NRC FORM 313
(10-87)
10 CFR 30, 32, 33, 34, 35 and 40

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED BY OMB
3150-0120
Expires 6-30-90

APPLICATION FOR MATERIAL LICENSE

INSTRUCTIONS: SEE THE APPROPRIATE LICENSE APPLICATION GUIDE FOR DETAILED INSTRUCTIONS FOR COMPLETING APPLICATION. SEND TWO COPIES OF THE ENTIRE COMPLETED APPLICATION TO THE NRC OFFICE SPECIFIED BELOW.

APPLICATIONS FOR DISTRIBUTION OF EXEMPT PRODUCTS FILE APPLICATIONS WITH:

U.S. NUCLEAR REGULATORY COMMISSION
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY, NMSS
WASHINGTON, DC 20555

ALL OTHER PERSONS FILE APPLICATIONS AS FOLLOWS. IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

IF YOU ARE LOCATED IN:

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

PERSONS LOCATED IN AGREEMENT STATES SEND APPLICATIONS TO THE U.S. NUCLEAR REGULATORY COMMISSION ONLY IF THEY WISH TO POSSESS AND USE LICENSED MATERIAL IN STATES SUBJECT TO U.S. NUCLEAR REGULATORY COMMISSION JURISDICTION.

1. THIS IS AN APPLICATION FOR *(Check appropriate item)*

- [ ] A. NEW LICENSE
- [ ] B. AMENDMENT TO LICENSE NUMBER _____
- [X] C. RENEWAL OF LICENSE NUMBER 33-18224-01

2. NAME AND MAILING ADDRESS OF APPLICANT *(Include Zip Code)*

Basin Electric Power Cooperative
1717 E. Interstate Avenue
Bismarck, ND 58501

3. ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED.

Laramie River Station
347 Grayrocks Road
Wheatland, WY 82201

4. NAME OF PERSON TO BE CONTACTED ABOUT THIS APPLICATION

Robert L. Eriksen

TELEPHONE NUMBER: (701) 223-0441

SUBMIT ITEMS 5 THROUGH 11 ON 8½ x 11" PAPER. THE TYPE AND SCOPE OF INFORMATION TO BE PROVIDED IS DESCRIBED IN THE LICENSE APPLICATION GUIDE.

5. RADIOACTIVE MATERIAL
a. Element and mass number, b. chemical and/or physical form, and c. maximum amount which will be possessed at any one time.

6. PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED.

7. INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE.

8. TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS.

9. FACILITIES AND EQUIPMENT.

10. RADIATION SAFETY PROGRAM.

11. WASTE MANAGEMENT.

12. LICENSEE FEES *(See 10 CFR 170 and Section 170.31)*
FEE CATEGORY 10CFR 170.31 3P. AMOUNT ENCLOSED $ 120.00

13. CERTIFICATION. *(Must be completed by applicant)* THE APPLICANT UNDERSTANDS THAT ALL STATEMENTS AND REPRESENTATIONS MADE IN THIS APPLICATION ARE BINDING UPON THE APPLICANT.

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATION ON BEHALF OF THE APPLICANT, NAMED IN ITEM 2, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PARTS 30, 32, 33, 34, 35, AND 40 AND THAT ALL INFORMATION CONTAINED HEREIN, IS TRUE AND CORRECT TO THE BEST OF THEIR 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.

SIGNATURE–CERTIFYING OFFICER	TYPED/PRINTED NAME	TITLE	DATE
Dallas Wade	Dallas Wade	Plant Manager	8/11/88

FOR NRC USE ONLY

TYPE OF FEE	FEE LOG	FEE CATEGORY	COMMENTS	APPROVED BY
Rec	Dept 2-16	3P		M. Musser
AMOUNT RECEIVED	CHECK NUMBER			DATE
$120	00026782			9/6/88

5.	a.	b.	c.
(1)	Cesium 137	Sealed Source	15- 100 mCi each
(2)	Cesium 137	Sealed Source	27- 25 mCi each
(3)	Cesium 137	Sealed Source	22- 50 mCi each
(4)	Cesium 137	Sealed Source	2- 100 mCi each
(5)	Cesium 137	Sealed Source	30-1,000 mCi each
(6)	Cesium 137	Sealed Source	5- 25 mCi each

6. (1) Used in Kay Ray Model 7062P and 7062BP source holders for measurement of scrubber slurry density.

(2)-(4) Used in Kay Ray Model 7062P source holders for coal flow measurement.

(5) Used in Kay Ray Model 7063P source holders for measurement of scrubber slurry density.

(6) Used in Kay Ray Model 7062P source holders for limestone flow measurement.

STEVE ALLEN

7. TRAINING OF EACH INDIVIDUAL NAMED IN ITEMS 7 & 8.

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
Principles and practices of radiation protection	Texas Nuclear Training Course	1 week	Yes (No)	(Yes) No
Radioactivity measurement standardization and monitoring techniques and instruments	" "	"	Yes (No)	(Yes) No
Mathematics and calculations basic to the use and measurement of radioactivity	" "	"	Yes (No)	(Yes) No
Biological effects of radiation	" "	"	Yes (No)	(Yes) No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience).

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs 137	1000 mCi	Basin Electric Power Cooperative	1 year	Density and Level Detection
Ra 226	3.3 mCi			

(Continued)

TRAINING OF EACH INDIVIDUAL NAMED IN ITEM

TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer)
Principles and practices of radiation protection			Yes No	Yes No
Radioactivity measurement standardization and monitoring techniques and instruments			Yes No	Yes No
Mathematics and calculations basic to the use and measurement of radioactivity			Yes No	Yes No
Biological effects of radiation			Yes No	Yes No

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience).

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE

TRAINING OF EACH INDIVIDUAL NAMED IN ITEM 8 BRIAN LARSON

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer).
Principles and practices of radiation protection	Kay Ray	1 week	(Yes) No	(Yes) No
Radioactivity measurement standardization and monitoring techniques and instruments	Nuclear Training	1 week	(Yes) No	(Yes) No
Mathematics and calculations basic to the use and measurement of radioactivity	Course	1 week	(Yes) No	(Yes) No
Biological effects of radiation			Yes (No)	Yes (No)

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience).

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs 137 Ra 226	1000 mci 3.3 mci	Basin Electric Power Cooperative	5 years	Density and Level Detection

(Continued)

TRAINING OF EACH INDIVIDUAL NAMED IN ITEM 8 RAY SANFORD

8. TYPE OF TRAINING	WHERE TRAINED	DURATION OF TRAINING	ON THE JOB (Circle answer)	FORMAL COURSE (Circle answer).
Principles and practices of radiation protection			(Yes) No	Yes No
Radioactivity measurement standardization and monitoring techniques and instruments	U.S. Navy	6 years	(Yes) No	(Yes) No
Mathematics and calculations basic to the use and measurement of radioactivity	Kay-Ray	1 week	Yes (No)	(Yes) No
Biological effects of radiation	Aerojet Nuclear	8 years	(Yes) No	Yes (No)

EXPERIENCE WITH RADIATION (Actual use of radioisotopes or equivalent experience).

ISOTOPE	MAXIMUM AMOUNT	WHERE EXPERIENCE WAS GAINED	DURATION OF EXPERIENCE	TYPE OF USE
Cs 137		Vermont Yankee Nuclear	5 years	Monitoring
Ra 226		Basin Electric Power	9 years	Equipment

BOX 9267, AUSTIN, TEXAS 78766-9990 USA (512) 835-0801, TELEX 77-6413

TEXAS NUCLEAR
A Baker Hughes company

LETTER OF CERTIFICATION

This is to certify that

Steven R. Allen
Basin Electric Power Corporation

has attended and successfully completed a course of instruction, conducted under the auspices of Texas Nuclear Corporation and described in the attached Course Agenda. The course covers fundamentals of radiation, units of dose and quality of radiation fields, hazards of radiation exposure, detection devices, regulatory controls, industrial devices and specific training on installation and leak testing of Texas Nuclear density, level and weigh gauges.

The said course of instruction, together with prior experience, is structured to qualify persons who complete it to understand and safely perform various operations involving nuclear devices including the installation, relocation and leak testing of such equipment. The operations are to be done in accordance with the rules and regulations of the United States Nuclear Regulatory Commission and/or "Agreement States", and are in all respects subject to such rules and regulations.

This letter cannot be used in lieu of a specific license from or other sanction by an appropriate regulatory agency.

TEXAS NUCLEAR CORPORATION

W. Hendrick

W. G. Hendrick
Health Physicist

Certificate Of Training

This is to certify that

STEVEN R. ALLEN

Has Successfully Completed a Radiation Safety Training Course

Presented by Texas Nuclear Corporation

Issued 17th Day Of JULY 19 87

[signature]

Health Physicist

[signature]

President

TRAINING CERTIFICATE

This certifies that

Brian Larson

has successfully completed factory training in:

Installation and Nuclear Radiation Safety

In accordance with this specific program
this Certificate is issued:

May 20, 1983

D Sheehan

KAY-RAY INC.

INDUSTRIAL PROCESS CONTROL EQUIPMENT

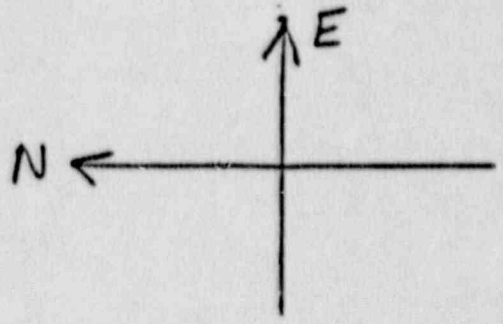
9. Sources referenced to part 5, followed by location sketches

	Location Number	Source Holder Model Number	Activity
5. (1)	Construction Warehouse (3)	7062P	100 mCi
	TC-1	7062BP	100
	TC-2	7062BP	100
	TB-1	7062P	100
	TB-2	7062P	100
	TA-1	7062P	100
	TA-2	7062P	100
	1X-1	7062P	100
	LG-1	7062P	100
	LG-2	7062P	100
	LG-3	7062P	100
	LG-4	7062P	100
	2X-1	7062P	100
(2)	1-CAS-A	7062P	25
	1-CAS-B	7062P	25
	1-CAS-C	7062P	25
	1-CAS-D	7062P	25
	1-CAS-E	7062P	25
	1-CAS-F	7062P	25
	1-CAS-G	7062P	25
	CSB-1	7062P	25
	CSB-2	7062P	25
	CSB-3	7062P	25
	CSB-4	7062P	25
	2-CAS-A	7062P	25
	2-CAS-B	7062P	25
	2-CAS-C	7062P	25
	2-CAS-D	7062P	25
	2-CAS-E	7062P	25
	2-CAS-F	7062P	25
	2-CAS-G	7062P	25
	3-SB-1	7062P	25
	3-SB-2	7062P	25
	3-CAS-1	7062P	25
	3-CAS-2	7062P	25
	3-CAS-3	7062P	25
	3-CAS-4	7062P	25
	3-CAS-5	7062P	25
	3-CAS-6	7062P	25
	3-CAS-7	7062P	25
(3)	CD-1	7062P	50
	CD-2	7062P	50
	CD-3	7062P	50
	CD-4	7062P	50
	CD-5	7062P	50

	Location Number	Source Holder Model Number	Activity
5. (3) cont.			
	CD-6	7062P	50
	RC-1	7062P	50
	RC-2	7062P	50
	RC-3	7062P	50
	RC-4	7062P	50
	CA-1	7062P	50
	CA-2	7062P	50
	CA-3	7062P	50
	CA-4	7062P	50
	CB-1	7062P	50
	CB-2	7062P	50
	CB-3	7062P	50
	CB-4	7062P	50
	CC-1	7062P	50
	CC-2	7062P	50
	CC-3	7062P	50
	CC-4	7062P	50
(4)	CCH-1	7062P	100
	CCH-2	7062P	100
(5)	1A-1	7063P	1000
	1A-2	7063P	1000
	1A-3	7063P	1000
	1B-1	7063P	1000
	1B-2	7063P	1000
	1B-3	7063P	1000
	1C-1	7063P	1000
	1C-2	7063P	1000
	1C-3	7063P	1000
	1D-1	7063P	1000
	1D-2	7063P	1000
	1D-3	7063P	1000
	1E-1	7063P	1000
	1E-2	7063P	1000
	1E-3	7063P	1000
	2A-1	7063P	1000
	2A-2	7063P	1000
	2A-3	7063P	1000
	2B-1	7063P	1000
	2B-2	7063P	1000
	2B-3	7063P	1000
	2C-1	7063P	1000
	2C-2	7063P	1000
	2C-3	7063P	1000

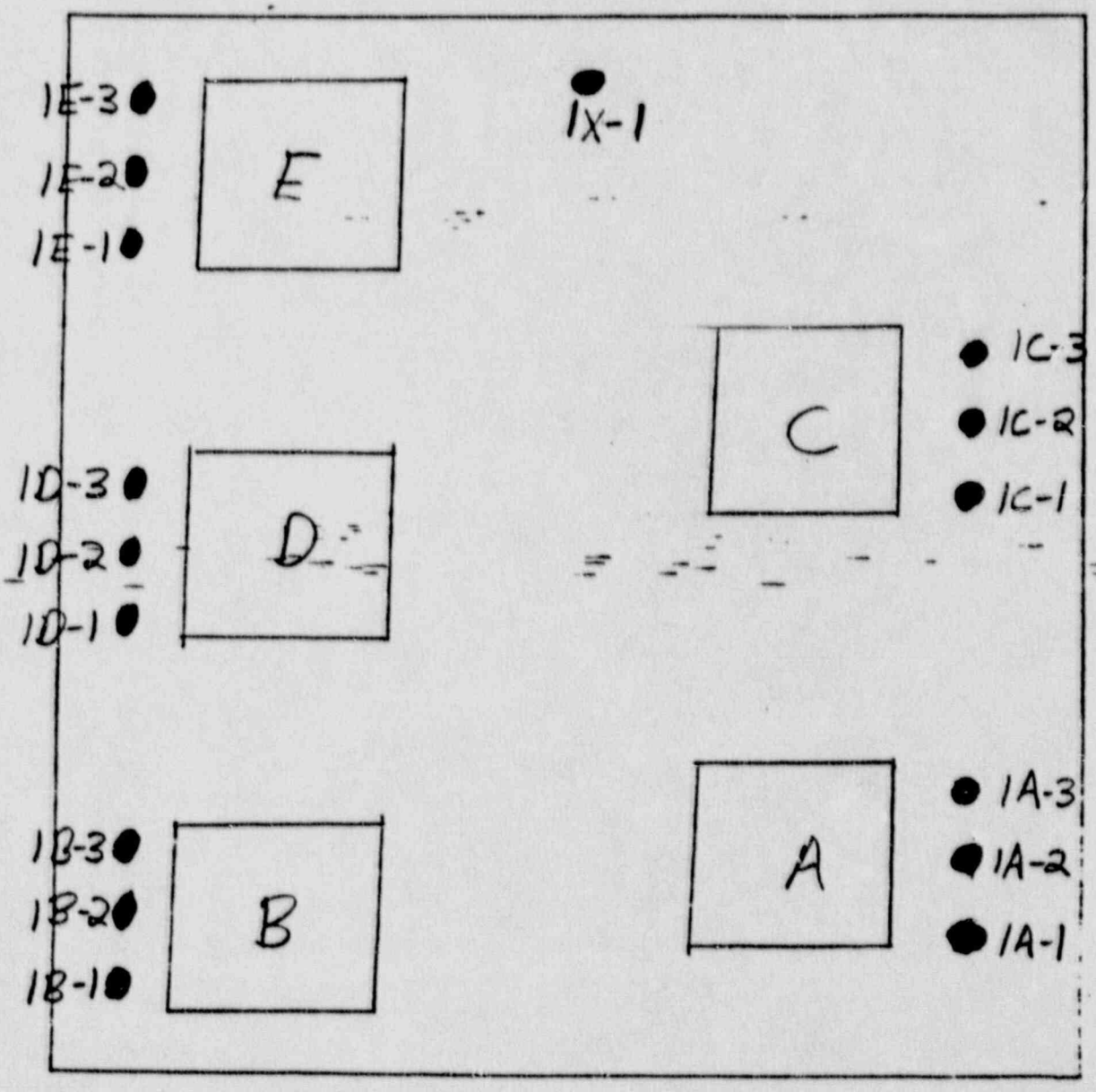
	Location Number	Source Holder Model Number	Activity
5. (5) cont.			
	2D-1	7063P	1000
	2D-2	7063P	1000
	2D-3	7063P	1000
	2E-1	7063P	1000
	2E-2	7063P	1000
	2E-3	7063P	1000
(6)	LU-1	7062P	25
	LU-2	7062P	25
	LR-1	7062P	25
	LR-2	7062P	25
	LR-3	7062P	25

Kay Ray
Unit-1 Scrubber
Nuclear Gauge Numbers

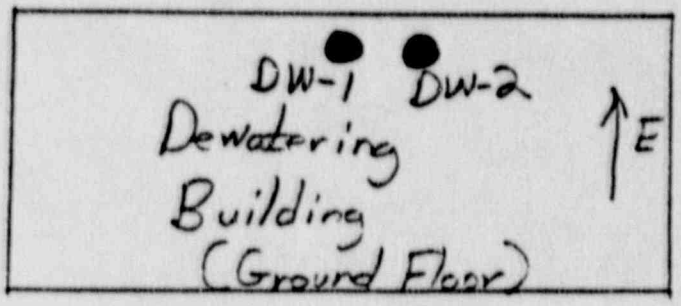


Inventory Date _____

Total Gouges Previous Inventory _____ Total Now _____

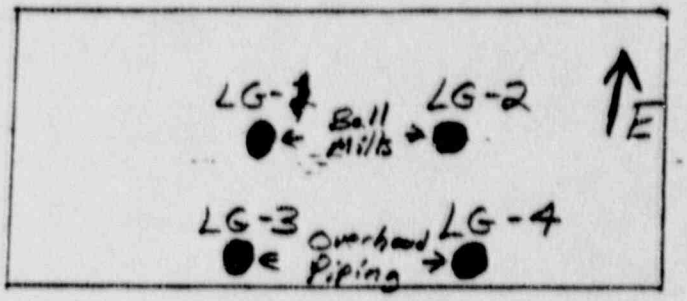


Dewatering, Limestone Grinding, & Thicken
Nuclear Gouge Numbers
Kay Ray



Inventory Dat

Total Gouges. Previous Inventory _____ Total Now _____

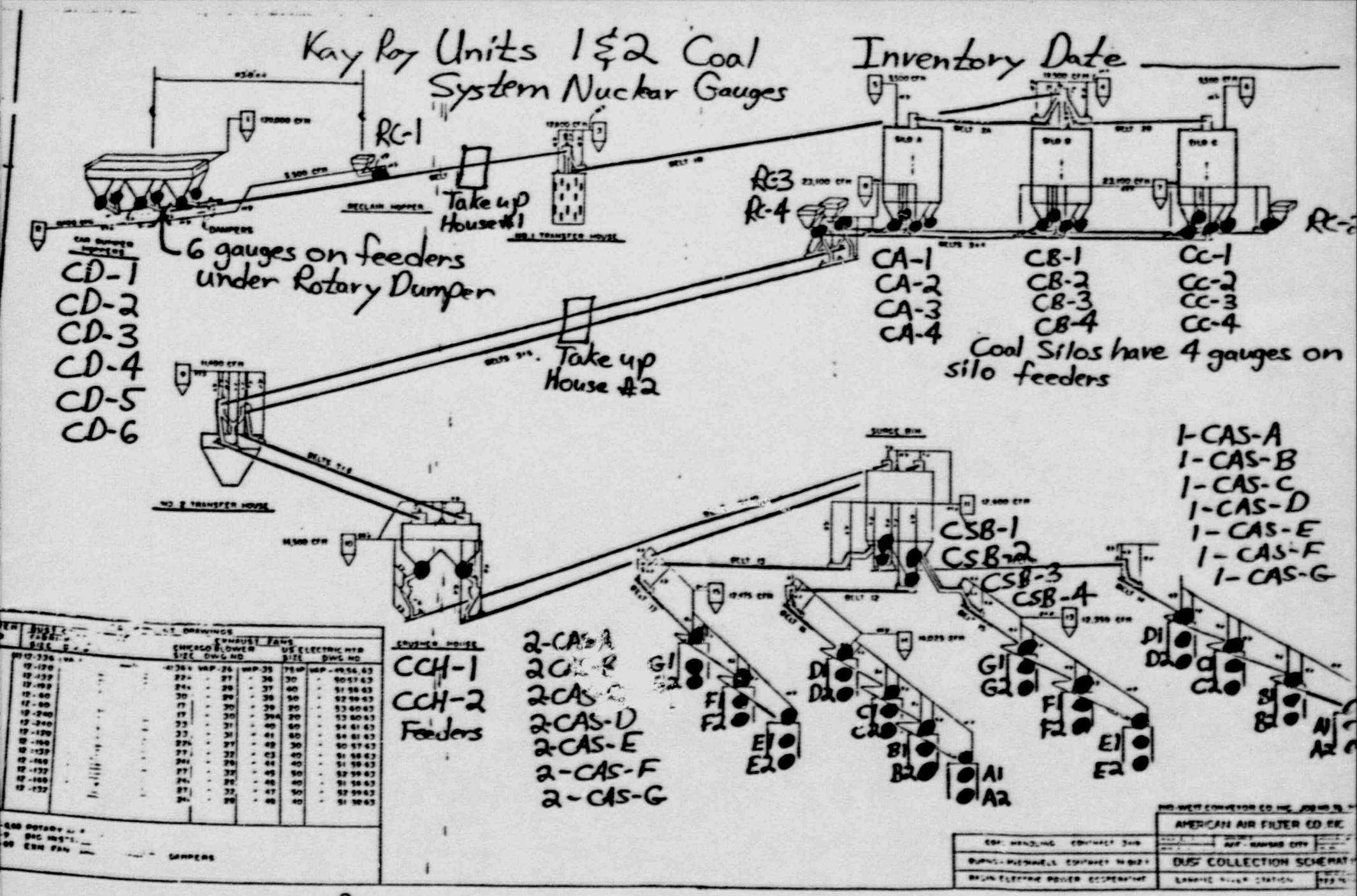


"A" Thickener "B" Thickener "C" Thickene

Two Gauges under each thickener.

Kay Roy Units 1&2 Coal System Nuckar Gauges

Inventory Date _____



Total Gauges Previous Inventory

Unit 1 _____ Unit 2 _____

Total Now

Unit 1 _____ Unit 2 _____

Unit-2 Scrubber
Nuclear Gauge Numbers

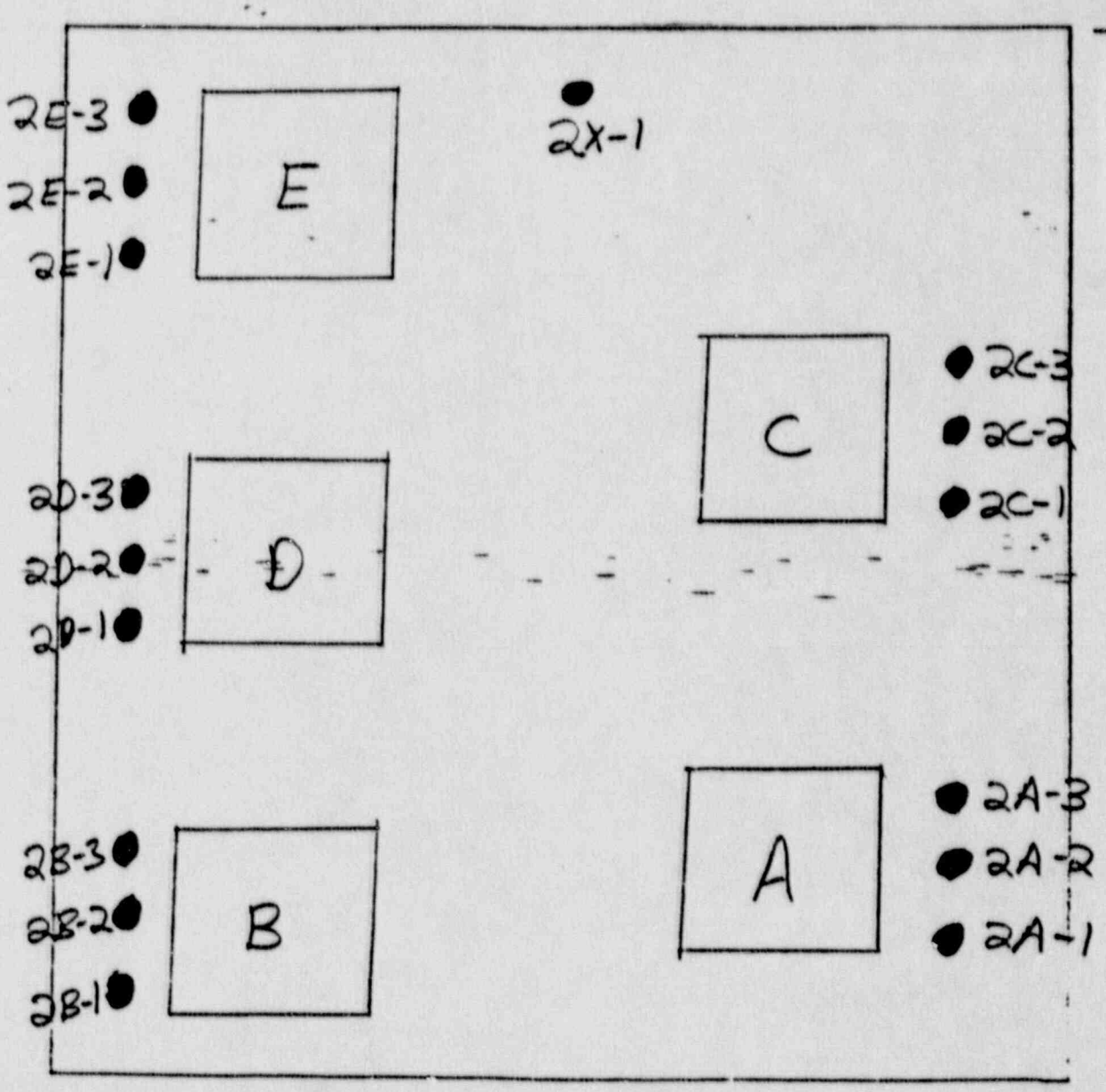
Kay Ray

E

N

Inventory Date _____

Total Gouges Previous Inventory _____ Total Now



Kay Ray
Unit # 2

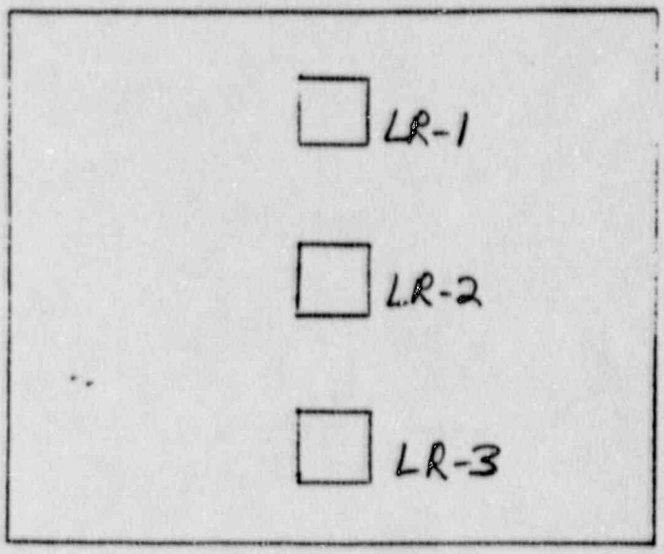
Limestone Reclaim

↑ East

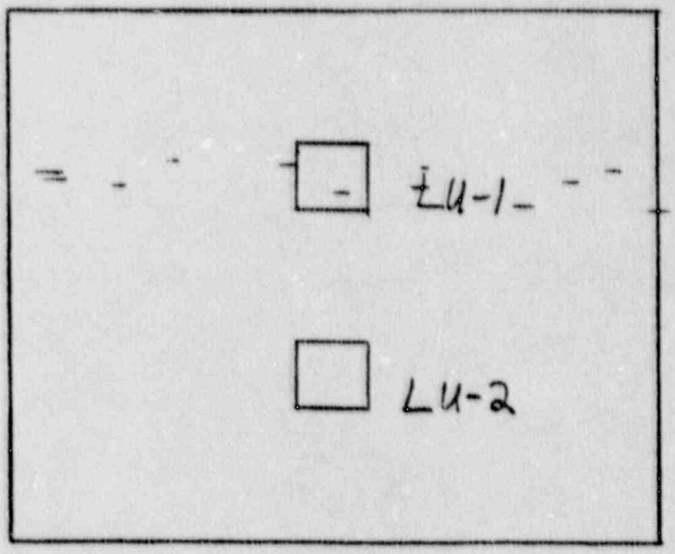
Inventory Da

Total Gauges
Previous Invents

Total Now

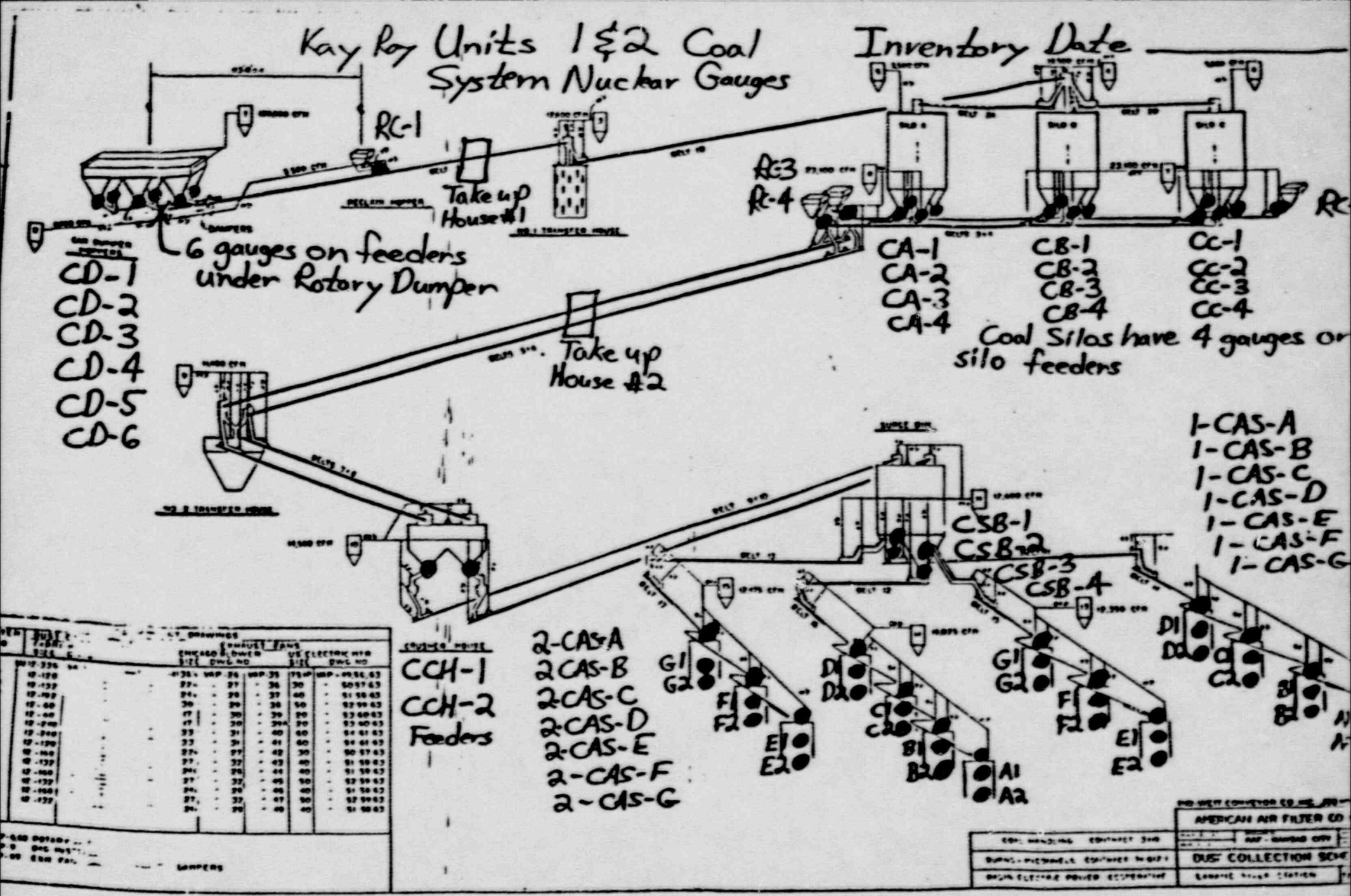


Limestone Unloading



Kay Ray Units 1 & 2 Coal System Nuckar Gauges

Inventory Date _____



Total Gauges Previous Inventory
Unit 1 Unit 2

_____

Total Now
Unit 1 Unit 2

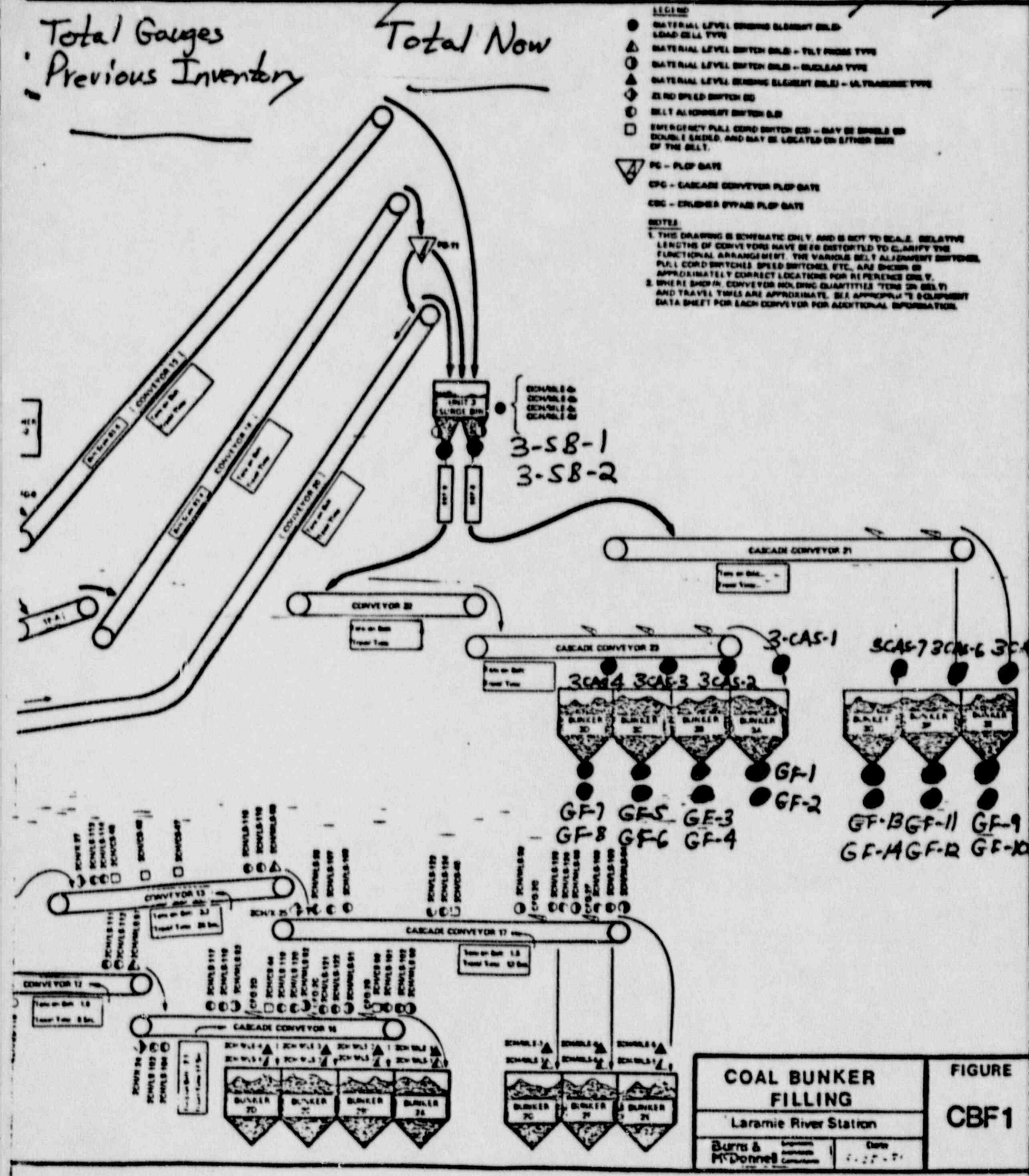
_____ _____

U-3 Coal System Nuclear Gauges

Inventory Date _____ Kay Roy

Total Gauges Previous Inventory _____

Total Now _____



COAL BUNKER FILLING	FIGURE
Laramie River Station	CBF1
Burns & McDonnell	

10. **Radiation Protection Program**

The responsibility of ensuring that the radiation sources used within the Laramie River Station plant are handled, stored, leak checked, etc. in an acceptable and approved manner consistent with Nuclear Regulatory Commission (NRC) rules and regulations, has been assigned to the Radiation Protection Officer. The Radiation Protection Officer shall ensure that:

1. appropriate labels are affixed to the devices containing necessary instructions and precautions to be followed when handling or working on or around the devices.

2. all devices are inventoried every six (6) months.

3. all devices are tested for leakage of radioactive materials, and to ensure proper operation of the shutter at no longer than three (3) year intervals. The leak tests shall be performed using an acceptable survey meter that is calibrated within 6 months of its use.

4. upon detection of device failure to operate properly, damage to a device or the detection of 0.005 mci or greater removable radioactive material, the Radiation Protection Officer shall ensure that the device is removed from operational status until repaired or disposed of in an NRC approved manner.

5. records are maintained showing compliance with the provisions of the radiation protection program, including periodic inventories, results of leak tests, instrumentation calibration, user qualifications, information concerning installation or relocation of sources, etc.

6. ensure that procedures to be followed in the event of damage to a device are made known to plant personnel, and that an emergency response plan is established to react to such an emergency.

Radioactive Device Servicing

Servicing of the radiation sources listed in item 8 will be limited to the installation, relocation, and calibration of devices. The sources will not be repaired by Laramie River Station staff. In the event of the need for repairs to a device, that device will be returned to the manufacturer or other authorized repair center.

During any installation or relocation of devices, the Radiation Protection Officer shall ensure that:

1. the device is installed in accordance with manufacturer instructions (example procedures attached).

2. proper storage is provided for devices in the event that devices being relocated or initially installed must be stored prior to installation.

3. proper lock-out procedures are followed for securing the device shutters and switches in closed or shielded positions.

4. leak tests are performed upon receipt of a device, and after installation/relocation of a device.

5. only those individuals that are designated as qualified to service the devices will perform said services.

Personnel designated to perform installation or relocation of devices at Laramie River Station:

1. Ray Sanford
2. Brian Larson
3. Steve Allen

10. continued

INDUSTRIAL DEVICE INSTALLATION

For this procedure, "installation" will mean in all cases the surveying, leak testing and insuring the integrity of the device being installed. Some devices are shipped and authorized so that the user may already have physically mounted the device. If this is the case, proceed with the installation surveying, leak testing and instructing of the user personnel. If the device is not authorized for the user to physically mount, then installation starts with the shipping container. Each separate placement or relocation is to be interpreted as a new installation.

Installation of industrial devices may be conducted only by those persons who have a specific license condition authorizing them to perform this work. The authorized individual must be equipped with an appropriate survey meter for the type of source and calibrated leak test standards, and must be physically present at the site during the entire installation.

Inspection and Installation Procedure:

1. Survey the shipping box or crate at the storage location to determine if damage has been done during transportation.

2. Remove the outer cover of the box or shipping crate but do not remove the unit from the base skid. Visibly inspect the unit for transportation damage, particularly the locking mechanism and shutter integrity.

3. Conduct a brief radiation survey to insure the security of the source and shutter.

4. If visible damage is evident, the unit should be leak tested for contamination. Damage or any degree of contamination precludes installation and Texas Nuclear Health Physics should be notified immediately. Following this inspection, the device may be transported to job location and mounted.

5. The installer shall assure that the devire shutter is in a closed, locked condition and supervise the mounting of the device in its proper location.

6. A radiation survey will be made by the installer in accordance with the appropriate survey pattern sheet and the original furnished the user as a permanent record.

7. The installer will conduct a leak test and complete the appropriate leak test certificate. The original should be furnished the user as a permanent record.

8. The installer will insure that individual users are furnished the information listed on the Installation Check List.

10. continued

LEAK TEST PROCEDURE QT/1S

QT/1S is designed for use by service people in the field and individuals who have received specific hands-on-training in its application. The gauge should not be dismantled or disassembled in order to leak test. Testing of the external seams, flanges and end plate is adequate.

1. If the gauge has a movable shutter, position the shutter actuator to the closed position. In the event that the shutter actuator is frozen, or appears damaged, notify Texas Nuclear Division, Health Physics Department (512/836-0801, Ext. 310).

2. Refer to "Calculations for Leak Testing" before proceeding. Remove the end cap from the end window of the G.M. Survey Meter, Model 2652, or its equivalent, and with the use of the appropriate certified standard source, calibrate the unit on the proper scale. Insure that the most active side of the source faces the meter (the labeled side).

3. Obtain as many cotton-tipped applicators as indicated on the applicable drawing and slightly moisten. (Use water, alcohol or other solvent.)

4. With the shutter closed, wipe the areas of the source housing assembly at the locations designated on the appropriate drawings (care should be taken not to touch the Q-tips with the fingers following wiping operation)

5. Carefully place the swab end of each Q-tip in exactly the same position as the standard source and read the results. The degree of removable contamination may be readily evaluated by the method referenced above. The highest reading obtained should be used in making the calculation.

6. A leak test certificate should be completed and filed as a permanent record of your leak test. Amounts of radioactivity found should be recorded in microcuries (μCi). However, if no radioactivity is detected it is preferable to record the results as < (less than) the minimum detectable amount as opposed to zero. (e.g., <0.003 μCi).*

7. One should send the wipes to a counting laboratory for additional analysis if any contamination appears on the wipes. Notify Texas Nuclear for instructions.

8. Note: Generally it is advisable to use a certified standard source containing the same isotope as that being tested. However, this is not always necessary where the isotope is an energetic gamma emitter, e.g., Cs-137 standard will work for Co-60, Ir-192, Ra-226, etc., because these isotopes have higher exposure rates/μCi than Cs-137.

* Leak Test Certificates furnished customers should include background reading and the meter reading of the certified standard source on the certificate.

CALCULATIONS FOR LEAK TESTING (07/15)

The following technique can be used to assess the presence of small amounts of radioactive material necessary during leak testing of gauging devices, using a Texas Nuclear Model 2652 Portable Survey Meter or equivalent that has the necessary sensitivity to detect 0.005 μCi or less of almost all gamma emitting isotopes and beta emitting isotopes with Emax greater than 80 KeV.

1. Turn on unit; check battery, verify unit operation and calibration using the supplied check source.

2. Place the appropriate certified standard source (Cs-137, Ra-226, etc.) disk on a clean flat surface and position the open end of the G. M. Tube over it and as close as possible without damaging the thin window. No fixture is necessary if the source is simply centered under the window. Set the range selector to give an approximate mid-scale reading. Note and record the observed readings; M_1 (in either c/m or mR/h).

3. Remove the standard source away a few feet. With the G. M. probe in the same position, note and record the background (Bkg.) radiation in the same units as M_1.

4. Each swab end of the cotton-tipped applicators used in wiping the gauge is in turn placed in the same geometrical position as the above-noted standard. Note and record the observed meter reading, M_2. M_1 and M_2 must be taken in the same units.

5. To determine the degree of contamination in microcuries, a simple expression of proportionality is used:

$$\frac{A}{M_1} = \frac{C}{M_2} \quad \text{or} \quad C = A(\mu Ci) \times \frac{M_2\ (mR/h)}{M_1\ (mR/h)} \quad \text{where}$$

A = activity of certified standard source in microcuries (μCi);

C = amount of removable contamination in microcuries (μCi); to be calculated

M_1 = survey meter reading with calibrated source in place in either milliroentgens per hour (mR/h) or counts per minute (cpm); minus backgrou

M_2 = survey meter reading with swab in place in either mR/h or cpm minus background

Bkg. = survey meter reading with neither source nor swab near the G.M. probe in either mR/h or counts cpm. This should be subtracted as stated, however, the result can't be zero. Background will determine the lowest detectable level (conservatively taken as 2 times Bkg.).

FIELD VERIFICATION OF RADIATION INSTRUMENTATION CALIBRATION

This procedure is applicable to the most commonly used field survey instrument at Texas Nuclear, namely the end window GM tube Model 2652. This instrument is used by all service personnel in the installation of devices containing gamma emitting isotopes.

The instrument properties, its physical construction, the effects of shock, sound, vibrations, switching transients, etc. are well known. The characteristi that need to be checked and verified in the field prior to making radiation surv and leak tests are precision, that is reproducibility of repeated measurements, accuracy, sensitivity and its linearity.

Tests for these items should be repeated routinely, particularly because instruments in travel are subjected to such physical abuse. This precision calibration should be completed prior to or soon after going on any job site for the installation of gauging devices. This periodic recalibration is distinctly different from the in-house calibration. The in-house calibration should be performed any time the instrument is in for maintenance or repair or any time the instrument readings differ from those established by this procedure by more than ± 20%.

At the time the primary instrument calibration is completed, a Ra-226 check source is assigned and read on that instrument. The two widely different (e.g., 50 mR/h side I and 1.5 mR/h side II) readings are recorded in the instrument backplate where the source is stored.

The field calibration procedure then is as follows:

1. Remove the instrument to a relatively low background area.

2. The equipment necessary would be the instrument itself, the check source supplied and a small 6" pocket steel ruler.

3. Set the instrument on a flat surface, check the battery and adjust if necessary. Remove the end cap, measure and record the background radiation.

4. Place the highest reading side of the check source on the meter probe. One does not have to be very careful on the newer models since the screen protects the probe. For old models with an unprotected end window, one is cautioned to exercise care to keep from destroying the tube. With the highest reading side down on the end window and positioned symmetrically with the probe, verify that the instrument is reading the same as that stamped inside the back cover ± 20%.

5. By using the pocket steel ruler as a brace, move the source approximately 1/4" above the end window and you should have a reading on the highest scale that is also verifiable on the 30 mR/h scale. A typical example would be that the check source reads 50 mR/h in contact with the meter probe, and at 1/4" or so away it should drop to 25 mR/h, which is verifiable on the 30 mR/h full scale.

6. Move the source until it is approximately an inch away, and one will have a reading of less than 10 mR/h which means you can verify the instrument calibration on the 100 mR/h scale, the 30 mR/h scale and now the 10 mR/h scale. Reading scale to scale should be within ± 10%.

7. At approximately 2" away on the 10 mR/h scale another reading is produced which could be verified on the 3 mR/h scale.

8. Turn the source over and place the lower reading side in direct contact with the meter probe. Verify that this reading is the same as that stamped inside the instrument. This reading should be approximately mid-range on the 3 mR/h scale. The lower side of the source can also be used to verify the instrument to the 10 mR/h scale.

9. Slight separation of about one inch will allow readings on the 1 mR/h scale that are verifiable on the 0.3 mR/h scale. Separation of about 3 inches will allow you to get down onto the 0.1 mR/h scale.

10. The leak test standard, that is the certified 0.005 microcurie standard should produce another check source reading on the 1 mR/h or 3 mR/h scales.

11. This procedure performed routinely prior to entering customer job sites, or very soon thereafter on installation work, will allow one to have confidence in the accuracy of the meter readings taken during survey and leak test work. Without this detailed calibration of the instrument on all scales questionable readings could be obtained.

13. In the performance of this calibration verification work, if the instrument readings deviate by more than ± 20% from those expected, that is those readings taken at the time the instrument and source were calibrated the instrument must be removed from service and brought back or returned to Texas Nuclear for repair and re-calibration.

11. Sources to be disposed of will be returned to the manufacturer.