUAL(S) WHO WILL USE OR DIRECTLY SUPERVISE THE USE OF LICENSED MATERIAL
(See Items 16 and 17 for required training and experience of each individual named below)

	FULL NAME	TITLE
a.	Dennis A. Humphris	Project Manager - Instrumentation
b.	Richard W. Lynch	Chemical Engineer
c.	Robert N. Campbell	Supervisor, Results Section Paradise Steam Plant

7. RADIATION PROTECTION OFFICER

R. B. Maxwell

Attach a resume of person's training and experience as outlined in Items 16 and 17 and describe his responsibilities under Item 15.

8. LICENSED MATERIAL

LINE NO.	A ELEMENT AND MASS NUMBER	B CHEMICAL AND/OR PHYSICAL FORM	C NAME OF MANUFACTURER AND MODEL NUMBER *(If Sealed Source)*	D MAXIMUM NUMBER OF MILLICURIES AND/OR SEALED SOURCES AND MAXIMUM ACTIVITY PER SOURCE WHICH WILL BE POSSESSED AT ANY ONE TIME
(1)	Californium - 252	Sealed Source	USDOE - Savannah River Model SRCL (190Z)	2 Sources not to exceed 330 Micrograms (177MCi)ea.
(2)	Cesium - 137	Sealed Source	Texas Nuclear Model 570-57157C	1 Source not to exceed 100 Millicuries
(3)	Cesium - 137	Sealed Source	Texas Nuclear Model 570-57157C	1 Source not to exceed 200 Millicuries

DESCRIBE USE OF LICENSED MATERIAL
E

(1)	To be used in a continuous nuclear analyzer of coal (CONAC), to measure total
(2)	elemental analysis of coal by prompt neutron activation. Also continuous level
(3)	gauge for monitoring coal level in feed hopper and nuclear belt weigh scale for
(4)	mass flow rate determination.

 39-19063

9. STORAGE OF SEALED SOURCES

LINE NO.	CONTAINER AND/OR DEVICE IN WHICH EACH SEALED SOURCE WILL BE STORED OR USED. A.	NAME OF MANUFACTURER B.	MODEL NUMBER C.
(1)	USDOE - Savannah River Model SRCL (190Z)	Science Applications, Inc.	Nuc. Analyzer
(2)	383296- (Level Guage) 12069	Texas Nuclear	5196
(3)	383233- (Belt Weigh Scale) 12069	Texas Nuclear	5034
(4)			

10. RADIATION DETECTION INSTRUMENTS

LINE NO.	TYPE OF INSTRUMENT A	MANUFACTURER'S NAME B	MODEL NUMBER C	NUMBER AVAILABLE D	RADIATION DETECTED (alpha, beta, gamma, neutron) E	SENSITIVITY RANGE (milliroentgens/hour or counts/minute) F
(1)	Neutron Rem Counter	Eberline	Pres-2p/NRD	1	Neutron	.01-10K Counts/Min
(2)	Alpha Scintillation	Eberline	Pcc -4s	2	Alpha	0-2,000,000 c/m
(3)	Geiger Counter	Ludlum Measurement,	Inc. Model 5	2	Gamma	0-2 R/hr.
(4)						

11. CALIBRATION OF INSTRUMENTS LISTED IN ITEM 10

☐ a. CALIBRATED BY SERVICE COMPANY

NAME, ADDRESS, AND FREQUENCY

☒ b. CALIBRATED BY APPLICANT

Attach a separate sheet describing method, frequency and standards used for calibrating instruments.

12. PERSONNEL MONITORING DEVICES

TYPE (Check and/or complete as appropriate.) A	SUPPLIER (Service Company) B	EXCHANGE FREQUENCY C
☐ (1) FILM BADGE ☒ (2) THERMOLUMINESCENCE DOSIMETER (TLD) ☐ (3) OTHER (Specify): _____	Tennessee Valley Authority Radiological Hygiene Branch River Oaks Building Muscle Shoals, Alabama 35660	☒ MONTHLY ☐ QUARTERLY ☐ OTHER (Specify): _____

13. FACILITIES AND EQUIPMENT (Check were appropriate and attach annotated sketch(es) and description(s).

- ☒ a. LABORATORY FACILITIES, PLANT FACILITIES, FUME HOODS (Include filtration, if any), ETC.
- ☒ b. STORAGE FACILITIES, CONTAINERS, SPECIAL SHIELDING (fixed and/or temporary), ETC.
- ☐ c. REMOTE HANDLING TOOLS OR EQUIPMENT, ETC.
- ☐ d. RESPIRATORY PROTECTIVE EQUIPMENT, ETC.

14. WASTE DISPOSAL

a. NAME OF COMMERCIAL WASTE DISPOSAL SERVICE EMPLOYED

N.A.

b. IF COMMERCIAL WASTE DISPOSAL SERVICE IS NOT EMPLOYED, SUBMIT A DETAILED DESCRIPTION OF METHODS WHICH WILL BE USED FOR DISPOSING OF RADIOACTIVE WASTES AND ESTIMATES OF THE TYPE AND AMOUNT OF ACTIVITY INVOLVED. IF THE APPLICATION IS FOR SEALED SOURCES AND DEVICES AND THEY WILL BE RETURNED TO THE MANUFACTURER, SO STATE.

Sealed sources - returned to manufacturer

INFORMATION REQUIRED FOR ITEMS 15, 16 AND 17

Describe in detail the information required for Items 15, 16 and 17. Begin each item on a separate page and key to the application as follows:

15. RADIATION PROTECTION PROGRAM. Describe the radiation protection program as appropriate for the material to be used including the duties and responsibilities of the Radiation Protection Officer, control measures, bioassay procedures *(if needed)*, day-to-day general safety instruction to be followed, etc. If the application is for sealed source's also submit leak testing procedures, or if leak testing will be performed using a leak test kit, specify manufacturer and model number of the leak test kit.

16. FORMAL TRAINING IN RADIATION SAFETY. Attach a resume for each individual named in Items 6 and 7. Describe individual's formal training in the following areas where applicable. Include the name of person or institution providing the training, duration of training, when training was received, etc.

    a. Principles and practices of radiation protection.

    b. Radioactivity measurement standardization and monitoring techniques and instruments.

    c. Mathematics and calculations basic to the use and measurement of radioactivity.

    d. Biological effects of radiation.

17. EXPERIENCE. Attach a resume for each individual named in Items 6 and 7. Describe individual's work experience with radiation, including where experience was obtained. Work experience or on-the-job training should be commensurate with the proposed use. Include list of radioisotopes and maximum activity of each used.

18. CERTIFICATE

(This item must be completed by applicant)

The applicant and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 30, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

WARNING.–18 U.S.C., Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

a. LICENSE FEE REQUIRED *(See Section 170.31, 10 CFR 170)* N.A.	b. CERTIFYING OFFICIAL *(Signature)* M. D. High
	c. NAME *(Type or print)* M. D. High
(1) LICENSE FEE CATEGORY:	d. TITLE Director of Energy Demonstrations & Technology
(2) LICENSE FEE ENCLOSED: $	e. DATE

FORM NRC-313 I (3-80)

Item 16, 1/

RADIATION PROTECTION OFFICER

Ronald Brown Maxwell

Education:

B.S. in Physics, Tennessee Technological University, 1965. Radiological Monitor Instructor, University of North Carolina Extension Division, 1970. M.S. in Nuclear Physics, North Carolina State University, 1971.

Formal Training in Radiological Safety

Experience:

June 1979 to Present - Acting Chief of the Radiological Hygiene Branch, Division of Occupational Health and Safety, Tennessee Valley Authority, Muscle Shoals, Alabama.

September 1978 to June 1979 - Acting Assistant Branch Chief, Radiological Hygiene Branch, Tennessee Valley Authority, Muscle Shoals, Alabama.

November 1975 to September 1978 - Supervisor of the Environmental Radiological Assessment Section, Radiological Hygiene Branch, Tennessee Valley Authority, Muscle Shoals, Alabama.

November 1972 to November 1975 - Health Physicist, Environmental Planning and Assessment Staff, Division of Environmental Planning, Tennessee Valley Authority, Chattanooga, Tennessee.

August 1971 to November 1972 - Health Physicist, Industrial and Radiological Hygiene Branch, Tennessee Valley Authority, Muscle Shoals, Alabama.

September 1967 to August 1971 - Assistant Radiological Safety Officer, North Carolina State University, Raleigh, North Carolina.

September 1965 to September 1967 - Health Physicist, Applied Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

June 1965 to September 1965 - Aerospace Technologist, National Aeronautics and Space Administration, Manned Spaceflight Center, Houston, Texas.

Dennis Alan Humphris

Education:

B.S., Chemistry, University of Texas, Austin, Texas, 1967.
M.S., Physical Chemistry, Florida State University, Tallahassee, Florida, 1970.
Basic radiation training course, TVA, Division of Occupational Health and Safety, Training Branch, Power Operations Training Center, September 16, 1980.

Formal Training in Radiological Safety

Experience:

May 1980 to Present--Projects Manager, Instrumentation; Particulate, Combustion, and Fuels Control Technology; Environmental Control and Assessment Branch; Division of Energy Demonstrations and Technology; Tennessee Valley Authority; Chattanooga, Tennessee. Project responsibilities include the rapid sulfur meter and continuous on-line nuclear assay of coal, coal pile inventory by electromagnetic sensing, and various particulate instrumentation projects.

August 1979 to May 1980--Environmental Engineer supervising the Air Quality Unit, Data Services Branch, Division of Natural Resources Services, Tennessee Valley Authority, Knoxville, Tennessee. Responsibilities included data validation, operational and quality assurance procedures for environmental instrumentation.

June 1972 to August 1979--Various positions with the New York State Department of Environmental Conservation, Albany, New York. Work was in environmental monitoring program. Last job title was Chief, Quality Assurance Section.

September 1970 to June 1972--Chemist, U.S. Environmental Protection Agency, New York, New York. On assignment to New York State in Albany.

Item 16, 17

Richard W. Lynch

Education:

A.S., Engineering Science, Jefferson Community College, Watertown, NY, 1969.
B.S., Chemical Engineering, Clarkson College of Technology, Potsdam, NY, 1971.
M.S., Chemistry, Clarkson College of Technology, 1973.

Formal Training in Radiological Safety

Experience:

July 1980 to Present--Chemical Engineer, Instrumentation, Division of Energy Demonstrations and Technology, Tennessee Valley Authority, Chattanooga, TN.

March 1975 to July 1980--Development Engineer, Charleston Technology Center, Chemicals Division, Olin Corporation, Charleston, Tennessee.

October 1973 to March 1975--Engineer, Production Control, Textile Fibers Division, E. I. duPont de Nemours and Co., Chattanooga, TN.

Item 16, 17

Robert N. Campbell

Education:

B. S. in mathematics, M.S. of Arts degree in mathematics and chemistry. Sixteen hours radiological health training provided for TVA's radiation protection officers in 1972. This was provided by TVA's radiological health staff. Eight hours training session conducted by members of TVA Radiological Hygiene Staff in 1978.

Experience:

Present - Supervisor, Power Plant Results Section, Paradise Steam Plant, Tennessee Valley Authority.
Fourteen years as Chemical Engineer, Tennessee Valley Authority.
Seven years as Assistant Supervisor, Power Plant Results Section.
Two years as Supervisor, Power Plant Results Section.

Item 15 -

Tennessee Valley Authority (TVA) is planning to install a Continuous On-line Nuclear Analyzer of Coal (CONAC) at our Paradise Coal Washing Plant near the Paradise Steam Plant in Drakesboro, Kentucky. The CONAC gives total elemental analysis of coal using a californium-252 sealed source for prompt neutron activation analysis of a moving coal steam. The CONAC will also give moisture and coal mass flow rate information, heat value, total ash content, and fouling and slagging indices.

The CONAC will be a permanent structure at the coal washing plant located at the Paradise Steam Plant. The initial installation, maintenance, repair, and removal from service of the devices containing the licensed material will be performed by the manufacturer (Science Applications, Inc. (SAI), Sunnyvale, California) or other qualified personnel. TVA will conduct the initial radiation survey and periodic surveys every six months thereafter. The records of these inventories will be maintained for at least two years.

Source Leak Testing Procedure:

Leak tests will be performed by health physics technicians with a minimum of two years' experience in the field and under the supervision of a health physicist with a minimum of two years' field experience. The entire program is managed by TVA's Radiological Hygiene Branch Chief who has many years experience in the field of health physics. Certified health physicists are available for consultation.

The sources shall be tested for leakage at intervals not to exceed six months. The test shall be capable of detecting the presence of 0.005 microcuries of alpha or beta contamination on the test sample. The test sample, using filter paper, shall be taken from the source or from appropriate accessible surfaces of the device in which the sealed source is permanently or semipermanently mounted or stored.

The filter paper will be counted in a shielded laboratory type smear counter in the central laboratory utilizing a large GM detector or gas proportional detector with an efficiency of from 10 to 30 percent.

Calibration consists mainly of standard sources brought from Eberline, supplemented by sources made in our radiological laboratory; all traceable to National Bureau of Standards.

Sample calculation:

$$\frac{\text{counts/min}}{\text{efficiency} \times 2.22 \times 10^{6}} = \mu\text{Ci}$$

where efficiency $= \frac{\text{counts/min}}{\text{d/min}}$ and $2.22 \times 10^{6} = \frac{\text{d/min}}{\mu\text{Ci}}$

Records of leak test results shall be kept in units of microcuries and maintained for inspection.

and laboratory equipment capable of detecting alpha, beta, gamma, and neutron radiation for their use in assuring safe handling of radioactive material. The health physics staff includes a minimum of one health physicist and two health physics technicians. All have a minimum of two years' experience and are familiar with sealed radioactive sources and the radiation hazards involved. A certified health physicist is available for consultation. The Radiological Hygiene Branch will provide monitoring whenever maintenance is performed on the apparatus when the neutron source is not in the shielded position. Any manipulation of sources, other than normal operation, will be supervised by personnel from the Radiological Hygiene Branch. During day-to-day operation, the californium neutron source is surrounded by a large radiation shielding enclosure that contains borated paraffin and other shielding materials. Should it be necessary to remove the neutron sources from the radiation shielding enclosure, health physics personnel will be called to provide radiation monitoring.

Radiation Protection Officer's Responsibilities:

The radiation protection officer is responsible for the work performed by the health physics staff including source leak testing, monitoring of source manipulation, dosimetry, and ensuring that the sources are used and manipulated in a manner that protects the worker and public from unnecessary radiation exposure. The radiation protection officer also assures that the sources are used in compliance with all license and regulatory requirements.

Items 16 and 17 -

Training and Experience:

The individual users listed in item 6 of the application received formal training from TVA that included the principles of radiation, practices of radiation protection and measurement, and biological effects of radiation. Specific training in the use of the CONAC will be provided by SAI at the time of installation.

3. Location of Use and Type of User

The CONAC will be housed in a controlled access area within an enclosed building. Instrumentation controls will be housed in an air-conditioned control room adjoining the CONAC area. Only authorized personnel are allowed access to either area. Maintenance operations will be conducted with the californium source in the retracted position as described below. During normal operation no individual has access to the inner portion of the CONAC where neutrons from the californium source interact with coal.

4. Events of Severe Conditions

a. In the event of an accident, fire, or explosion that may have damaged the source encapsulation or source mechanism, the TVA radiation protection officer, the regulatory authorities, and the CONAC manufacturer will be notified. Personnel will be kept away from the device until it has been determined by appropriate measurements that the area is safe.

b. If the source module containing radioactive californium-252 or the cesium-137 is lost or stolen, the regulatory authorities listed in the license will be immediately notified.

CONSTRUCTION

Engineering Drawings of the Source Housing--The following describes, in brief, those design features which protect the radioactive material from abuse and minimize the radiation hazard. (See attached annotated sketch.)

- The neutron and gamma shielding is designed to reduce radiation exposure to personnel.

- The entire system is enclosed so that the accidental exposure of personnel would be highly unlikely.

- Complete mechanical and electrical annunciation systems will indicate the source position both locally and in the control room.

- Special and specific tools are required to remove the source. Unavailability of these tools to unauthorized personnel makes abuse of the radioactive material virtually impossible.

- Complete encasing of the shielding materials by an aluminum vessel prevents loss of source and shielding material in catastrophic conditions such as fire.

- An automatic source retractor system has been incorporated to prevent accidental exposure to personnel when:

CONAC, Supporting Information

PROPOSED USE

1. Operation

The purpose of the CONAC is to analyze elemental composition in coal by prompt neutron activation using a californium-252 neutron source. Initially, coal is diverted from the main stream and fed to the receiving hopper at a predetermined rate by the feed system. The coal level is maintained in the receiving hopper within limits. As the coal is conveyed from the hopper it passes under a control gate which is designed to maintain a level bed of coal before entering the nuclear analyzer portion of the CONAC.

The CONAC also employs two cesium 137 sealed sources. The first is used in a level gauge for continuous monitoring of the coal level in the feed hopper. The other is used in determining mass flow rates. (The attached conceptual design indicates the location of the three sealed sources.)

2. Environment

All environmental factors have been presented to the CONAC's manufacturer for evaluation prior to specifying this device. Due to its location in the building, there are no severe environment conditions that can affect the integrity of the source and shielding. The potential for damage from vibration, corrosion, or impact is minimal.

a. The system is not operating.

b. An anomaly from normal operating conditions occurs.

c. Access to the neutron radiation area is necessary in order to perform diagnostics or repair.

d. Access is required for calibration.

e. An emergency condition occurs.

- The basic principle of neutron source "on-off" position is based on location of the californium-252 source on an 18-inch diameter disc of borated epoxy. During normal operation the source is located within 1.5 inches of the coal flow region. When an abnormal condition occurs, the source is moved within the shielding vessel to approximately 18 inches below the coal flow region via the rotation of the disc. This retracted or "safe" source position occurs automatically via a pneumatic actuator and is annunciated both at the control panel and the device. The maximum dosage inside the neutron interaction area (coal flow cavity) when the source is "off" is 12 mrem/hr. The source shield and the actuator system have been successfully tested in the manufacturer's laboratory for an equivalent of forty years of performance.

HUMAN ACCESS

Our personnel will be instructed as to the size and location of the radiation field and radiation levels within the field and will be cautioned that unless the source is in the "safe position," radiation levels between the source and detector may be significant. In addition:

- Restrictions to the accessibility of the CONAC device should be sufficient to prevent unauthorized entry to the radiation field and preclude any unintentional radiation exposure.

- During normal operation no individual has access to the CONAC neutron interaction area. The contained material and operating parameters preclude the access of any major portion of the body to the radiation field. Only authorized personnel are allowed to change the operating parameters and/or authorize access.

- If the operation is to be shut down for any extended period of time or if extensive work is to be done on the system, the TVA radiation protection officer will be notified to ensure that the source is locked in the safe position and remains locked during this period of time.

- In accordance with 10 CFR 20.203, signs displaying "Radioactive Materials" and the standard symbol for radiation will be posted in plain view of all personnel entering the building.

ANSI CLASSIFICATION DESIGNATION

The American National Standards Institute (ANSI) classification of the californium-252 source is 66445.

OPERATION

A. Startup

1. Mechanical

Actual startup of the coal transport system will be described under item 2 of this section. However, the following items should be checked mechanically by the startup personnel before the operation begins:

- o The forward edge of the control gate should be set at the proper distance of 10 inches above the top of the conveyor belt surface.
- o The belt alignment switch should be set at approximately three-fourths of an inch from the edge of the belt.
- o The safety stop pull cord cables should be free and unobstructed.
- o The winsmith reducer and all bearings will be checked for proper lubrication.
- o The tilt switch in the discharge hopper will be checked to ensure it is hanging free.

During startup, checks should be made for conveyor belt tracking and adjustments made accordingly.

2. Electrical

The first step in operating the CONAC is to energize all control circuits for the belt controls. All circuit breakers in the CONAC control panel should be turned on and front panel controls set to the following positions:

--Belt Conveyer	--Off
--Belt Brush	--Off
--Sample Gate	--Close
--Receiving Hopper Level Controller	--Manual

The annunciator will be cleared as soon as power is applied to the alarm circuit. Rope switches must be set, and visual checks must be made to see that misalignment switches are clear and the discharge bin is clear.

Before operating the detector there must be coal in the neutron interaction area. To achieve this, all downstream conveyors must be running. At such time the belt brush and belt conveyor controls should be set to the "auto" position. The feed bin level control should then be manually adjusted to obtain desired belt speed (at least 20-percent speed). This will allow the upstream equipment to run. The sample gate should be enabled from the remote control area and the local switch set to "auto."

At this time coal should begin flowing into the CONAC receiving hopper. Belt speed should be adjusted to allow the level to slowly rise until it is at a desired level indicated on the receiving hopper level control. If continuous coal flow is desired, the level controller may be set to the "auto" position so level will automatically be maintained. If the operator accompanied by authorized personnel wishes to test the CONAC with the coal setting stationary, he may stop the conveyor by setting the control switch to "off". NOTE: Stopping the conveyor with coal on it will stop upstream equipment and close the sample gate. It will also defeat the 15 minute automatic purge time circuit. Therefore, this procedure may be used for a "quick check." See calibration instructions for further reference.

B. For calibration purposes there is a provision for manual operation of the belt conveyor. Before calibrating, the system should be purged and cleared out completely. The conveyor control can then be set to "hand" at which time the local station will have control of the belt. This will allow the belt to run foward or reverse at any desired speed to position the calibration block in the neutron interaction area. NOTE: This is the only time manual mode of belt operation is intended for use.

For calibrating the CONAC, a special key actuated switch is provided inside the CONAC control cabinet. This switch is capable of defeating ALL interlocks, so the source can be activated at any time. Naturally, this is intended for use ONLY by qualified, authorized personnel.

C. Shutdown

1. Expected

If the CONAC and sampling system are to shut down for maintenance or idle time, the feed bin and belt should be completely purged. First, put the source in the safe position by placing the control switch to "out." This will disable the CONAC detector and cause certain malfunction alarms. NOTE: If the source is not taken out of position, it will do so automatically when the belt starvation sensor trips. It is better, though, to manually set it out for maximum safety. The local sample gate control switch should then be set to close and the receiving hopper level controller set to manual to keep the belt running. Allow sufficient time to empty the bin and allow the brush to thoroughly clean the belt.

It may also be advisable to tap the sides of the receiving hopper to knock the coal loose so it will not fall out later. When completely purged, the belt can be stopped, as well as downstream equipment. The system is now shut down and ready for maintenance or repair. NOTE: Observe all safety precautions in source area!

Under normal operation the coal feed may periodically stop or downstream equipment may stop. If downstream interlocks are satisfied, the belt may stop automatically due to coal feed stopping via the receiving hopper level controller. If the belt is stopped under these conditions for 15 minutes, the belt will start and run until the level is down to

the bottom of the receiving hopper. If coal flow resumes within 24 hours (determined by the source removal timer), the CONAC will resume normal operation and no corrective action will be necessary.

If the downstream interlocks fail, the belt will stop and no purging action may take place after 15 minutes. This will also be self-correcting, however, if operation downstream resumes within 24 hours.

2. Unexpected

In the event of a belt failure, downstream equipment failure, or coal plugging, the belt will stop in a safe mode. An air pressure failure, power failure, starvation, or computer failure will cause automatic retraction of the source.

In the event of a mechanical failure the source will react if no belt movement is detected in 24 hours. If the belt will be down for some time, the source should be manually retracted for maximum safety. If access to the belt is necessary, the source should be locked out before removing coal, servicing, etc.

INITIAL RADIATION SURVEY

The californium-252 will be stored in an approved transportation cask. This cask is specifically designed to mate with the CONAC for remote source transfer. (See attached sketch.)

The CONAC manufacturer and TVA personnel will perform an initial radiation survey and leak testing at the time of installation. Additionally, TVA personnel will receive specific training at the time of installation. This training will include construction features of the device, source integrity, neutron beam geometry, and intensity and operating details of the device. Any precautionary steps, such as the addition of shielding, signs, or precautions to be taken, will be covered at the time in accordance with manufacturer's installation procedures and training.

The following procedure shall be followed for pickup, receiving, and shipping of the transportation cask containing the californium-252 source.

A. Procedures for Picking Up - Receiving

1. The authorized TVA employee who expects to receive the transportation cast containing the californium-252 shall make all necessary arrangements to receive the cask.

2. Authorized personnel, upon receipt of a package of radioactive material, shall confine the material to a restricted access area and notify the authorized health physics personnel of the Radiological Hygiene Branch and request that they monitor the external surfaces of the cask for radioactive contamination caused by leakage of the radioactive contents. The monitoring shall be performed as soon as practicable after receipt but no later than three (3) hours after the cask is received at the facility if received during the normal working hours, or eighteen (18) hours if received after normal working hours.

If removable radioactive contamination in excess of 0.01 microcurie (22,200 disintegrations per minute) per 100 square centimeter of the cask surface is found on the external surfaces of the package, the radiation protection officer shall immediately notify, by telephone and telegraph, mailgram, or fascimile, the final delivering carrier and the regulatory agency.

3. Upon receipt of the cask containing the californium-252, authorized personnel shall confine the material to a restricted area and notify the authorized health physics personnel of the Radiological Hygiene Branch and request that they monitor the radiation levels external to the package. The package shall be monitored as soon as practicable after receipt but no later than eighteen (18) hours after it is received at the facility. The procedure applies to receipt by other than transport by exclusive use vehicle.

   If radiation levels are found on the external surface of the cask in excess of 200 millirem per hour or at three (3) feet from the external surface of the package in excess of ten (10) millirems per hour, the authorized personnel shall immediately notify, by telephone and telegraph, mailgram, or facsimile, the final delivering carrier and the regulatory agency.

B. Leak Testing

The CONAC manufacturer and TVA personnel will perform the initial radiation survey and leak testing at the time of installation. Additionally, our personnel will receive specific training at the time of installation. This

training will include construction features of the device, source integrity, neutron beam geometry and intensity, and operating details of the device. Any precautionary steps, like the addition of shielding, signs, or precautions to be taken, will be covered at the time in accordance with the manufacturer's installation procedures and training.

C. Emergency Procedures

The CONAC interlock system is designed to withdraw the californium-252 source into the main shielding if any abnormality from the intended use occurs. These conditions include: loss of power, loss of coal flow, loss of instrument air, etc. In the event of some catastrophic emergency which may involve this device, we will notify the manufacturer and the regulatory agency.

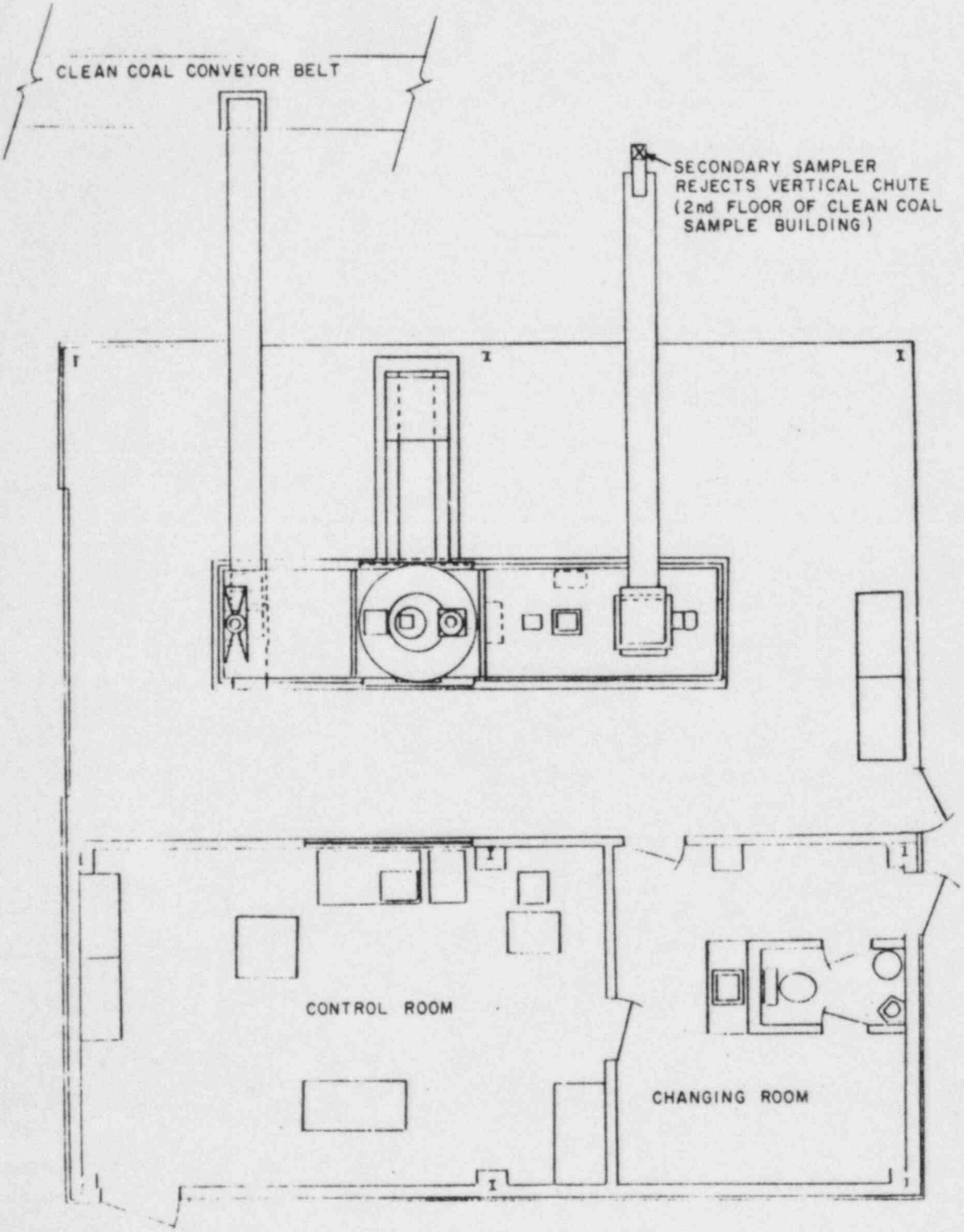
D. Disposal

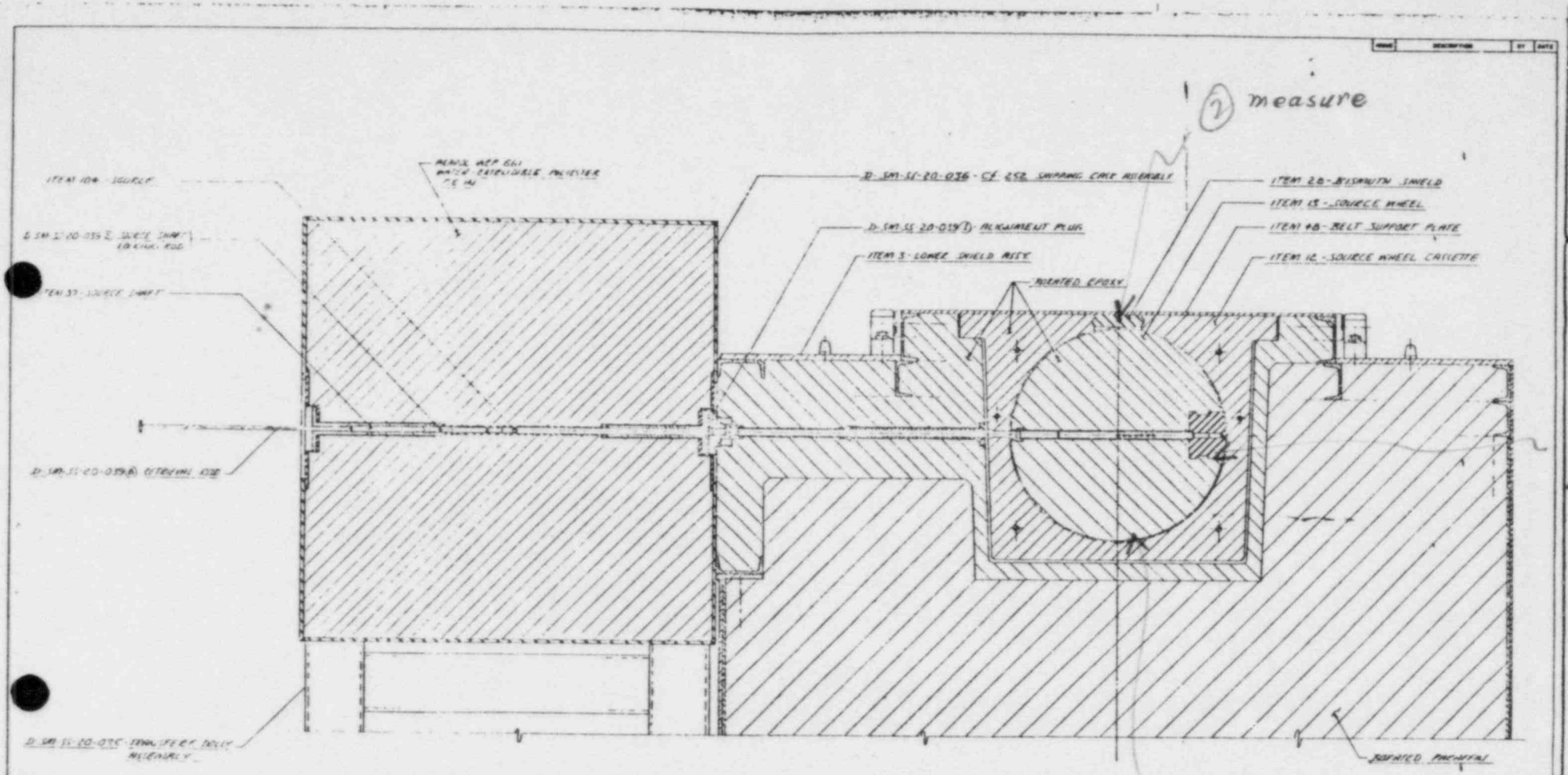
No waste disposal is involved. In the event that the device is damaged or its uses discontinued, we shall notify the manufacturer for removal and return the device for repair or disposal of the source material.

E. Leak Test of the Source

The source manufacturer or TVA's Radiological Hygiene Branch will perform a leak test on each source by applying procedures in the current ANSI standard entitled "Classification of Sealed Radioactive Sources." A copy of the certificate will be provided to TVA.

CONAC Installation
Paradise Coal Washing Plant





ELEVATION SECTION VIEW
CASK MATED TO LOWER SHIELD ASSEMBLY

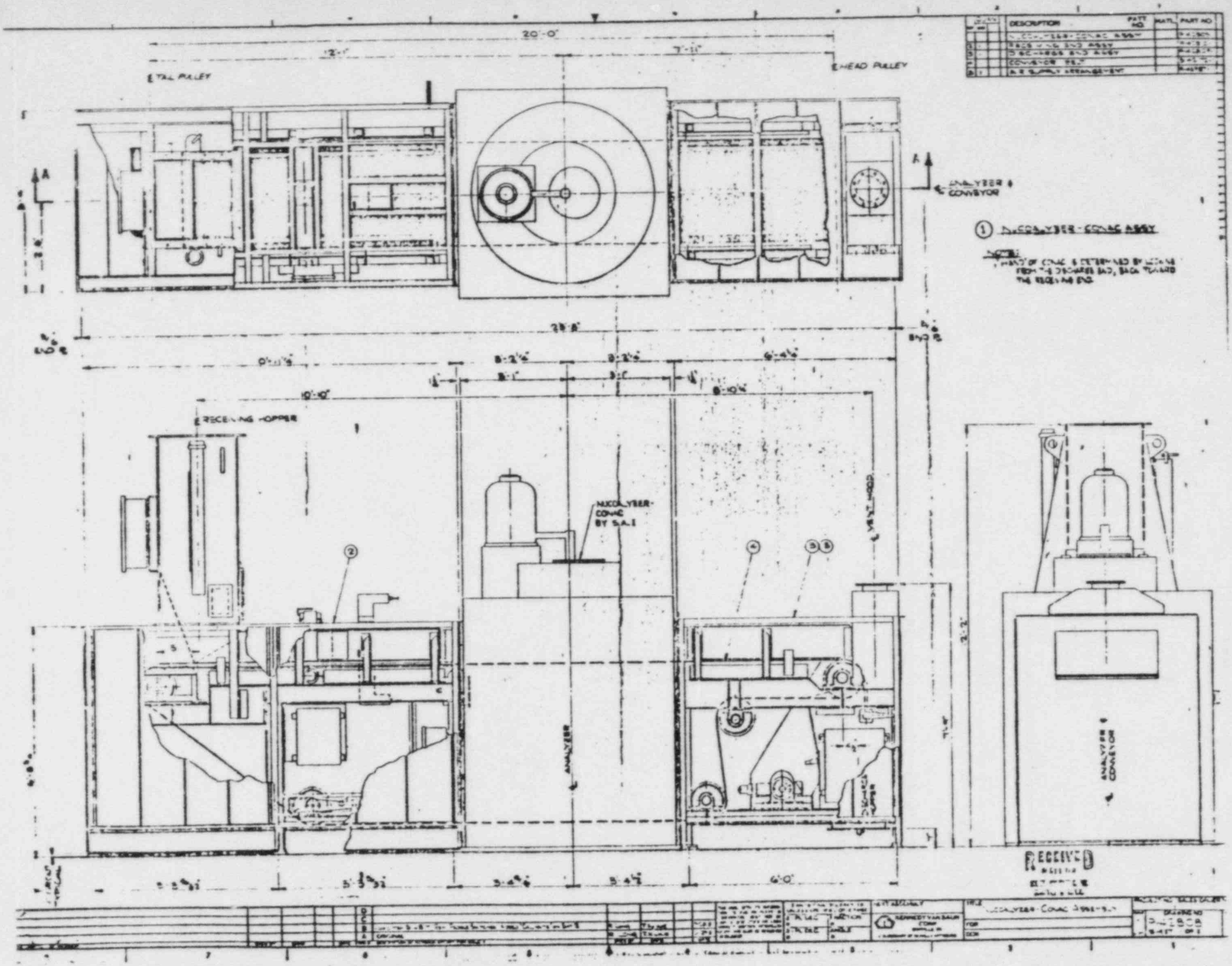
* NOTE: The SOURCE wheel is mounted on teflon bearings which allow the source to be moved to three positions: ① load, ② measure, ③ off.

Science Applications Inc
Sunnyvale, Calif

SOURCE TRANSFER

See also Conceptual Design (fig 1)

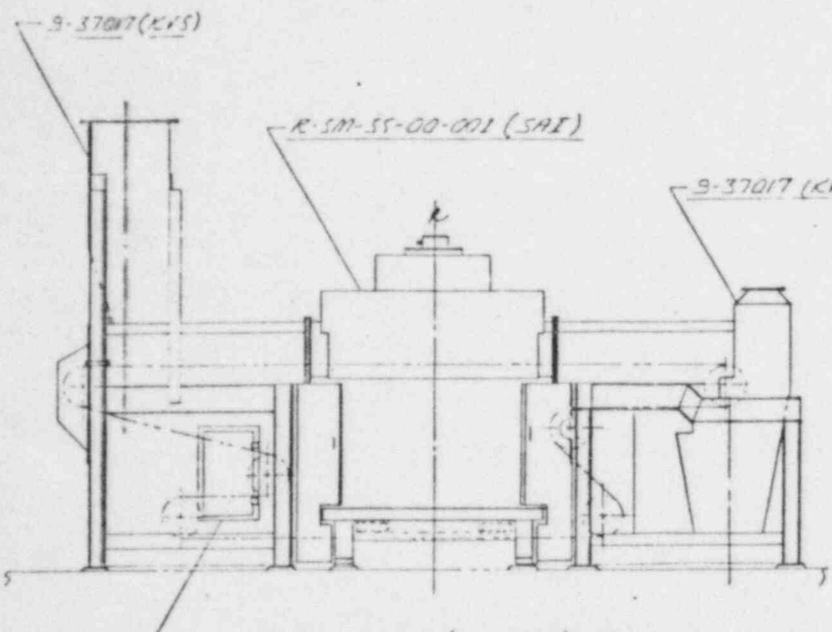
*Added by EGW per


20'-0"
TAIL PULLEY
HEAD PULLEY
ANALYZER & CONVEYOR
RECEIVING HOPPER
NUCLEYSER-CONAC BY S.A.I
ANALYZER
ANALYZER & CONVEYOR
RECEIVED

ISSUE	DESCRIPTION	BY	DATE
B	REVISED & REDRAWN	[illegible]	7-13-[illegible]
C	ITEM 3[illegible] [illegible] SOURCE [illegible] [illegible] WAS D-SM-SS-00-[illegible] SOURCE [illegible] COVER PLATE	[illegible]	5-13-[illegible]

Also Available On
Aperture Card

TI
APERTURE
CARD



8505290622-01

SAI PROPRIETARY
INFORMATION

ITEM	DWG. NUMBER	DESCRIPT[ION]
197	1/16 DIA. × 1/2 LONG.	COTTER PIN - ST
196	5/16-18UNC × 1 3/8 LG.	HEX HD. BOLT-
195	1/4-20 UNC × 5/8 LG.	SOCKET HD. CAP
194	NO. 10-32 UNF × 3/4 LG.	KNURLED [illegible]
193	NO. 6 DIA.	LOCK WASHER
192	NO. 8 DIA.	LOCK WASHER
191	NO. 10 DIA.	LOCK WASHER
190	1/4 DIA.	LOCK WASHER -
189	3/8 DIA.	LOCK WASHER -
188	1/2 DIA.	LOCK WASHER -
187	NO. 6 DIA.	PLAIN WASHER -
186	NO. 8 DIA.	PLAIN WASHER -
185	NO. 10 DIA.	PLAIN WASHER
184	1/4 DIA.	PLAIN WASHER -
183	3/8 DIA.	PLAIN WASHER -
182	3/8 DIA.	PLAIN WASHER
181	1/2 DIA.	PLAIN WASHER -
180	1/4-20 UNC	HEX HD. NUT - ST
179	5/16-18 UNC	HEX. HD. NUT - LOCK
178	3/8-16 UNC	WING NUT - ST
177	3/8-16 UNC	HEX HD NUT - L
176	3/8-16UNC	HEX. HD. NUT - ST
175	1/2-13UNC	HEX. HD. NUT - ST
174	NO. 6-32 UNC × 1/4 LG.	SET SCREW - S
173	1/4-20UNC × 1/2 LG.	SET SCREW - S.
172	5/16-18 UNC × 1/2 LG.	SET SCREW - S
171	NO. 6-32 UNC × 3/8 LG.	FLAT HD M.S. -
170	NO. 6-32 UNC × 1/2 LG.	FIL. HD. M.S. - STL
169	NO. 6-32 UNC × 5/8 LG.	FIL. HD M.S. - STL
168	NO. 8-32 UNC × 3/8 LG.	FLAT HD. M.S. - S
167	NO. 8-32 UNC × 3/8 LG.	FIL. HD. M.S. - STL
166	NO. 8-32 UNC × 1/2 LG.	FLAT HD. M.S. - S
165	NO. 8-32 UNC × 1/2 LG.	FIL HD M.S. - S
164	NO. 8-32 UNC × 5/8 LG.	FIL. HD. M.S. - STL.
163	NO. 10-32 UNF × 3/8 LG.	PAN HD. M.S. - STL.
162	NO. 10-32 UNF × 1/2 LG.	FIL. HD. M.S. - STL.
161	1/4-20 UNC × 3/8" LG.	SOCKET HD CAP SC
160	1/4-20 UNC × 1/2" LG.	FLAT HD M.S. S

TL	1
	1
SCREW	4
CREW	2
	8
	2
	8
TL	6
TL.	12
TL.	8
TL.	4
TL.	18
TL.	10
TL	78
ALUM.	10
STL.	38
STL.	24
	2
TYE STL.	1
	8
=O. STL.	1
	10
	10
	33
TL.	2
TL.	1
STL.	20
	32
	4
L.	48
	2
TL.	10
	18
	4
	4
	10
SM-STL	4
TL	24
	QTY.

ITEM	DWG NUMBER	DESCRIPTION	QTY.
159	1/4-20UNC × 5/8 LG.	FLAT HD. M.S. - S. STL.	46
158	1/4-20UNC × 3/4 LG.	FLAT HD. M.S. - ALUM.	56
157	1/4-20UNC × 3/4 LG.	FLAT HD. M.S. - S. STL.	38
156	1/4-20UNC × 7/8 LG.	SOCKET HD. CAP SCREW - STL.	22
155	1/4-20UNC × 1/2 LG.	HEX. HD. BOLT - STL.	30
154	1/4-20UNC × 3/4 LG.	HEX. HD. BOLT - STL.	22
153	1/4-20UNC × 1" LG.	HEX. HD. BOLT - STL.	6
152	1/4-20UNC × 1 1/2 LG.	HEX. HD. BOLT - STL.	2
151	5/16-18UNC × 1" LG.	SHOULDER BOLT - STL.	1
150	3/8-16UNC × 11" LG.	THD. ROD - STL.	1
149	× 1" LG.	CAP SCREW - STL.	4
148	× 1/2 LG.	HEX. HD. BOLT - STL.	4
147	× 3/4 LG.	HEX. HD. BOLT - STL.	5
146	× 1" LG.	HEX. HD. BOLT - STL.	8
145	× 1 1/4 LG.	HEX. HD. BOLT - STL.	8
144	× 1 1/2 LG.	HEX. HD. BOLT - STL.	4
143	3/8-16UNC × 2 1/4 LG.	HEX. HD. BOLT - ALUM.	6
142	1/2-13UNC × 1 3/4 LG.	HEX. HD. BOLT - STL.	8
141	1/2-13UNC × 2" LG.	HEX. HD. BOLT - STL.	2
140	1/2-13UNC × 2 1/4 LG.	HEX. HD. BOLT - STL.	15
139			
138			
137			
136			
135	NO. B-4-MHC-25	MALE HOSE CONNECTOR - CAJON	2
134	NO. 506	MOUNTING BRACKET - NORGEN	1
133	NO. 2101-4-4B	MALE ELBOW - PARKER	4
132	NO. 30282-4-4B	PUSH LOCK HOSE FITTING - PARKER	4
131	NO. 801-4	PUSH LOCK HOSE - PARKER	AR
130	NO. B-400-2-2	90° ELBOW - SWAGELOK	1
129	NO. B-400-7-2	FEMALE CONNECTOR - SWAGELOK	1
128	NO. B-2-ME	90° ELBOW - CAJON	1
127	NO. 9600K25	1/4 GROMET - MCMASTER CARR	2
126	NO. B-4-HCG	HEX COUPLING - CAJON	1
125	NO. SEALITE (UL) - 1/2 TYPE UA	METAL HOSE - M - ANACONDA	AR
124	NO. LTB 5090	90° MALE CONNECTOR - E...	3
123	NO. 10-141	TERMINAL BLOCK - CINCH	1
122	1/8 I.D. POLYURETHANE	TUBE - COMMERCIAL	AR
121	NO. BF1	BARBED FITTING - HUMPHREY	4
120	NO. RBF	REDUCER BUSHING - HUMPHREY	2
119	NO. 9533B-2PP	VALVE - CIRCLE SEAL	1
118		CLAMP - TEGLAN AIRCRAULICS	2
117	NO. SYAR-612	TANK - TEGLAN AIRCRAULICS	1
116	NO. B-400-2-4	90° ELBOW - SWAGELOK	1
115	NO-C125	CHECK VALVE - HUMPHREY	1
114	NO. B-400-1-2	MALE CONNECTOR	4
113	NO. B-400-3-4-TTM	MALE TEE - SWAGELOK	1
112	NO. SS-QC4-B1-400	QUICK CONNECT - SWAGELOK	1
111	NO. B-400-7-4	FEMALE CONNECTOR - SWAGELOK	1
110	NO. SC1	SPEED CONTROL	2
109	NO. 18-013-209	GAUGE - NORGEN	1
108	NO. 41E1	AIR VALVE	1
107	NO. 12SV3-10-21	TOGLE VALVE - HUMPHREY	1
106	NO. SA10A/TF10A11	SWITCH - ASCO	1
105	NO. UL B06-134 ASK	FILTER/REGULATOR - NORGEN	1
104	MODEL 2765	SOURCE - MONSANTO RESEARCH CORP.	1
103	1/4 O.D. COPPER TUBE	COMMERCIAL	AR
102	1/4 × 1/4 × 1 1/4 LONG	KEY STOCK - COMMERCIAL	1
101	NO. B-400-1-4	MALE CONNECTOR - SWAGELOK	4
100	NO. 207AC BHS-4	ANCHOR CONNECTOR - PARKER	4
99	NO. SS C100	COLLAR - BOSTON GEAR	1
98	NO. 4943	PROXIMITY PROBE - ELECTRO CORP.	2
97	NO. 3014Y999-57	THD. EYE BOLT 3/8 × 2 1/4 - MCMASTER CARR	4
96	NO. 3014Y999-53	THD. EYE BOLT 1/4 × 2 1/2 - MCMASTER CARR	4
95	NO. 6015-N4	VIBRATION ABSORBER - MCMASTER CARR	4
94	NO. 6015K-2	LEVELING WEGE - MCMASTER CARR	4
93	NO. 78-6 × 318	TURNBUCKLE - PACIFIC HARDWARE	1
92	NO. TB-512	THRUST BEARING - BOSTON GEAR	1
91	NO. FB-68-3	SLEEVE BEARING - BOSTON GEAR	2
90	NO. FB-57-3	SLEEVE BEARING - BOSTON GEAR	1
89	NO. DRT 0612-2	THRUST BEARING - KINGWELL	32
88	NO. DRS 0609-6	SLEEVE BEARING - KINGWELL	32
87	NO. DRF 1620-12	FLANGE BEARING - KINGWELL	1
86	NO. DRF 2428-16	FLANGE BEARING - KINGWELL	10
85			
84			
83			
82			
81			
80			
79	D-SM-SS-00-176	ENCLOSURE PANEL	1
78	D-SM-SS-00-175 (3)	SPEED CONTROL BRACKET	2
77	D-SM-SS-00-175 (2)	STAND-OFF	1

CA22

ITEM	DWG NUMBER	DESCRIPTION	QTY.
76	D-SM-[illegible]-175 (1)	PNEUMATIC [illegible] PANEL	1
75	D-SM-SS-00-171 (2)	RETAINER BRACKET	4
74	D-SM-SS-00-165 (2)	AIR VALVE MT. BRACKET	1
73	D-SM-SS-00-165 (1)	CONTROL PANEL MT. BRACKET	1
72	D-SM-SS-00-155 (11)	ARM STAND OFF	8
71	(10)	DUST GROMET R.H.	1
70	(9)	DUST GROMET L.H.	1
69	(8)	HOLD ARM L.H.	2
68	(7)	HOLD ARM R.H.	2
67	(6)	LOCKING ARM L.H.	2
66	(5)	LOCKING ARM R.H.	2
65	(4)	BACKING BAR L.H.	1
64	(3)	BACKING BAR R.H.	1
63	(2)	DUST SEAL ASSEMBLY L.H.	1
62	D-SM-SS-00-155 (1)	DUST SEAL ASSEMBLY R.H.	1
61	B-SM-SS-00-150	SIGNAL ARM	1
60	D-SM-SS-00-149 (5)	CLOSURE PLATE	1
59	(3)	ACTUATOR DRIVE ARM	1
58	(2)	ROD END	1
57	D-SM-SS-00-149 (1)	SIGNAL ARM FRAME	1
56	D-SM-SS-00-122	GUIDE PIN	4
55	D-SM-SS-00-112 (7)	GASKET	1
54	(6)	GASKET RETAINER	1
53	(5)	DUST SEAL SLEEVE	1
52	(4)	ROTARY ACTUATOR	1
51	(3)	ISOLATOR ACCESS COVER	4
50	(2)	SOURCE RETRIEVAL COVER GASKET	1
49	D-SM-SS-00-112 (1)	DRIVE COVER SEAL GASKET	1
48	D-SM-SS-00-100 (3)	BELT SUPPORT PLATE	2
47	(2)	BELT SUPPORT PLATE	2
46	D-SM-SS-00-100 (1)	BELT SUPPORT PLATE	2
45	C-SM-SS-00-059	DETECTOR ISOLATOR PAD	1
44	D-SM-SS-00-097	ACTUATOR SEAL COVER	1
43	D-SM-SS-00-096	ACTUATOR SEAL SKIRT	1
42	D-SM-SS-00-093 (4)	PROXIMITY PROBE ADAPTER	2
41	(3)	BRACKET PILOT	1
40	(2)	THRUST WASHER	1
39	D-SM-SS-00-093 (1)	SOURCE WHEEL POSITIONING BRACKET	1
38	D-SM-SS-00-092 (5)	SOURCE SHAFT LOCKING ROD	1
37	D-SM-SS-00-092 (1)	SOURCE SHAFT LOCKING ROD	1
36	C-SM-SS-00-091 (1)	SOURCE SHIELD PLUG	1
35	C-SM-SS-00-090	ROLLER HOUSING	8
34	C-SM-SS-00-183	SOURCE RETRIEVAL SECURITY ASSY.	1
33	(4)	ROLLER SHAFT	16
32	(3)	CONTACT ROLLER	16
31	D-SM-SS-00-088 (2)	COVER PLATE	6
30	D-SM-SS-00-080 (4)	PARAFFIN INSPECTION PLATE	5
29	D-SM-SS-00-078 (3)	TOP SHIELD INDEX PIN	4
28	D-SM-SS-00-072 (11)	BISMUTH SHIELD	1
27	D-SM-DS-00-057	No. 1 DETECTOR ASSEMBLY	1
26	C-SM-DS-00-048	DETECTOR SUPPORT SPACER	1
25	D-SM-SS-00-045 (26)	SKIMMER ALUMINUM BAR	2
24	(22)	SKIMMER POLYETHYLENE BAR	2
23	(15)	SKIRT ALUMINUM PLATE	2
22	D-SM-SS-00-045 (12)	SKIRT POLYETHYLENE PLATE	2
21	C-SM-SS-00-034	ROTARY ACTUATOR MT. PLATE	1
20	D-SM-SS-00-033	ROTARY ACTUATOR SUPPORT PLATE	1
19	D-SM-SS-00-032 (6)	SOURCE WHEEL DRIVE PIN	1
18	(5)	ROTARY ACTUATOR PLATE STAND-OFF	4
17	(4)	SOURCE WHEEL DRIVE SHAFT	1
16	(3)	BEARING RETAINER	1
15	(2)	WHEEL SHAFT DRIVE ARM	1
14	D-SM-SS-00-032 (1)	ROTARY ACTUATOR DRIVE ARM	1
13	D-SM-SS-00-031	SOURCE WHEEL	1
12	D-SM-SS-00-030	SOURCE WHEEL CASSETTE	1
11	D-SM-SS-00-022	SULFURMETER SUPPORT BASE	1
10	D-SM-SS-00-019 (8)	BEARING BLOCK SPACER	AR
9	(7)	ROLLER BEARING ASSY SPACER	8
8	(6)	ACTUATOR MOUNTING SPACER	4
7	(4)	ROLLER SLEEVE	8
6	(3)	BEARING BLOCK	8
5	D-SM-SS-00-019 (1)	LEVELING WEDGE SPACER	AR
4	C-SM-SS-00-018	BELT SUPPORT ROLLER	4
3	D-SM-SS-00-008	BOTTOM SHIELD ASSEMBLY	1
2	D-SM-SS-00-007	TOP SHIELD ASSEMBLY	1
1	R-SM-SS-00-001	SULFURMETER ASSEMBLY	

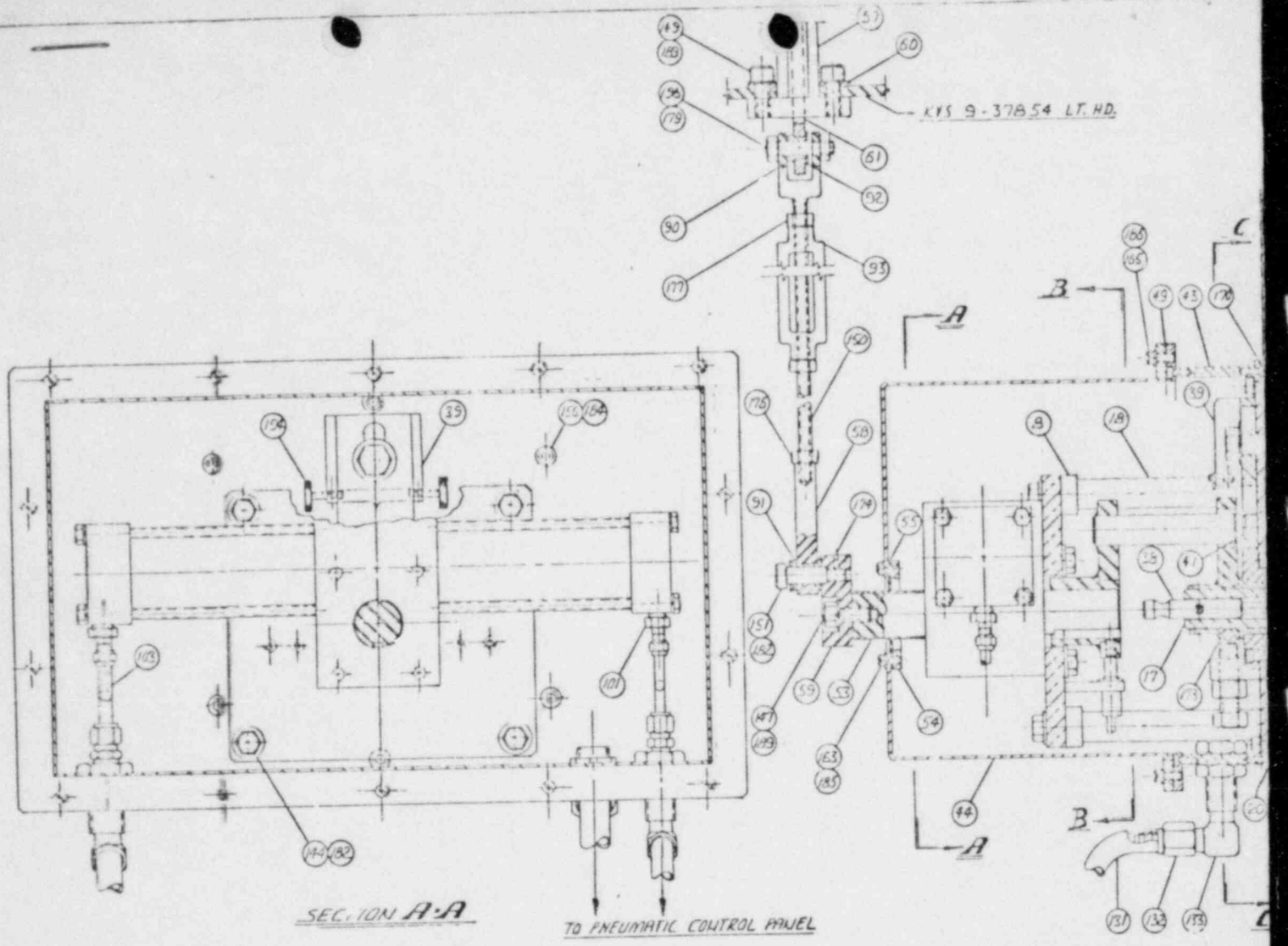
MAT'L	—	TOLERANCES UNLESS OTHERWISE SPECIFIED	BASIC DIMS	FRACT. TOL	DECIMAL TOL
FINISH	—		0 TO 1/2	± 1/128	± .005
			1/2 TO 6	± 1/64	± .005
		ANGULAR TOL	6 TO 24	± 1/32	± .010
		± 1/2°	ABOVE 24	± 1/16	± .015

DR.	SANFORD	7-2-80	TITLE: SULFURMETER ASSEMBLY
CKD.	[signature]	7-11-80	
APPD.	[signature]		
APPD.			

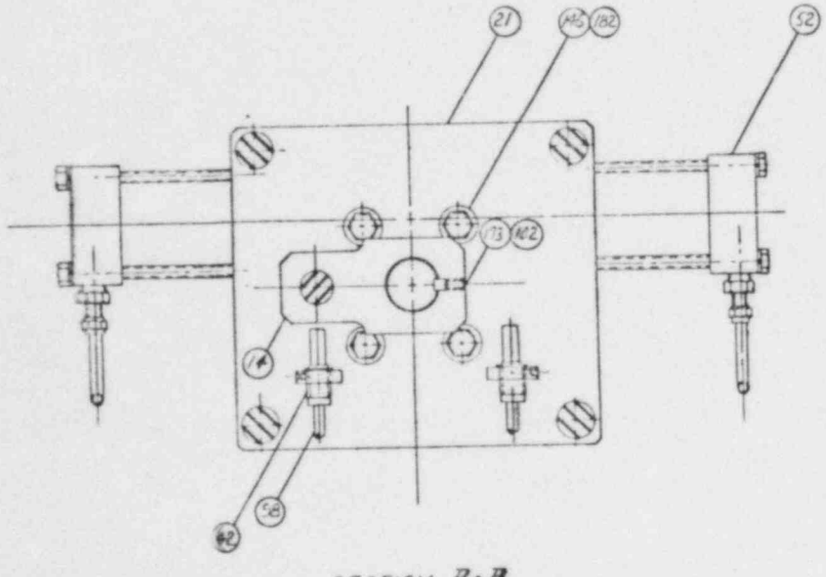
NEXT ASSEMBLY | SCALE

Science Applications Inc.
Sunnyvale, Calif.

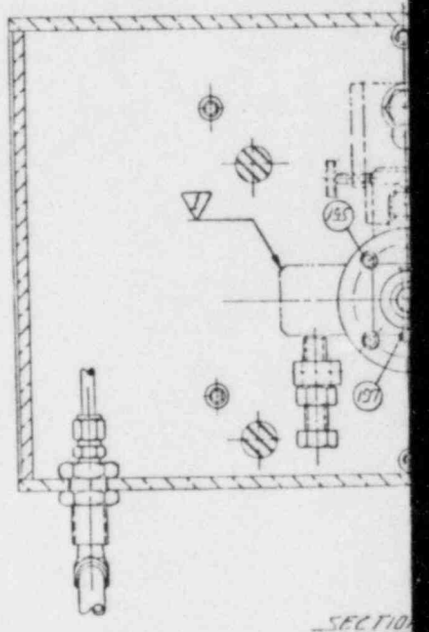
DWG. NO. SHEET 4 OF 5 D-SM-SS-00-001 | ISSUE C

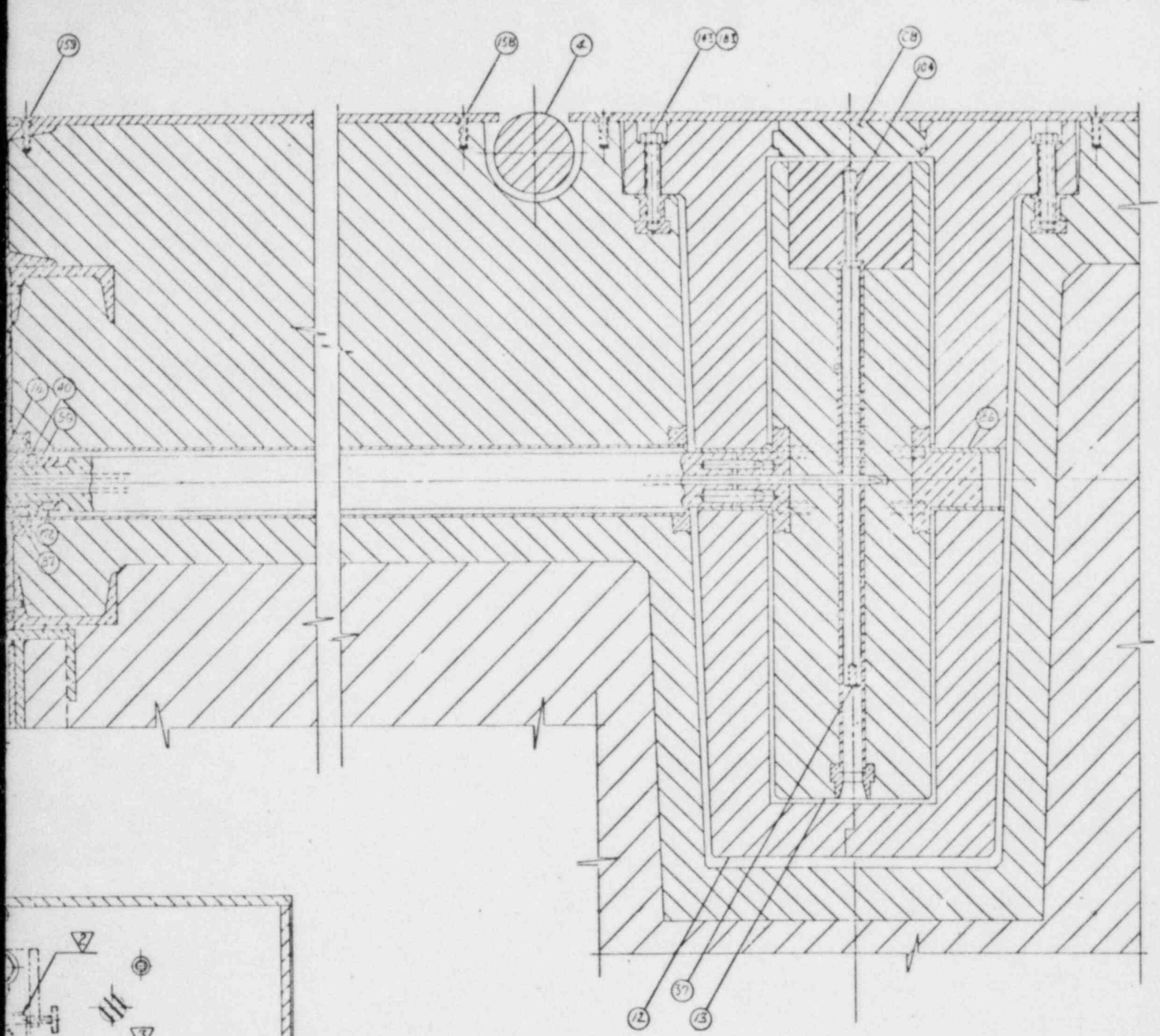


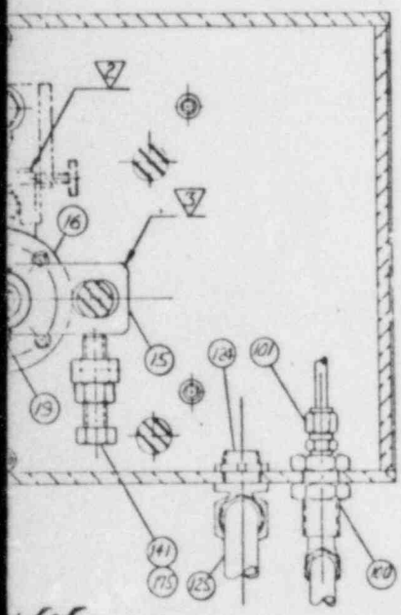
SECTION A-A



SECTION B-B







1 — SOURCE IN "SHIELDED POSITION"

2 — SOURCE IN "RETRIEVAL POSITION"

3 — SOURCE IN "ACTIVATED POSITION"

SECTION D-D

FROM SHEET 2 OF 4

Also Available On Aperture Card

TI APERTURE CARD

SAI PROPRIETARY INFORMATION

ITEM	DWG. NUMBER	DESCRIPTION	QTY.
MATL	———		
FINISH	———		

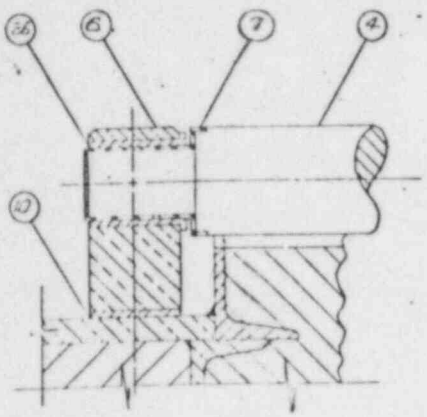
DR.	APPROVED	11-7-79
CHK		11-16-79
APPD		11-27-79
APPD		

TITLE: SULFURIMETER ASSEMBLY

Science Applications Inc.
Sunnyvale, Calif.

DWG NO. D SM-SS 080-001 SHEET 3 OF 5 REV. B

8505290622-02



SECTION C·C
SCALE: 1/2"=1"

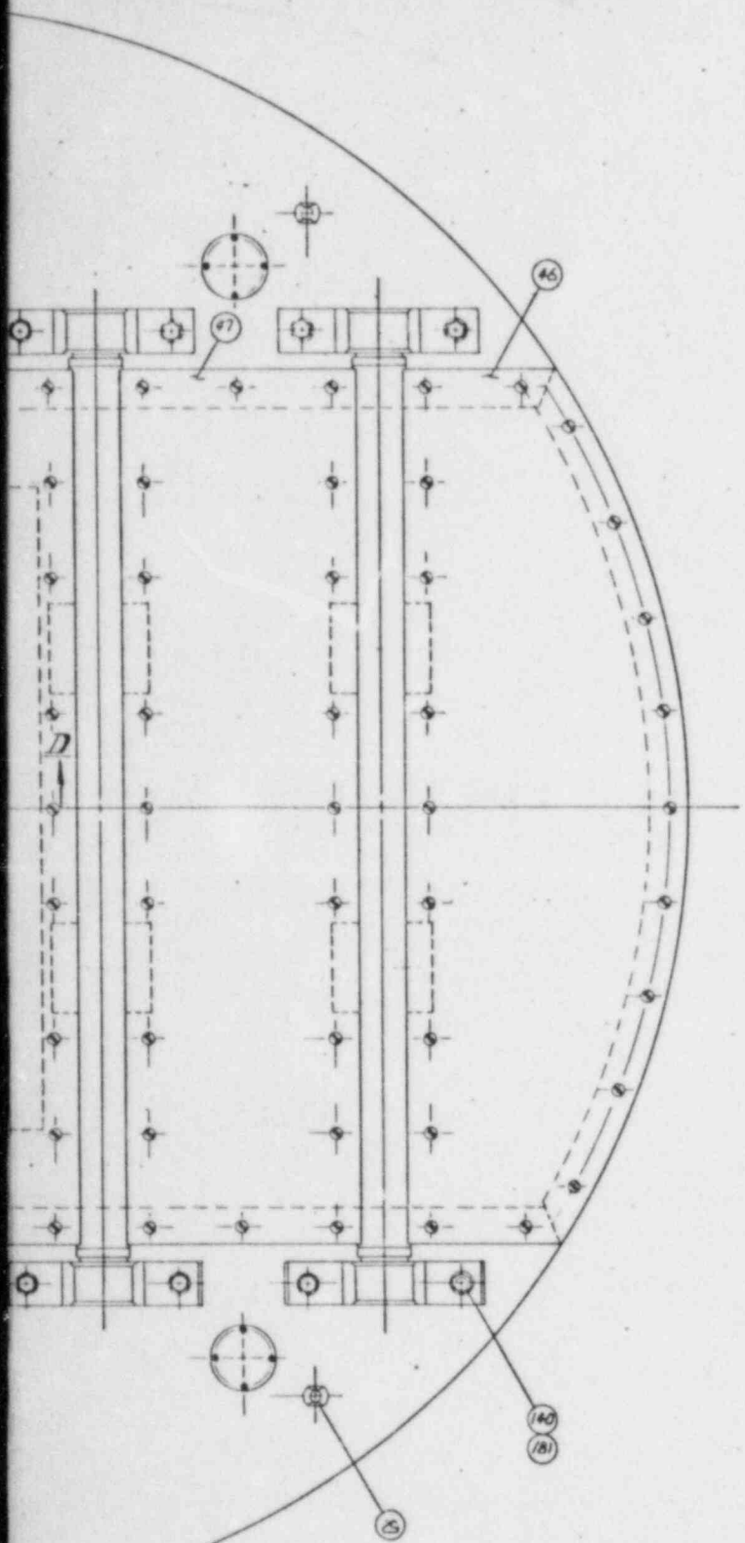
SEE SHEET 3 OF 4 - D

SECTION VIEW B·B

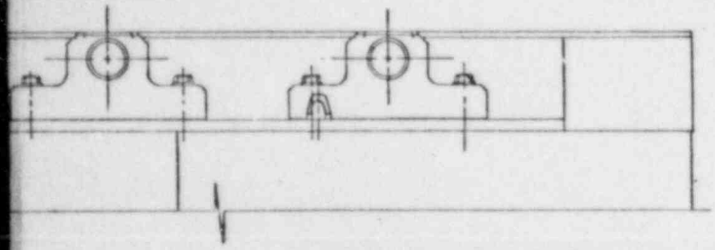
SECTION A·A
SCALE: 1/2"=1"

ISSUE	DESCRIPTION	BY	DATE
B	SHEET 2 OF 5 WAS 2 OF 4 REVISED CALLOUTS	[illegible]	11-10-83

0422



SECTION VIEW C-C FROM SHEET 1 OF 4



Also Available On
Aperture Card

TI
APERTURE
CARD

SAI PROPRIETARY
INFORMATION

ITEM	DWG. NUMBER	DESCRIPTION	QTY.
MATL			
FINISH			

DR.	[illegible]	10-21-79
CKD.	[illegible]	11-26-79
APPR.	[illegible]	11-27-79
APPR.		

TITLE: SULFURIMETER ASSEMBLY

NEXT ASSEMBLY

SCALE: FULL

Science Applications Inc.
Sunnyvale, Calif.

DWG NO. D-SM-55-00-001 SHEET 2 OF 5 ISSUE B

8505290622-03