0812

Medical Center

508 Fulton Street
Durham, NC 27705

Veterans Administration

'84 DEC 10 P3:36

.November 27, 1984

Ms. Helen Malaskiewicz (115A)
VA Central Office
Washington, D.C. 20420

SUBJ: Incineration of radioactive waste

1. Enclosed is a letter with two copies requested by Ms. Sandra McDonald at the Nuclear Regulatory Commission to complete the packet concerning our request for incineration of radioactive waste.

2. Please forward this letter to Ms. McDonald for us.

B. F. Brown
Medical Center Director

Enclosures

DEC 06 1984

JAMES [illegible] SMITH, M. D. (115)
Director, Nuclear Medicine Service
VA Central Office
Washington, D.C. 20420

8603210323 860228
REG2 LIC30
32-01134-01 PDR

In Reply Refer To: Nuclear Medicine (114B)

STATE OF NORTH CAROLINA
DEPARTMENT OF HUMAN RESOURCES
Division of Facility Services
P. O. BOX 12200 RALEIGH 27605-2200

JAMES B. HUNT, JR.
GOVERNOR

SARAH T. MORROW, M.D., M.P.H.
SECRETARY

I. O. WILKERSON, JR.
DIRECTOR
TELEPHONE

(919) 733-4283

November 20, 1984

Mr. B. F. Brown
Medical Center Director
Durham VA Medical Center
508 Fulton Street
Durham, N.C. 27705

Dear Mr. Brown:

This Agency reviewed your letter with application dated July 30, 1984 concerning the incineration of low-level radioactive waste from the VA Hospital. Since the VA Hospital is a federal facility located on federal property, all receipt, use, and disposal of radioactive material is regulated by the Nuclear Regulatory Commission. For the above reason, no action was taken on your application.

Your application should be directed to the Nuclear Regulatory Commission, Region II, 101 Marietta Street, N.W., Atlanta, Georgia 30323, Attn: Mr. Paul Guinn.

If I can assist you further in this matter, please let me know.

Sincerely yours,

Cecil B. Brown

Cecil B. Brown, Head
Radioactive Materials Branch
Radiation Protection Section

CBB/lnh

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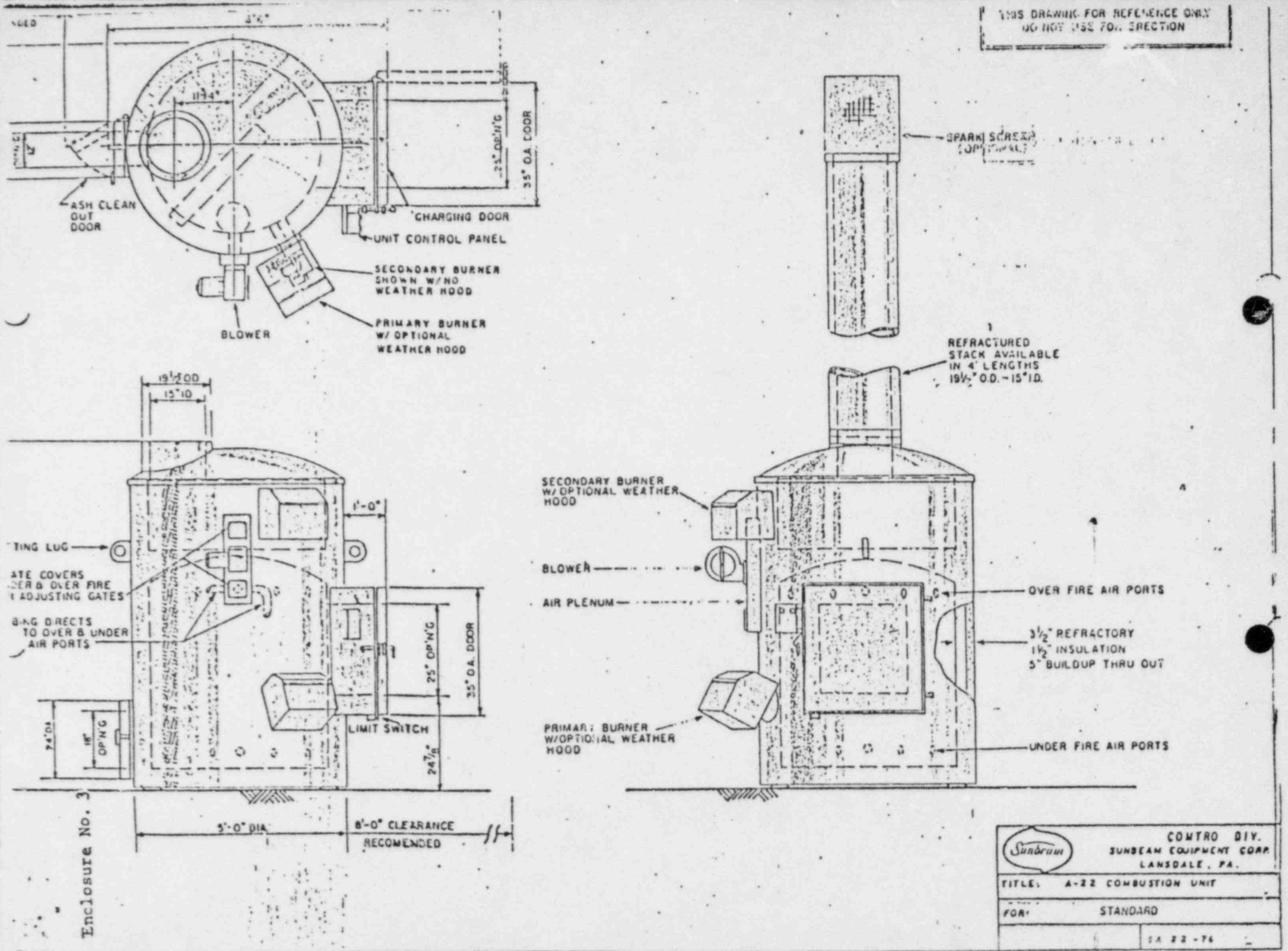


Enclosure No. 3

Standard Specifications
MODEL A-22 Pathological

Burning Capacity Type 4	-	290 lbs. per hour
Burning Capacity Type 0	-	170 lbs. per hour
Burning Capacity Type 1	-	220 lbs. per hour
Burning Capacity Type 2	-	320 lbs. per hour
Hearth Area	-	12.5 sq. ft.
Primary Volume	-	56.70 cu. ft.
Secondary Volume	-	19.64 cu. ft.
Charging Door	-	25" wide x 25" high effective opening. Free swing refractory lined door.
Ash Door	-	12" wide x 18" high effective opening. Free swing refractory lined door.
Burners	-	a) Primary - One (1) J-120 - 50,000 to 1,200,000 adjustable burner. b) Secondary - One (1) J-80 - 50,000 to 800,000 adjustable burner.
Electrical Requirements	-	110 volt, 60 cycle, single-phase, 20 amp.
Gas Requirements	-	5" to 15" W.C. at combustion unit. Maximum gas consumption natural gas 2,000 cu. ft. gas per hour.
Shell	-	3/16" steel plate
Refractory	-	3-1/2" castable 2600° service temperature. 1-1/2" block insulation 1900° service temperature.
Controls	-	Weatherproof Nema box with two timers located at charging door. 0-60 minute timer for the primary burner and 0-20 hour timer for the secondary burner Temperature controller with thermowell high-low burner control in the priamry chamber. Limit switch on the charging door turns off the primary burner when the charging door is open.
Air Supply	-	1/3 HP blower with external air flow, adjustable va
Approximate Weight	-	8800 lbs.
Paint	-	One coat high heat primer. One coat high heat blue modified silicon.
Stack	-	Minimum of two (2) 4' long refractory lined sections, 15" I.D. x 19-1/2" O.D. required.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
ENVIRONMENTAL HEALTH SERVICE
NATIONAL AIR POLLUTION CONTROL ADMINISTRATION

Date: September 1, 1970

Reply to Attn of: FF - DA

Subject: Compliance Test - Comtro Inc., Model A-20 incinerator

To: All Federal Agencies

1. We have received a report prepared by an independent testing concern on the compliance test of the Comtro, Model A-20 incinerator, manufactured by:

Comtro Inc.
North Wales, Pennsylvania 19454

2. The test results show that the incinerator will meet the emission standards in the Code of Federal Regulations (42 DFR 76.8) when burning Type 4 waste and based on the test results and a comparison of design parameters, it is believed that the following incinerators will meet Federal emission standards while operating at the rated capacities shown below:

Model	Capacity lb/hr	Primary Burner Input BTU/hr	Secondary Burner Input BTU/hr
A-20	100	400,000	400,000
A-22	300	600,000	600,000
A-25	400	1,200,000	800,000
A-26	450	1,600,000	800,000
A-35	800	2,800,000	1,200,000
A-39	1350	3,200,000	1,200,000

Contact the Emission Testing Branch of the Environmental Protection Agency if additional information concerning the test report and/or the evaluation is required. The manufacturer should be contacted if information concerning design details is desired.

Sincerely yours,

Peter R. Westlin

Peter R. Westlin
Emission Testing Branch
Applied Technology Division

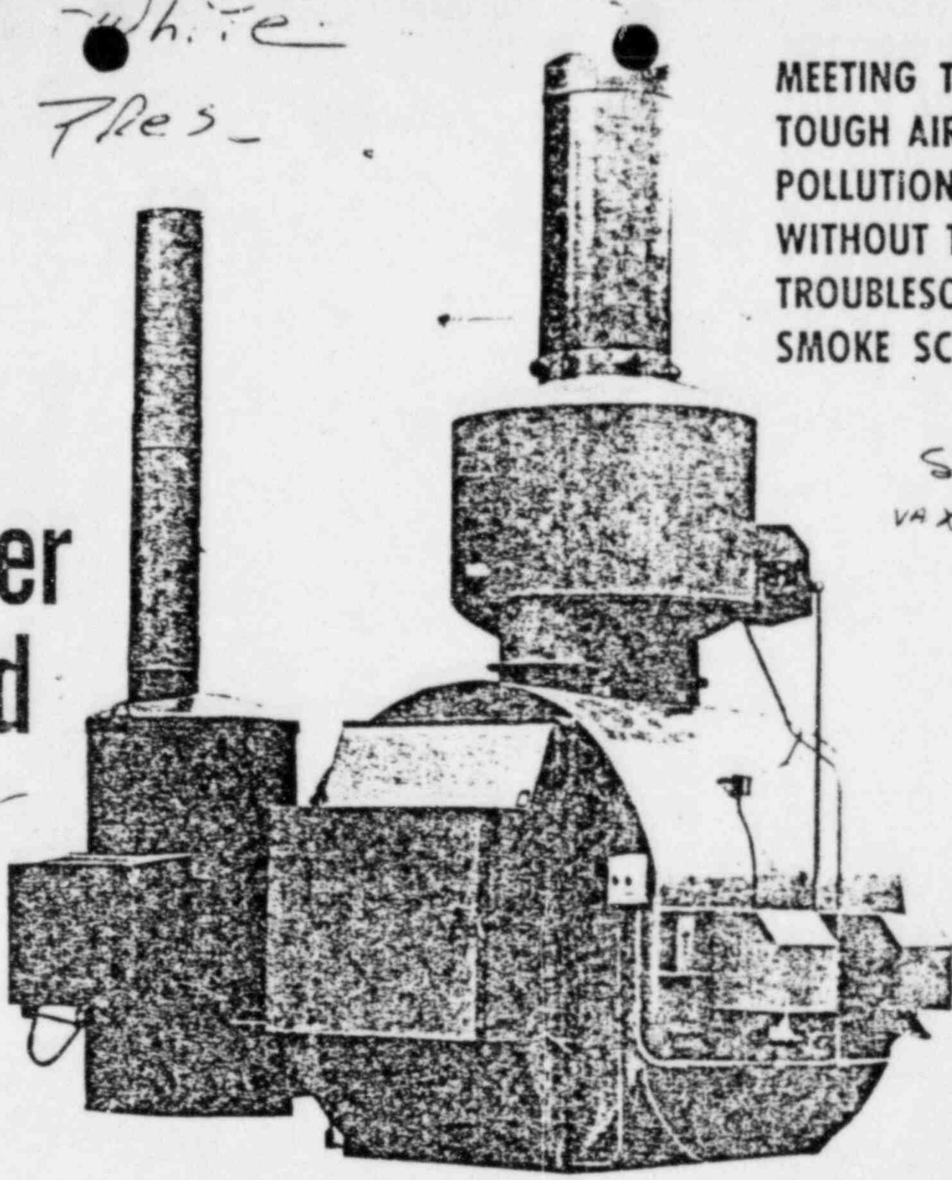
Gene White
Vice Pres

MEETING TODAY'S TOUGH AIR POLLUTION CODES WITHOUT THE USE OF TROUBLESOME WET SMOKE SCRUBBERS

Specification
VA X1429

Computer Selected

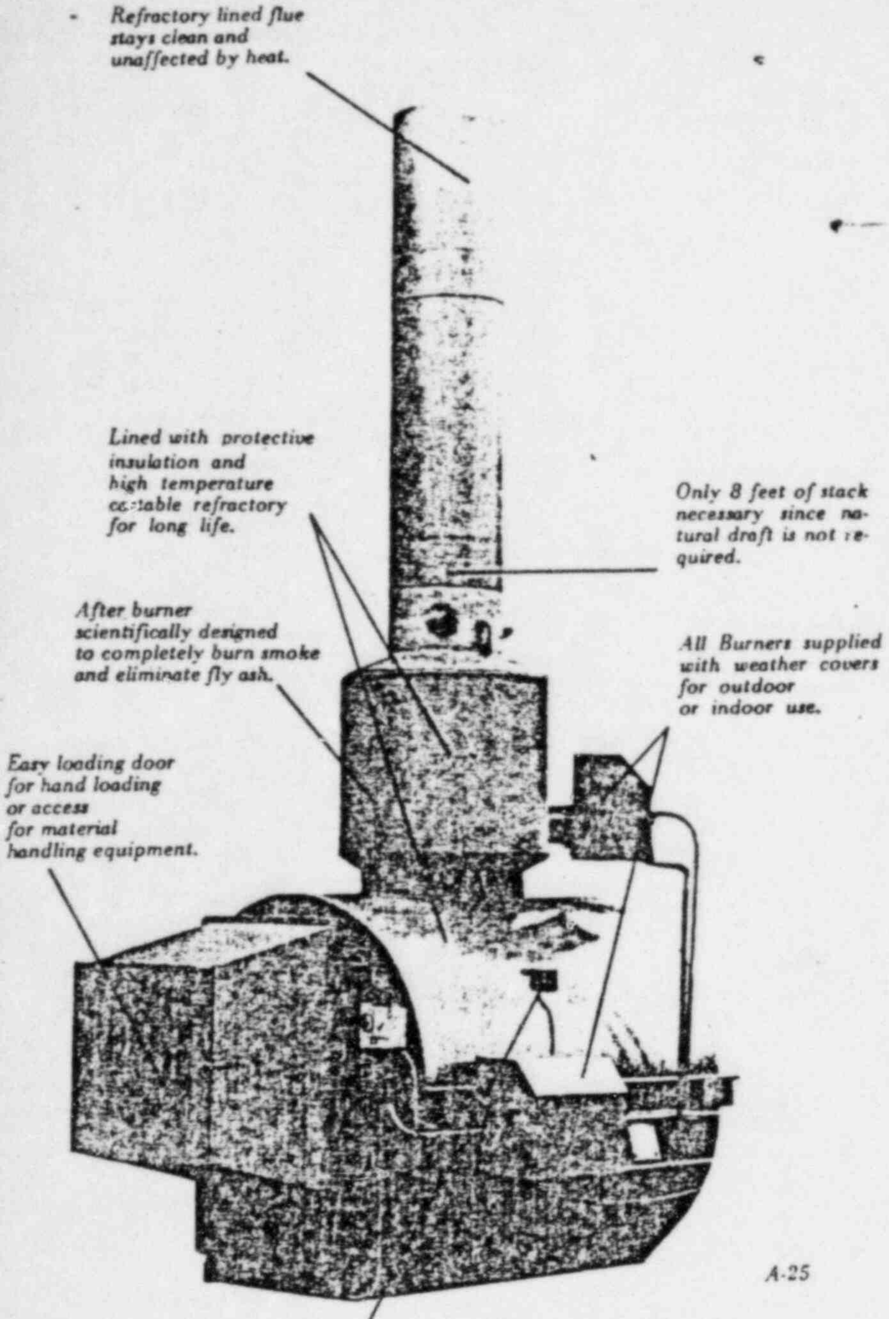
New Bldg
#14



COMTRO

Controlled Combustion Units

North Wales
Pennsylvania 19454
(215) 699-3421
a subsidiary of Stainless Inc.



A-25

Completely packaged units built on skids for easy installation or future relocation.

Pyrometer for complete temperature and fuel control. When waste is supplying its own BTU's no other fuel is needed for combustion.

COMTRO RATED CAPACITIES

MODEL	A-20	A-22	A-25	A-35	A-39
#1 Waste lbs. per hr.	155	220	190	550	900
#2 Waste lbs. per hr.	230	320	250	800	1350
#0 Waste lbs. per hr.	115	170	130	420	600
Pathological lbs. per hr.	100	300	400	800	1300
Estimated weight pe: unit	4900	6200	9100	19400	26500

#0 Waste – Highly combustible paper, wood and including no more than 10% treated paper, rubber and plastics.

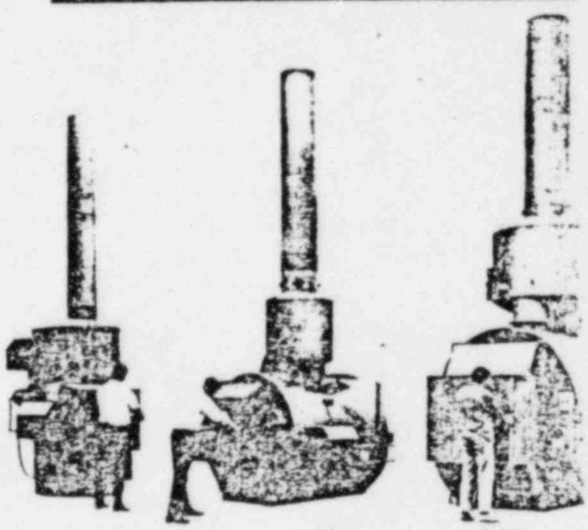
#1 Waste – Combustible waste paper, cartons – rags and floor sweepings – 25% moisture.

#2 Waste – Rubbish and garbage – 50% moisture.

#3, 5, & 6 Waste capacities on request.

Capacities can vary depending on degree of compaction, percentage of moisture and also if the waste is to be manually or automatic loaded.

LARGER UNITS AVAILABLE ON SPECIAL ORDER



A-20 A-25 A-39

Comtro Controlled Combustion Units are made in five basic sizes. These sizes are useable for a wide range of capacities. Experience has shown that units of these capacities (see table at left) can handle the refuse disposal requirements of institutions, supermarkets, industrial plants, etc., under normal operating time cycles. Comtro will gladly discuss any requirements in excess of those covered by these units.

Clean heat is carried off swiftly into atmosphere through ref[illegible] lined flue.

Here again, Comtro's exclusive design, creating circumferential circulation, extends the time of combustion for complete combustion before releasing clean heat into the flue.

The after-burner unit is also tangentially mounted to retain turbulence and combustibility of any unburned solids or unburned gases causing smoke. Complete combustion is accomplished in the after burner section. No smoke or fly ash is left to go out the flue.

Over-fire and under-fire air is constantly forced in by blower to accelerate and aid turbulence and to support complete combustion.

The flame of the burner unit is directed tangentially at material as it falls to floor of the combustion chamber. Thus immediate combustion and turbulence are accomplished. Flame from burner creates a circumferential circulation which does not allow waste to pack tightly or gather on floor. The waste is blown apart from the force of the flame and becomes surrounded by flame and kept in a constant combustible environment for sufficient time, which has been extended by the circumferential circulation.

All burner units are a standard packaged product produced by a reputable manufacturer. The burners are adjustable over a wide range of capacities to properly incinerate varying charges with maximum efficiency. These burners are not draft sensitive. Superior safety characteristics are built-in.

All Comtro units have fool-proof semi or fully automatic control systems. By use of a limit switch on the unit door or automatic loader, we automatically control air flow, proper temperature and gas retention time. All control components are commercially available.

COMTRO

Controlled Combustion Units

Engineered for your *waste disposal problems*

The disposal of waste material, trash and rubbish has become one of today's major problems. The high cost of "Rubbish Men" with litter, odors, disruptive and uncertain time of pick-up; with space at a premium; with concern over disposal of confidential matter for security; these all become factors worthy of consideration.

Many of those concerned are finding that on-site disposal can be the better, less costly and more convenient way to handle trash. And they are finding Comtro Controlled Combustion Units, which have been engineered and researched by a staff of combustion engineers and materials handling engineers with over two decades of experience, to be a practical, economical solution.

Whether it's your existing location or you are contemplating a new structure, our engineering staff will assist you, through our dealer, with all of the details of locating and installing a Comtro unit.

Competent assistance can also be given in the form of a survey of your disposal problem. The survey will show advantages, such as lower monthly cost (quick write-off) compared to the permanently mounting monthly costs using the rubbish truck. Also the advantages of various purchase plans including a liberal lease-purchase plan which will enable you to benefit from having a new, modern "Air Pollution Approved" Comtro Controlled Combustion Unit.

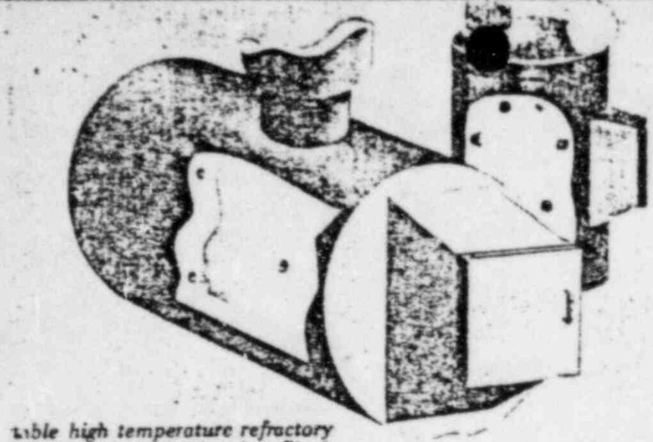
Great care has gone into the design of every part of Comtro Controlled Combustion Units. Some of the features have been highlighted above.

The burners with which each unit is equipped have superior safety characteristics, as follows:

1. Proven blower operation — Blower motor must be in operation before gas valves will energize.
2. Burners have high-temperature safety as an integral part of its safety system.
3. Separate pilot flame proving — pilot flame must be electrically proven prior to energizing the main gas valves.
4. Blowers are computer selected to provide the precise amount of air to completely consume smoke and fly ash.

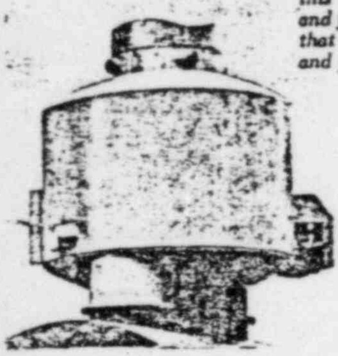
These superior burners also take advantage, through the design of the total unit, of the forward velocity of the flame which penetrates and causes turbulence to the charge for uniform drying and ignition.

No Grate Design: There are no grates to clog or clean. Only occasional cleaning of a fine powdery ash or small non-combustible clinker is necessary.



ɩable high temperature refractory
ɩg of combustion chamber. Block
ɩlation is waterproofed and an-
ɩed to allow necessary movement.
ɩkness of castable insulation has
ɩ computer determined. Thus you
ɩ long life and cool operation
ɩ every Comtro Unit.

After-burner — Of similar construction as the main combustion chamber, this unit reburns the smoke, gases and fumes, producing a stack effluent that is smoke and odor free. Servicing and parts replacement are simplified.



Computer Selected

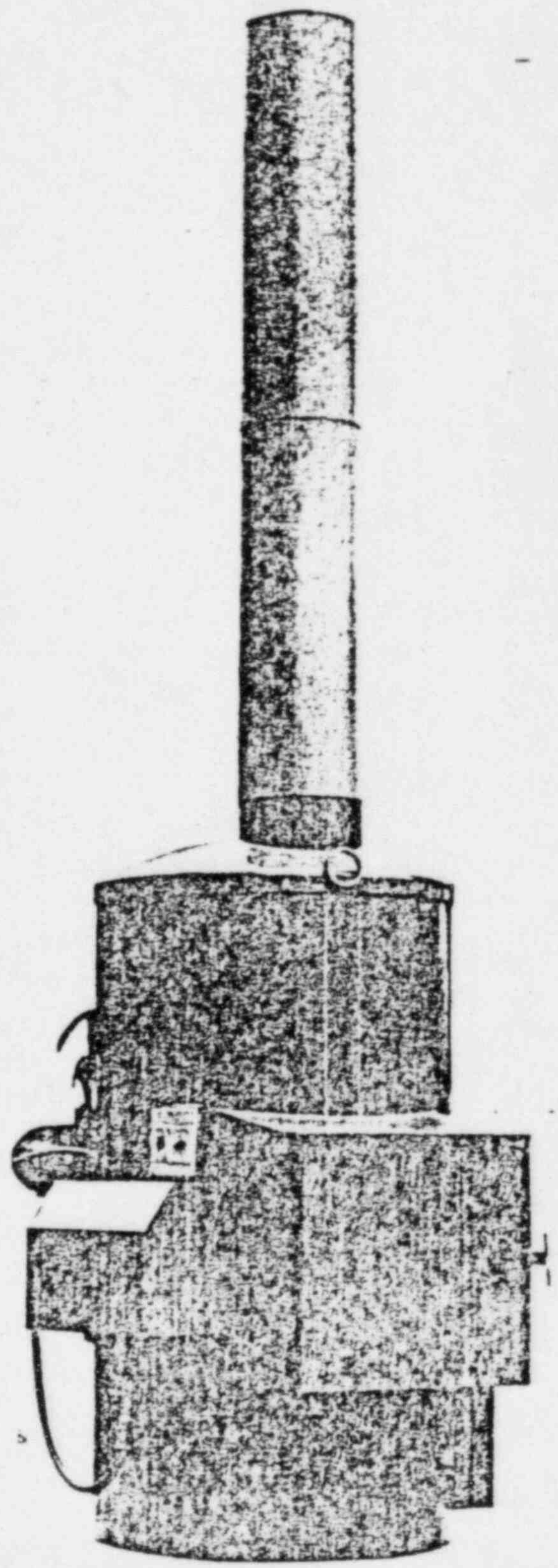
Comtro combustion engineers were assisted in the design stage by our company owned 1130 I.B.M. computer, and continue to use it effectively in their research and development projects.

Each waste application is calculated for capacity rating by computing temperature, volumes, velocities and BTU input to insure proper sizing and overall design of each Comtro Controlled Combustion Unit.

COMTRO

UPRIGHTS **A-20 & A-22**

The Ideal Answer for Schools, Nursing Homes, Hospitals or Pathological Laboratories, Light Industry, Drive-ins, Restaurants, Veterinarians, or anyone with dry or wet waste.



Your waste disposal need not be a problem.

Hospitals.

The special problems of urban and suburban hospital waste disposal can be overcome with a Comtro Unit. All normal trash, garbage and medical and pathological waste can be disposed of and still maintain health and air pollution standards. Operating costs can be lowered considerably over the present compacted container waste disposal methods in practice in many hospitals today.

Industrial Plants.

Many plants produce a mixed rubbish of paper, cardboard, etc. Others have specific waste disposal problems relating to their production. Comtro Controlled Combustion Units can dramatically reduce waste disposal costs for all types of waste. Plastic molders, paper mills, furniture plants, etc., can all benefit. Materials handling equipment can be supplied for specific requirements.

Supermarkets, Drive-ins, Restaurants.

Paper and boxboard packaging, bags, sacks, vegetable and other organic waste can be disposed of without adding to the labor force. Contract pick-up costs can be eliminated, space utilized better and unsightly odorous piles of trash eliminated. Comtro units are available for thru the wall, inside, outside and automatic loading.

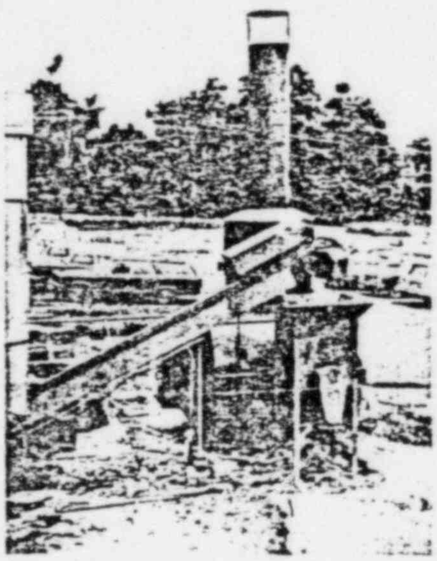
Airports.

The trash collected daily at large airports from workshop and ramp areas, coffee shops and restaurants, etc., can all be disposed of at low cost. . .without separation. . .without creating a safety hazard and by present labor with a Comtro Controlled Combustion Unit.

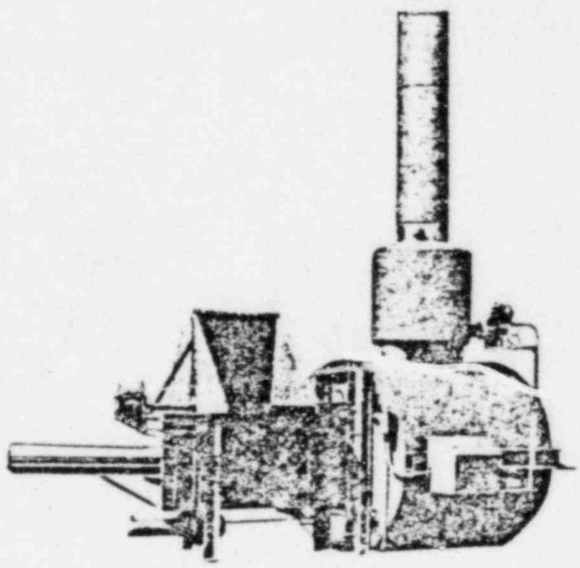
A full line of packaged standard waste material handling equipment available for Comtro Controlled Combustion Units

Tested and Approved.

Comtro Controlled Combustion Units have been thoroughly tested by United States Testing Company, Incorporated, Hoboken, N.J., and others to T-6 and H.E.W. test methods, for particulate emissions in connection with the amount of waste fed, and their findings show that Comtro equipment far exceeds all federal, state and local air pollution requirements without the use of wet scrubbing equipment. Copies of these tests are available on request.



A-35 with Screw Feed



A-25 with Rotor Compactor

AUTOMATIC LOADERS A standard package loader available for every need.

1. Comtro Rotor Loader Compactor for super market and accounts with large cardboard box accumulations.

2. Comtro In Line Loader Compactor for light industry, hospitals, nursing homes, restaurants and schools.

3. Comtro Heavy Duty Hopper Loader Compactor for heavy industry waste which may include pallets, light gauge steel strapping and lumber.

4. Comtro Screw Feeders for sludge, plastic and any screw adaptable waste.

5. Combustible Liquid Feeders using pumping or atomizing techniques in conjunction with solid waste burning.

6. Hopper Type Air Lock Feeders for sawdust, and other light granule waste.

7. Thru-the-wall manual or automatic loading is available to eliminate internal theft via rubbish box.

All our automatic loaders are adaptable to your present or future materials handling systems.

WARRANTY "Comtro, Inc. guarantees all materials and components of Comtro units designed, manufactured or assembled by Comtro under proper and normal use, (erosion, corrosion and spark ignitors excepted) against defective design and workmanship for a period of one year after shipment (except such items as motors and electronic equipment, on which Comtro's suppliers' guarantees of 90 days shall apply) and agrees to repair or replace all such materials or components F.O.B. our plant. Such repair or replacement by Comtro Inc. or its dealers constitutes a discharge of all Comtro Inc. liabilities. The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral or implied." Dealer shall provide to his customer all warranty services without obligation on the part of the Manufacturer in connection with the foregoing warranty including the installation of warranted replacement parts supplied by the Manufacturer.

COMTRO INC.

North Wales Pennsylvania 19454
(215) 699-4421
a subsidiary of
Stainless Inc.

Plants: Perkasie, Pa. and Pine Forge, Pa.
Canada: Office: Walcan Limited, Toronto, Ontario
Plant: Carleton Place, Ontario

Tomorrow's combustion unit . . . today

Installation and Service

Your local dealer who sells you your Comtro Controlled Combustion Unit will also be responsible for installation and service of your unit. Only reputable, well-established organizations capable of such services are Comtro dealers. They can be depended upon to have both the facilities and capabilities of making the installation for you with full consideration of your location, local requirements and waste disposal needs.

SOLD, INSTALLED AND SERVICED BY:

PRINTED IN U.S.A.

C 10M RLR41721D 3

Enclosure No. 5

Local Climatological Data

Annual Summary With Comparative Data

1982

RALEIGH, NORTH CAROLINA

Narrative Climatological Summary

The Raleigh-Durham Airport is located in the zone of transition between the Coastal Plain and the Piedmont Plateau. The surrounding terrain is rolling, with an average elevation of around 400 feet; the range over a 10-mile radius is roughly between 200 and 550 feet. Being centrally located between the mountains on the west and the coast on the south and east, the Raleigh-Durham area enjoys a favorable climate. The mountains form a partial barrier to cold airmasses moving eastward from the interior of the Nation. As a result, there are very few days in the heart of the winter season when the temperature falls below the 20° mark. The average length of freeze-free growing season in the area is about 210 days, the average latest freeze in spring occurring around the first week in April and the first in fall about November 1. The average date of last occurrence in spring of a 28° temperature is around March 15; of 24°, March 1. In fall the average first occurrence of 28°, is about November 20; of 24°, December 1. Tropical air is present over the eastern and central sections of North Carolina during much of the summer season, bringing warm temperatures and rather high humidities to the Raleigh-Durham area frequently during the summer. Afternoon temperatures reach 90° or higher an average of about every fourth day in the middle of the summer, but reach 100° an average of less than once per year. Even in the hottest weather, early morning temperatures almost always drop into the lower seventies.

Rainfall is well distributed throughout the year as a whole. July has, on an average, the greatest amount of rainfall, and November the least. There are times in spring and summer when soil moisture is scanty. This usually results from too many days between rains rather than from a shortage of total rainfall, but occasionally the accumulated total during the growing season falls short of plant needs. Most summer rain is produced by thundershowers, which may occasionally be accompanied by strong winds, intense rains, and hail. The Raleigh-Durham area is far enough from the coast so that the bad weather effects of coastal storms are reduced. While snow and sleet usually occur each year, excessive accumulations of snow are rare.

From September 1887 to December 1950, the office was located in the downtown areas of Raleigh. The various buildings occupied were within an area of three blocks. All thermometers were exposed on the roof, and this, plus the smoke over the City, had an effect on the temperature record of that period. Lowest temperatures at the city office were frequently from 2° to 5° higher than those recorded in surrounding rural areas. Conversely, maximum temperatures in the City were generally a degree or two lower. Thus, the average daily temperatures at the old city office exposure were not very different from those in surrounding areas. These observations are supported by a period of simultaneous record from the Municipal Airport and the city office location between 1937 and 1940.

From September 1946 to May 1954, simultaneous records were kept at a surface location on North Carolina State College campus in Raleigh, and at the Raleigh-Durham Airport 10-1/2 air miles to the northwest. Minimum temperatures of this period are generally from 2° to 5° lower at the airport; these readings are believed to be representative of the surrounding countryside, and of suburban residential areas of Raleigh and Durham. Maximum temperatures recorded at the two stations were usually identical.

noaa NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION / NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE / NATIONAL CLIMATIC DATA CENTER ASHEVILLE, N.C.

8294

Meteorological Data For The Current Year

Station: RALEIGH, NORTH CAROLINA RALEIGH-DURHAM AIRPORT # 13722 Standard time used: EASTERN Latitude 35° 52' N Longitude 78° 47' W Elevation (ground) 434 feet Year 1982

Month	Temperature °F Averages Daily maximum	Daily minimum	Monthly	Extremes Highest	Date	Lowest	Date	Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Total	Greatest in 24 hrs.	Date	Snow, Ice pellets Total	Greatest in 24 hrs.	Date	Relative humidity, pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Resultant Direction	Resultant Speed m.p.h.	Average speed m.p.h.	Fastest mile Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover, tenths, sunrise to sunset	Number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility 1/4 mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 441 feet m.s.l.
JAN	44.1	26.8	35.5	71	31	4	11	907	0	3.43	0.98	3	6.0	5.0	14	70	77	58	63	27	2.5	8.9	26	33	10	44	7.2	6	6	19	10	2	2	5	0	6	22	0	1003.4
FEB	55.1	35.9	45.5	81	24	25	14	538	0	4.97	1.40	26-27	0.6	0.6	27	71	77	61	63	35	2.5	8.8	23	35	22	44	7.2	2	13	13	12	0	0	5	0	0	4	0	1005.1
MAR	62.9	40.4	51.7	80	13	23	24	411	3	3.02	1.04	7	0.0	0.0		73	82	54	60	31	0.4	7.9	20	32	26	41	6.5	9	6	16	7	0	2	5	3	0	5	0	1003.4
APR	69.6	45.2	57.4	84	17	27	7	244	24	3.33	0.80	17	0.0	0.0		66	71	37	45	23	1.5	8.4	32	21	3	55	6.5	7	7	16	14	0	2	0	0	0	3	0	1002.0
MAY	83.8	58.1	71.0	93	30	43	1	15	208	4.70	0.93	26-27	0.0	0.0		78	80	49	63	19	1.7	5.9	21	28	29	59	6.0	7	11	13	14	0	13	3	5	0	0	0	1001.7
JUN	84.0	65.4	74.7	90	29	56	7	0	299	8.39	2.82	10	0.0	0.0		85	83	58	73	18	1.1	5.9	22	34	30	42	7.1	2	13	15	14	0	4	2	7	0	0	0	998.6
JUL	88.3	69.8	79.1	94	27	57	2	0	443	3.34	0.98	28-29	0.0	0.0		87	87	60	73	18	1.8	5.0	23	01	4	43	6.4	5	10	16	13	0	9	6	13	0	0	0	1002.0
AUG	86.4	66.6	76.5	92	25	53	30	0	363	1.03	1.07	9-10	0.0	0.0		83	84	56	73	19	1.1	4.8	16	32	17	41	6.4	4	14	13	4	0	4	2	6	0	0	0	1002.7
SEP	81.0	59.9	70.5	91	16	45	24	14	183	1.55	0.78	26	0.0	0.0		83	87	54	71	03	1.6	4.9	20	01	26	53	6.3	7	12	11	5	0	3	5	4	0	0	0	1002.7
OCT	71.1	50.1	60	85	6	34	18	182	53	3.93	2.04	24-25	0.0	0.0		87	82	51	75	03	1.5	5.8	30	36	24	49	5.6	12	6	13	4	0	0	1	0	0	0	0	1004.7
NOV	63.5	40.3	51		4	26	16	392	5	2.34	0.87	4	0.0	0.0		87	86	55	71	02	0.5	5.2	18	24	4	40	6.1	9	6	15	4	0	0	6	0	0	4	0	1007.5
DEC	57.0	38.0	47			18	14	542	7	4.02	1.66	11-12	T	T	30	84	89	64	77	20	0.2	7.2	21	01	12	29	7.2	7	6	18	11	0	0	8	0	0	12	0	1007.3
YEAR	70.6	49.7	60.2	94	JUL 27	4	JAN 11	5245	1588	44.35	2.82	JUN 10	6.6	5.0	JAN 14	79	82	55	67	26	0.3	6.6	32	21	APR 3	47	6.6	77	110	178	124	2	44	48	32	6	59	0	1003.4

Normals, Means, And Extremes

Month	Temperatures °F Normal Daily maximum	Daily minimum	Monthly	Extremes Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs.	Year	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover, tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog visibility 1/4 mile or less	Temperatures °F Max. (b) 90° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb Elev. 441 feet m.s.l.
(a)				38		38					38		38		38		38		38		18	18	18	18	33	14	29	29		28	33	34	34	34	38	38	38	33	18	18	18	18	10
J	51.0	30.0	40.5	79	1952	-1	1977	760	0	3.22	7.52	1954	0.87	1981	2.79	1954	14.4	1955	9.0	1966	73	79	55	64	8.6	SW	41	27	1971	54	6.1	9	7	15	10	1	*	*	0	3	21	*	1003.0
F	53.2	31.1	42.2	84	1977	5	1971	638	0	3.32	5.75	1961	1.00	1968	3.22	1973	17.2	1979	10.4	1979	69	76	51	57	9.0	SW	40	22	1966	59	5.9	9	6	13	10	1	1	3	0	1	18	0	1003.2
M	61.0	37.4	49.2	92	1945	11	1980	502	9	3.44	6.26	1975	1.48	1949	2.51	1952	14.0	1960	9.3	1969	71	80	50	57	9.4	SW	44	32	1967	62	5.9	10	7	14	10	*	2	2	0	*	10	0	1001.3
A	72.2	46.7	59.5	95	1980	23	1972	180	16	3.07	6.10	1978	0.23	1976	4.04	1978	T	1950	T	1950	73	81	45	53	9.1	SW	40	14	1961	64	5.6	10	9	11	9	0	3	2	1	0	7	0	1001.0
M	79.4	55.4	67.4	97	1953	31	1977	48	121	3.32	7.67	1974	0.92	1969	4.40	1957	0.0		0.0		86	87	55	67	7.6	SW	54	20	1972	59	6.0	8	10	13	10	0	7	3	1	0	*	0	999.6
J	85.6	63.1	74.4	104	1954	38	1977	0	270	3.67	9.38	1973	0.55	1981	3.44	1967	0.0		0.0		87	88	57	68	7.0	SW	39	33	1977	60	5.9	8	11	11	9	0	7	2	6	0	0	0	1000.7
J	87.3	67.2	77.5	105	1952	48	1975	0	394	5.08	10.05	1945	0.80	1953	3.89	1952	0.0		0.0		89	90	59	72	6.6	SW	69	23	1962	61	6.0	7	12	12	11	0	11	3	11	0	0	0	1001.3
A	86.8	66.2	76.5	101	1953	46	1965	0	372	4.93	10.49	1955	0.81	1950	5.20	1955	0.0		0.0		90	91	60	76	6.3	NE	46	33	1969	61	5.9	8	12	11	10	0	8	3	10	0	0	0	1002.6
S	81.5	59.7	70.6	104	1954	39	1970	12	189	3.78	12.94	1945	0.57	1954	5.16	1944	0.0		0.0		89	91	60	78	6.7	NE	35	23	1972	59	5.6	10	9	11	8	0	4	4	3	0	0	0	1002.7
O	72.4	48.0	60.2	98	1954	19	1962	186	23	2.81	7.53	1971	0.44	1963	4.10	1954	0.0		0.0		85	89	54	76	7.1	NNE	73	29	1954	62	4.9	13	7	11	7	0	1	4	0	0	2	0	1003.5
N	62.1	37.8	50.0	88	1950	11	1970	450	0	2.82	8.22	1948	0.61	1973	4.70	1963	2.6	1975	2.6	1975	78	84	51	67	7.7	SW	35	32	1969	60	5.2	12	7	11	8	*	1	3	0	*	10	0	1004.2
D	51.9	30.5	41.2	79	1978	4	1962	738	0	3.08	6.38	1973	0.25	1965	3.18	1958	10.4	1958	9.1	1958	76	81	56	68	8.0	SW	35	21	1968	55	5.8	10	7	14	9	*	*	4	0	1	17	0	1003.8
YR	70.4	47.8	59.1	105	JUL 1952	-1	JAN 1977	3514	1394	42.54	12.94	SEP 1945	0.23	APR 1976	5.20	AUG 1955	17.2	FEB 1979	10.4	FEB 1979	81	87	54	67	7.8	SW	73	29	OCT 1954	60	5.7	114	104	147	112	2	45	26	31	4	81	*	1002.2

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Lowest temperature -2 in February 1899; maximum monthly precipitation 13.63 in August 1908; minimum monthly precipitation 0.06 in November 1931+; maximum precipitation in 24 hours 6.66 in September 1929; maximum monthly snowfall 20.0 in January 1893; maximum snowfall in 24 hours 17.8 in March 1927.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Meteorological Data For The Current Year

Station: RALEIGH, NORTH CAROLINA # 13722 RALEIGH-DURHAM AIRPORT Standard time used: EASTERN Latitude 35° 52' N Longitude 78° 47' W Elevation (ground): 434 feet Year 1982

Month	Temperature °F Averages Daily maximum	Daily minimum	Monthly	Extremes Highest	Date	Lowest	Date	Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Total	Greatest in 24 hrs.	Date	Snow, Ice pellets Total	Greatest in 24 hrs.	Date
JAN	44.1	26.8	35.5	71	31	4	11	907	0	3.43	0.98	3	6.0	5.0	14
FEB	55.1	35.9	45.5	81	24	25	14	536	0	4.97	1.40	26-27	0.6	0.6	27
MAR	62.9	40.4	51.7	80	17	23	24	411	3	3.02	1.04	7	0.0	0.0	
APR	69.6	45.2	57.4	84	17	27	7	244	24	3.33	0.80	17	0.0	0.0	
MAY	83.8	58.1	71.0	93	30	43	1	15	208	4.20	0.93	26-27	0.0	0.0	
JUN	84.0	65.4	74.7	90	29	56	7	0	299	8.39	2.82	10	0.0	0.0	
JUL	88.3	69.8	79.1	94	27	57	2	0	443	3.34	0.90	28-29	0.0	0.0	
AUG	86.4	66.6	76.5	92	25	53	30	0	363	1.83	1.07	9-10	0.0	0.0	
SEP	81.0	59.9	70.5	91	14	45	24	14	183	1.55	0.78	26	0.0	0.0	
OCT	71.1	50.1	60.6	85	[illegible]	34	19	102	53	3.93	2.04	24-25	0.0	0.0	
NOV	63.5	40.3	51.9	80	4	26	16	392	5	2.34	0.87	4	0.0	0.0	
DEC	57.0	38.0	47.5	76	5	18	14	542	7	4.02	1.66	11-12	T	T	30
YEAR	70.6	49.7	60.2	94	JUL 27	4	JAN 11	3245	1588	44.35	2.82	JUN 10	6.6	5.0	JAN 14

Month	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Resultant Direction	Resultant Speed m.p.h.	Average speed m.p.h.	Fastest mile Speed m.p.h.	Direction	Date	Percent of possible sunshine	Average sky cover tenths, sunrise to sunset	Number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility 1/4 mile or less	Temperature °F Maximum (b) 90° and above	32° and below	Minimum 32° and below	0° and below	Average station pressure mb Elev. 441 feet m.s.l.
JAN	70	77	58	63	27	2.5	8.9	26	33	10	44	7.2	6	6	19	10	2	2	5	0	6	22	0	1003.4
FEB	71	77	61	63	35	2.5	8.8	23	35	27	44	7.2	2	17	13	17	0	0	5	0	0	4	0	1005.1
MAR	73	82	54	60	31	0.4	7.9	20	32	26	51	6.5	9	6	16	7	0	2	5	0	0	5	0	1003.4
APR	66	71	37	45	23	1.5	8.4	32	21	3	55	6.5	7	7	16	14	0	2	0	0	0	3	0	1002.0
MAY	78	80	49	63	19	1.7	5.9	21	28	29	59	6.0	7	11	13	14	0	13	3	5	0	0	0	1001.7
JUN	85	83	58	73	18	1.1	5.9	22	34	30	42	7.3	2	13	15	14	0	4	2	7	0	0	0	998.6
JUL	87	87	60	73	18	1.8	5.0	23	01	4	43	6.9	5	10	16	13	0	4	6	17	0	0	0	1002.0
AUG	83	84	56	73	19	1.1	4.8	18	32	17	41	6.4	4	14	13	8	0	4	2	6	0	0	0	1002.7
SEP	83	87	59	71	03	1.6	4.9	20	01	26	53	6.3	7	12	11	5	0	3	5	6	0	0	0	1002.7
OCT	87	82	51	75	01	1.5	5.8	30	36	24	49	5.6	12	6	13	4	0	0	1	0	0	0	0	1004.7
NOV	82	84	55	71	02	0.5	5.2	18	24	4	40	6.1	9	6	15	4	0	0	6	0	0	4	0	1007.5
DEC	84	84	64	77	20	0.2	7.2	21	01	12	29	7.2	7	4	18	11	0	0	8	0	0	12	0	1001.1
YEAR	79	82	55	67	26	0.3	6.6	32	21	APR 3	47	6.6	77	110	178	126	2	44	48	32	6	59	0	1003.4

Normals, Means, And Extremes

Month	Temperatures °F Normal Daily maximum	Daily minimum	Monthly	Extremes Record highest	Year	Record lowest	Year	Normal Degree days Base 65 °F Heating	Cooling	Precipitation in inches Water equivalent Normal	Maximum monthly	Year	Minimum monthly	Year	Maximum in 24 hrs.	Year	Snow, Ice pellets Maximum monthly	Year	Maximum in 24 hrs.	Year
(a)				38		38					38		38		38		38		38	
J	51.0	30.0	40.5	79	1952	-1	1977	760	0	3.22	7.52	1954	0.87	1981	2.79	1954	14.4	1955	9.0	1966
F	53.2	31.1	42.2	84	1977	5	1971	638	0	3.32	5.75	1961	1.00	1968	3.22	1973	17.2	1979	10.4	1979
M	61.0	37.4	49.2	92	1945	11	1980	502	9	3.44	6.26	1975	1.48	1949	2.51	1952	14.0	1960	9.3	1969
A	72.2	46.7	59.5	95	1980	23	1972	180	16	3.07	8.10	1978	0.23	1976	4.04	1978	T	1950	T	1950
M	79.4	55.4	67.4	97	1953	31	1977	48	121	3.32	7.67	1974	0.92	1964	4.40	1957	0.0		0.0	
J	85.6	63.1	74.4	104	1954	38	1977	0	270	3.67	9.38	1973	0.55	1981	3.44	1967	0.0		0.0	
J	87.7	67.2	77.5	105	1952	48	1975	0	394	5.06	10.05	1945	0.80	1953	3.89	1952	0.0		0.0	
A	86.8	66.2	76.5	101	1953	46	1965	0	372	4.93	10.49	1955	0.81	1950	5.20	1955	0.0		0.0	
S	81.5	59.7	70.6	104	1954	39	1970	12	189	3.74	12.94	1945	0.57	1954	5.16	1944	0.0		0.0	
O	72.4	48.0	60.2	98	1954	19	1962	186	23	2.81	7.53	1971	0.44	1963	4.10	1954	0.0		0.0	
N	62.1	37.8	50.0	88	1950	11	1970	450	0	2.82	8.22	1948	0.61	1973	4.70	1963	2.6	1975	2.6	1975
D	51.9	30.5	41.2	79	1978	4	1962	730	0	3.08	6.38	1973	0.25	1965	3.18	1958	10.4	1958	9.1	1958
YR	70.4	47.8	59.1	105	JUL 1952	-1	JAN 1977	3514	1394	42.54	12.94	SEP 1945	0.23	APR 1976	5.20	AUG 1955	17.2	FEB 1979	10.4	FEB 1979

Month	Relative humidity pct. Hour 01 (Local time)	Hour 07	Hour 13	Hour 19	Wind Mean speed m.p.h.	Prevailing direction	Fastest mile Speed m.p.h.	Direction	Year	Pct. of possible sunshine	Mean sky cover tenths, sunrise to sunset	Mean number of days Sunrise to sunset Clear	Partly cloudy	Cloudy	Precipitation .01 inch or more	Snow, Ice pellets 1.0 inch or more	Thunderstorms	Heavy fog, visibility 1/4 mile or less	Temperatures °F Max. (b) 90° and above	32° and below	Min. 32° and below	0° and below	Average station pressure mb Elev. 441 feet m.s.l.
(a)	18	18	18	18	33	14	29	29		28	33	34	34	34	38	38	38	33	18	18	18	18	10
J	73	79	55	64	8.6	SW	43	27	1971	54	6.1	9	7	15	10	1	*	*	0	3	21	*	1003.0
F	69	76	51	57	9.0	SW	40	22	1966	59	5.9	9	6	13	10	1	1	3	0	1	18	0	1003.2
M	71	80	50	57	9.4	SW	44	32	1967	62	5.9	10	7	14	10	*	2	2	0	*	10	0	1001.3
A	73	81	45	53	9.1	SW	40	19	1961	64	5.6	10	9	11	9	0	3	2	1	0	7	0	1001.0
M	84	85	55	67	7.6	SW	54	20	1972	59	6.0	8	10	13	10	0	7	3	1	0	*	0	999.6
J	87	88	57	68	7.0	SW	39	33	1977	60	5.9	6	11	13	9	0	7	2	6	0	0	0	1000.7
J	89	90	59	72	6.6	SW	69	25	1962	61	6.0	7	12	12	11	0	11	3	11	0	0	0	1001.3
A	90	93	60	76	6.3	NE	46	33	1969	61	5.9	6	12	11	10	0	8	3	10	0	0	0	1002.6
S	89	93	60	78	6.7	NE	35	23	1977	59	5.6	10	9	11	8	0	4	4	3	0	0	0	1002.2
O	85	89	54	76	7.1	NNE	73	29	1954	62	4.9	13	7	11	7	0	1	4	0	0	2	0	1003.5
N	78	84	51	67	7.7	SW	35	32	1969	60	5.2	12	7	11	8	*	1	3	0	*	10	0	1004.2
D	74	81	56	68	8.0	SW	35	21	1968	55	5.8	10	7	14	9	*	*	4	0	1	17	0	1003.8
YR	81	84	54	67	7.0	SW	73	29	OCT 1954	60	5.7	114	104	147	112	2	45	36	31	4	81	4	1002.2

Means and extremes above are from existing and comparable exposures. Annual extremes have been exceeded at other sites in the locality as follows: Lowest temperature -2 in February 1899; maximum monthly precipitation 13.63 in August 1908; minimum monthly precipitation 0.06 in November 1931+; maximum precipitation in 24 hours 6.66 in September 1929; maximum monthly snowfall 20.0 in January 1893; maximum snowfall in 24 hours 17.8 in March 1927.

(a) Length of record, years, through the current year unless otherwise noted, based on January data.
(b) 70° and above at Alaskan stations.
* Less than one half.
T Trace.

NORMALS - Based on record for the 1941-1970 period.
DATE OF AN EXTREME - The most recent in cases of multiple occurrence.
PREVAILING WIND DIRECTION - Record through 1963.
WIND DIRECTION - Numerals indicate tens of degrees clockwise from true north. 00 indicates calm.
FASTEST MILE WIND - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Average Temperature

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943	43.6	45.4	45.9	57.0	71.0	77.4	79.2	79.1	69.2	60.1	49.5	41.6	60.6
*1944	41.4	44.5	49.4	54.7	73.4	77.6	77.7	75.7	72.4	59.5	49.0	37.5	59.4
1945	39.0	43.5	57.2	62.3	64.9	74.6	77.9	75.5	74.6	59.5	51.9	36.8	60.3
1946	41.2	44.4	54.4	58.7	66.3	74.5	76.1	73.9	70.8	61.4	54.7	45.6	60.4
1947	46.4	35.6	42.0	61.1	68.4	74.5	75.2	78.1	71.3	64.4	46.8	40.7	59.1
1948	34.5	41.4	53.8	61.5	67.6	74.9	78.4	76.4	70.1	57.1	53.8	44.9	59.8
1949	49.2	48.6	51.4	57.6	68.0	74.4	81.1	77.6	69.0	64.7	49.5	44.2	61.4
1950	52.2	44.4	47.6	57.8	68.6	75.2	77.1	76.0	70.1	63.4	46.0	37.6	59.4
1951	43.1	44.2	49.4	58.4	65.2	74.2	79.3	76.1	71.5	63.6	46.1	45.4	60.1
1952	46.8	44.6	49.0	59.7	68.2	80.0	80.5	76.8	70.3	55.8	50.7	41.6	60.3
1953	46.7	45.7	51.3	59.6	73.5	74.8	78.6	77.8	71.3	61.9	50.3	43.4	61.3
1954	41.6	47.2	49.1	63.4	63.3	75.4	79.4	77.4	74.9	67.7	47.1	40.0	60.1
1955	38.9	42.7	53.5	63.1	69.7	71.0	80.7	78.4	71.9	59.4	46.4	37.3	59.6
1956	38.9	45.4	48.8	57.2	67.5	74.9	77.4	77.2	69.1	61.9	48.8	51.0	59.9
1957	40.7	47.1	48.7	63.0	68.1	74.6	77.9	75.4	72.4	55.0	51.7	44.8	60.1
1958	35.9	35.5	44.6	59.1	67.3	77.5	79.4	76.8	69.0	59.3	53.3	36.9	57.4
1959	39.6	43.7	48.6	60.7	70.1	74.3	77.5	78.6	71.0	61.7	49.1	43.3	59.9
1960	41.8	40.5	37.6	62.1	66.1	75.0	76.1	77.8	70.8	60.1	50.8	36.6	57.9
1961	36.5	44.9	52.7	53.6	64.2	77.8	77.6	76.6	73.2	59.1	52.4	41.3	58.7
1962	39.8	43.9	45.5	57.4	72.0	77.5	75.7	75.8	68.2	61.4	47.7	38.0	58.2
1963	36.7	38.1	53.4	60.5	65.4	77.7	76.0	76.3	67.4	60.5	51.0	34.7	57.5
*1964	41.2	39.4	50.6	59.4	68.1	77.6	76.4	74.9	69.3	55.2	52.7	43.3	58.9
1965	40.5	42.9	44.6	58.2	71.9	73.4	76.7	77.2	72.7	58.8	50.9	43.8	59.1
1966	35.8	42.1	49.7	57.0	66.5	77.4	79.1	77.7	71.0	58.6	50.8	41.9	58.7
1967	44.4	38.9	53.7	62.5	63.9	77.0	76.9	76.3	67.5	59.4	46.8	46.3	59.1
1968	37.1	36.4	52.6	58.1	63.9	73.6	76.9	79.2	70.9	62.0	51.7	38.8	58.4
1969	37.4	47.9	43.4	58.7	66.2	74.7	78.0	73.8	67.5	58.6	46.1	37.7	56.9
1970	32.9	38.9	46.2	59.4	66.0	72.7	76.1	75.3	73.3	61.0	49.4	42.7	57.8
1971	37.0	42.1	45.1	56.4	64.4	75.4	76.6	75.3	72.0	64.8	46.7	50.3	57.0
1972	44.7	40.0	49.5	58.0	64.3	69.9	77.1	75.6	70.4	57.4	48.1	46.2	58.5
1973	39.3	40.0	54.8	57.9	64.5	75.1	76.5	76.6	73.2	62.2	54.6	42.5	59.8
1974	49.3	42.9	54.4	60.7	67.4	71.4	76.5	76.0	69.0	56.5	48.7	43.2	59.7
1975	43.8	43.7	47.1	55.8	68.2	73.7	75.4	78.3	71.1	62.2	53.5	42.0	59.6
1976	37.6	50.1	56.2	60.7	66.8	74.7	78.6	75.4	69.7	55.7	42.5	37.1	58.7
1977	26.6	39.7	53.3	62.6	68.4	77.3	80.6	78.1	72.8	56.4	51.8	39.9	58.6
1978	31.3	33.1	48.2	59.2	66.0	75.4	78.0	79.9	73.7	59.5	55.1	44.9	59.1
1979	39.1	36.5	52.2	59.7	66.8	69.8	75.4	77.2	71.2	59.9	52.0	43.4	58.6
1980	40.6	34.5	44.5	62.0	69.8	75.0	78.9	79.6	74.9	58.7	49.1	40.7	59.3
1981	37.4	47.9	46.2	61.7	64.0	78.9	80.4	74.6	68.3	57.2	50.7	39.7	58.3
1982	35.5	45.5	51.7	57.4	71.0	74.7	79.1	76.5	70.5	60.6	51.9	47.5	60.2
RECORD MEAN	41.3	42.8	50.4	59.4	68.0	75.3	78.7	77.2	71.7	60.7	50.7	42.8	59.9
MAX	50.7	57.9	61.2	70.9	74.1	85.7	88.0	86.7	81.5	71.4	61.1	52.3	70.1
MIN	31.9	37.8	39.6	47.8	56.9	64.8	68.5	67.6	61.8	50.0	40.2	33.2	49.6

Heating Degree Days

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
1962-63	0	0	61	166	510	832	870	703	354	193	86	4	3879
1963-64	0	0	57	149	413	931	731	735	445	205	54	0	3722
*1964-65	0	1	75	305	365	665	759	616	628	232	0	15	3606
1965-66	0	5	7	208	416	652	898	629	473	263	72	12	3633
1966-67	0	0	11	216	425	709	623	723	361	151	105	13	3337
1967-68	0	0	35	199	539	574	855	824	391	213	67	0	3717
1968-69	0	0	0	151	396	805	848	667	667	195	61	0	3790
1969-70	0	0	45	222	561	847	989	725	536	200	74	0	4233
1970-71	0	0	22	154	460	684	863	736	611	258	67	0	3775
1971-72	0	0	3	61	496	456	623	718	478	237	51	16	3139
1972-73	0	0	9	239	504	576	790	692	334	231	88	0	3462
1973-74	0	0	2	126	312	690	481	619	346	187	48	0	2806
1974-75	0	0	44	269	501	669	651	589	553	293	34	0	3601
1975-76	0	0	17	117	351	705	843	426	300	194	52	6	3011
1976-77	0	0	7	307	668	857	1163	715	358	132	49	19	4285
1977-78	0	0	4	283	411	768	914	883	519	196	83	0	4056
1978-79	0	0	7	164	292	627	791	792	398	183	43	8	3327
1979-80	0	0	13	196	394	661	753	820	564	130	33	0	3564
1980-81	0	0	16	225	477	767	973	583	579	149	99	0	3868
1981-82	0	4	31	253	425	776	907	538	411	244	15	0	3604
1982-83	0	0	14	182	392	562							

Cooling Degree Days

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
1969	0	0	0	12	105	295	413	283	128	25	0	0	1264
1970	0	0	0	41	113	236	350	327	278	38	0	0	1383
1971	0	0	0	6	78	320	364	329	222	61	17	5	1402
1972	0	0	5	37	36	170	382	336	177	6	6	2	1157
1973	0	0	24	26	81	310	363	365	254	48	7	0	1478
1974	0	0	25	51	130	210	363	347	169	9	21	0	1325
1975	0	0	3	27	141	269	337	421	209	38	12	0	1452
1976	0	3	31	71	116	304	428	330	157	19	0	0	1459
1977	0	2	4	69	162	277	490	414	245	25	19	0	1701
1978	0	0	2	30	120	330	412	468	275	21	3	10	1671
1979	0	0	6	28	105	159	332	384	205	46	10	0	1275
1980	0	0	0	45	190	306	441	460	321	38	6	0	1807
1981	0	0	2	56	75	425	497	409	139	19	0	0	1522
1982	0	0	3	24	208	299	443	363	183	53	5	7	1588

Precipitation

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
1943	4.60	1.26	4.58	2.57	1.85	8.75	6.44	3.17	2.87	0.81	1.72	3.53	42.07
*1944	4.26	5.10	7.18	5.47	1.55	2.77	3.87	4.61	8.58	1.85	3.29	2.23	50.66
1945	1.65	5.39	1.83	2.96	2.82	1.90	10.05	5.25	12.94	2.16	1.89	6.20	55.04
1946	3.53	3.79	1.62	4.87	6.63	3.92	7.12	6.18	5.17	4.22	2.51	2.04	51.09
1947	4.90	1.20	2.74	3.12	1.62	5.34	2.68	4.68	6.29	6.28	5.97	1.18	45.95
1948	4.39	3.74	3.89	2.67	4.63	1.92	4.28	5.34	3.98	2.95	8.22	5.14	51.35
1949	2.83	3.14	1.48	2.45	4.18	2.80	5.35	8.87	5.87	2.59	2.31	1.65	43.52
1950	2.40	1.57	2.67	1.99	6.69	5.62	5.07	0.81	3.73	3.27	1.36	2.66	37.84
1951	1.57	1.86	2.47	4.49	1.77	3.43	4.69	4.03	1.38	2.90	2.71	3.29	34.54
1952	4.51	3.85	6.21	2.47	3.66	1.90	6.30	9.76	1.71	1.38	4.40	3.03	49.18
1953	4.10	3.68	4.43	4.57	1.37	3.99	0.80	2.70	3.46	0.44	1.65	4.84	36.03
1954	7.52	1.70	4.49	2.87	3.65	1.12	5.14	5.06	0.57	4.93	2.53	2.09	41.63
1955	2.52	3.93	1.56	2.70	1.95	2.13	6.38	10.49	4.33	1.96	2.34	0.59	40.88
1956	1.05	4.70	3.37	4.74	1.88	4.43	6.83	1.31	3.74	3.19	1.38	3.28	39.89
1957	2.87	4.40	2.25	1.66	5.86	6.03	2.15	4.85	4.58	1.71	6.53	3.42	46.26
1958	3.43	3.24	2.55	5.07	6.45	4.40	4.87	6.23	1.18	2.98	1.03	4.29	45.57
1959	1.77	1.39	3.22	5.83	2.53	2.59	8.83	5.92	3.52	6.53	2.58	2.25	48.95
1960	4.59	5.26	4.94	4.57	5.07	2.53	7.47	5.43	3.05	2.29	0.88	1.92	48.00
1961	2.88	5.75	4.37	2.23	2.94	4.05	3.10	6.52	1.25	1.16	2.10	4.76	41.11
1962	6.56	2.74	4.85	3.22	1.37	6.37	7.07	1.46	3.72	0.99	7.19	2.21	48.27
1963	2.96	3.47	3.80	1.77	4.05	1.72	3.51	2.10	2.77	0.44	7.06	3.29	36.91
1964	3.66	4.11	2.93	3.39	0.92	3.41	4.06	5.68	5.29	3.95	1.38	4.13	42.91
1965	1.47	2.40	4.08	1.51	2.20	8.32	5.59	3.00	2.65	1.77	1.23	0.25	34.42
1966	5.42	4.76	1.81	2.02	4.95	3.68	0.91	5.79	3.58	2.01	2.06	2.61	39.60
1967	1.64	3.80	1.62	3.07	4.15	4.57	3.49	6.27	1.74	2.26	2.14	4.93	39.58
1968	2.88	1.00	2.22	3.03	3.82	1.74	5.15	2.50	1.77	5.15	3.59	2.75	35.60
1969	1.55	3.67	1.95	1.43	2.65	4.81	4.40	6.31	6.21	2.09	1.01	3.31	41.52
1970	2.26	3.47	4.04	2.07	3.36	0.87	5.64	4.47	1.20	4.47	1.59	2.57	36.01
1971	3.28	3.85	3.69	2.59	4.68	2.79	4.56	6.26	2.91	7.53	1.81	1.69	45.64
1972	1.97	4.13	2.50	1.97	5.34	4.16	6.80	4.17	5.80	3.96	5.98	5.01	51.74
1973	2.67	5.50	4.06	4.40	3.99	9.38	3.12	4.60	1.13	0.60	0.61	6.38	46.44
1974	4.39	2.87	1.34	1.32	7.67	4.07	1.56	4.82	3.71	1.21	1.79	4.02	40.74
1975	6.09	2.85	6.26	1.64	3.84	1.66	6.74	2.11	5.77	1.27	4.60	4.04	46.83
1976	3.07	1.54	3.17	0.23	4.74	2.55	1.00	1.52	5.99	3.97	1.89	4.04	33.71
1977	2.87	2.17	5.63	1.89	3.94	0.84	0.89	4.12	3.86	5.06	2.22	3.70	37.10
1978	7.03	1.43	4.40	6.10	4.20	4.06	3.67	1.86	1.37	1.46	4.17	3.26	42.97
*1979	5.71	5.55	2.69	7.63	4.71	3.27	4.84	1.66	6.76	1.88	4.73	0.94	45.37
1980	4.39	1.91	5.67	1.97	2.33	4.89	2.11	1.87	3.76	2.25	2.87	1.42	35.64
1981	0.87	3.02	2.35	1.03	4.28	0.55	5.69	5.34	2.70	4.69	0.95	4.96	36.38
1982	3.43	4.97	3.02	3.37	4.20	8.39	3.34	1.83	1.55	3.93	2.34	4.02	44.35
RECORD MEAN	3.41	3.61	3.70	3.23	3.89	4.19	5.27	5.07	3.77	2.90	2.58	3.28	44.88

Snowfall

Season	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	Total
*1943-44	0.0	0.0	0.0	0.0	T	2.0	3.5	0.0	0.0	0.0	0.0	0.0	5.5
1944-45	0.0	0.0	0.0	0.0	0.0	T	T	0.0	0.0	0.0	0.0	0.0	T
1945-46	0.0	0.0	0.0	0.0	0.0	4.9	5.4	0.0	0.0	0.0	0.0	0.0	10.3
1946-47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	T	3.5	0.0	0.0	0.0	3.5
1947-48	0.0	0.0	0.0	0.0	T	0.4	2.5	13.5	T	0.0	0.0	0.0	16.4
1948-49	0.0	0.0	0.0	0.0	0.0	0.1	T	0.0	0.0	0.0	0.0	0.0	0.1
1949-50	0.0	0.0	0.0	0.0	0.0	T	T	T	T	T	0.0	0.0	T
1950-51	0.0	0.0	0.0	0.0	T	0.3	T	1.2	T	0.0	0.0	0.0	1.5
1951-52	0.0	0.0	0.0	0.0	0.0	T	T	3.5	1.2	0.0	0.0	0.0	4.7
1952-53	0.0	0.0	0.0	0.0	T	0.3	T	T	0.0	0.0	0.0	0.0	T
1953-54	0.0	0.0	0.0	0.0	0.6	T	6.5	0.0	0.0	0.0	0.0	0.0	7.1
1954-55	0.0	0.0	0.0	0.0	T	2.4	14.4	T	0.0	0.0	0.0	0.0	16.8
1955-56	0.0	0.0	0.0	0.0	0.0	T	2.0	0.0	T	0.0	0.0	0.0	2.0
1956-57	0.0	0.0	0.0	0.0	T	0.3	T	T	T	0.0	0.0	0.0	T
1957-58	0.0	0.0	0.0	0.0	0.0	1.0	3.0	7.9	T	0.0	0.0	0.0	7.9
1958-59	0.0	0.0	0.0	0.0	0.0	10.6	2.9	T	T	0.0	0.0	0.0	13.5
1959-60	0.0	0.0	0.0	0.0	T	T	T	4.7	14.0	0.0	0.0	0.0	18.7
1960-61	0.0	0.0	0.0	0.0	0.0	0.0	2.3	1.5	0.0	0.0	0.0	0.0	3.8
1961-62	0.0	0.0	0.0	0.0	0.3	T	10.1	0.4	4.3	0.0	0.0	0.0	14.8
1962-63	0.0	0.0	0.0	0.0	4.3	T	0.1	6.9	0.0	0.0	0.0	0.0	8.3
1963-64	0.0	0.0	0.0	0.0	0.0	T	0.4	7.1	T	0.0	0.0	0.0	3.5
1964-65	0.0	0.0	0.0	0.0	0.4	0.0	9.7	3.4	T	0.0	0.0	0.0	13.5
1965-66	0.0	0.0	0.0	0.0	0.0	0.0	12.3	T	0.0	0.0	0.0	0.0	12.3
1966-67	0.0	0.0	0.0	0.0	T	1.0	0.5	9.1	0.0	0.0	0.0	0.0	10.6
1967-68	0.0	0.0	0.0	0.0	T	1.4	3.0	1.3	T	0.0	0.0	0.0	5.7
1968-69	0.0	0.0	0.0	0.0	1.2	0.7	T	0.8	9.3	0.0	0.0	0.0	12.0
1969-70	0.0	0.0	0.0	0.0	0.0	0.0	2.0	T	T	0.0	0.0	0.0	2.0
1970-71	0.0	0.0	0.0	0.0	0.0	0.6	T	T	5.3	0.0	0.0	0.0	5.9
1971-72	0.0	0.0	0.0	0.0	T	3.7	0.0	1.4	2.6	0.0	0.0	0.0	7.7
1972-73	0.0	0.0	0.0	0.0	T	0.0	6.4	4.5	0.4	0.0	0.0	0.0	11.3
1973-74	0.0	0.0	0.0	0.0	0.0	2.8	0.0	T	2.9	0.0	0.0	0.0	5.7
1974-75	0.0	0.0	0.0	0.0	0.0	T	T	T	0.6	0.0	0.0	0.0	0.6
1975-76	0.0	0.0	0.0	0.0	2.6	T	0.4	T	0.0	0.0	0.0	0.0	3.0
1976-77	0.0	0.0	0.0	0.0	T	T	2.1	1.5	0.0	0.0	0.0	0.0	3.6
1977-78	0.0	0.0	0.0	0.0	T	T	T	9.0	1.6	0.0	0.0	0.0	10.6
1978-79	0.0	0.0	0.0	0.0	0.0	0.0	0.4	17.2	T	0.0	0.0	0.0	17.6
*1979-80	0.0	0.0	0.0	0.0	0.0	0.0	2.2	5.0	11.1	0.0	0.0	0.0	18.3
1980-81	0.0	0.0	0.0	0.0	0.0	3.1	2.6	0.0	T	0.0	0.0	0.0	5.7
1981-82	0.0	0.0	0.0	0.0	0.0	T	6.0	0.6	0.0	0.0	0.0	0.0	6.6
1982-83	0.0	0.0	0.0	0.0	0.0	T							
RECORD MEAN	0.0	0.0	0.0	0.0	0.2	0.9	2.6	2.4	1.5	T	0.0	0.0	[illegible]

* Indicates a station move or relocation of instruments. See Station Location table.

Record mean values above are means through the current year for the period beginning in 1887 for temperature and precipitation, 1945 for snowfall. Data are from the Raleigh Municipal Airport, 3.5 miles south of the Post Office, for the period December 12, 1940 through May 1944. Beginning with June 1944 data are from the Raleigh-Durham Airport.

STATION LOCATION

Location	Occupied from	Occupied to	Airline distance and direction from previous location	Latitude North	Longitude West	Elevation above: Sea level: Ground at temperature site	Elevation above Ground: Wind instruments	Extreme thermometers	Psychrometer	Sunshine Switch	Tipping bucket rain gage	Weighing rain gage	8" rain gage	Hygrothermometer	Automatic Observing Equipment *	Remarks (* Type: M = AMOS, T = AUTOB)
CITY																
N. C. Experiment Farm 2 miles W of Post Office on Hillsboro Road	1/1/87	9/6/87	NA	35° 47'	78° 40'	435	10	7	7				2			
Agriculture Building NW corner Edenton & Halifax Streets	9/6/87	9/30/96	2 mi. E	35° 47'	78° 37'	360	80	70	70				2			
Fisher Building 3rd Floor NE corner Fayetteville Street & Exchange	9/30/96	8/1/08	0.13 mi. S	35° 47'	78° 37'	363	79	71	71		64		64			
Masonic Temple, 4th Fl. NE corner Fayetteville & Hargett Streets	8/1/08	12/12/40	300 ft. N	35° 47'	78° 37'	345	110 a146	103	103		94		94			a - Raised 6/14/30.
Administration Building 2nd Floor Raleigh Municipal AP 3.5 miles S of P. O.	12/12/40	12/2/44	3.5 mi. S	35° 45'	78° 37'	363	69	27	27		25	b5	25			b - Installed 8/19/41.
1911 Building N. C. State College 2400 block Hillsboro Street	12/2/44	5/2/54	3.75 mi.NNW	35° 47'	78° 38'	400	71	58 c6	58 c6		56 d4		56 d4	e6		c - Moved to field site 9/18/46. d - Moved to field site 11/7/46. e - Installed in 1948. Consolidated at Airport.
AIRPORT																
Headquarters Building T206, Raleigh-Durham AP	5/17/44	5/16/54	10.5 mi. NW of Raleigh Post Office	35° 52'	78° 47'	438	30 f32	7	6			5	4			Thermometers relocated in Weather Bureau standard instrument shelter 12/10/53. f - Effective 9/27/49.
Weather Bureau Bldg. Raleigh-Durham Airport	5/17/54	12/14/79	0.5 mi. SSW	35° 52'	78° 47'	433 k434	26 i20	7 m	7 m	13 g18 h17	p4	4	4 n3	j4	NA	Airport and City offices consolidated 5/17/54. g - Effective 11/1/54. h - Effective 4/7/59. i - Effective 6/18/63. j - Commissioned 2000' E of thermometer site 11/1/64. k - Effective 11/1/64. m - Removed 8/13/68. n - Effective 8/19/68. p - Added 10/1/74.
Old Cargo Building Raleigh-Durham Airport	12/14/79	Present	0.25 mi. W	35°52'	78°47'	416	q20	5	5	31	3	4	4	q4	NA	q - Not moved 12/14/79.

SUBSCRIPTION:
Price and ordering information available through: National Climatic Data Center, Federal Building, Asheville, North Carolina 28801, ATTN: Publications.

I certify that this is an official publication of the National Oceanic and Atmospheric Administration, and is compiled from records received at the National Climatic Data Center, Asheville, North Carolina 28801.

L. Ray Hoxit
Acting Director
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Enclosure No. 6

DRAFT

(to be submitted to the Health Physics Journal)

MEASUREMENTS OF EFFLUENT RADIOACTIVITY DURING THE INCINERATION OF CARCASSES CONTAINING RADIOACTIVE MICROSPHERES

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The increasing use of radioactive microspheres in large animal research poses a growing problem in waste management for many institutions. Incineration, with its obvious volume reduction benefits, is an economically attractive means of disposing of carcasses containing radioactive microspheres. Although it is generally assumed that incinerated microspheres remain with the ash, few studies have been performed to actually quantify the fraction of radioactivity emitted in the effluent. These studies which have been published (Ba83, La83, Sh80) estimate the release of radioactivity by measuring the retention in the ash. The present paper presents the results of actual measurements of radioactivity in the effluent during the incineration of carcasses containng microspheres labelled with several different radionuclides.

Equipment

A modified EPA Method 5 sampling probe and train was installed on the stack of the Purdue University Radiological Services incinerator (La83). The sampling train consisted of a

Reeve Angel 125 mm glass fiber particulate filter followed by a series of four impingers. The first three impingers were filled with 200 ml of 0.1 N HCl to remove volatilized material and to collect water vapor. The fourth impinger contained approximately 200 g of silica gel to remove any water vapor remaining in the sample gas stream. By monitoring the stack gas velocity with a low pressure drop, magnehelic gauge and adjusting the sampling flow rate with a calibrated orifice meter, isokinetic sampling conditions were maintained throughout the sampling periods. The sampling for each burn was conducted at 10 traverse points across one diameter of the round 14-in. stack. Table 1-2 of the Federal Register (Fe77) Vol. 41, No. 160, was used to determine the positioning of the 10 traverse points. All analyses for sampled radioactivity were performed by a Ge(Li) detector connected to a Canberra Series 85 multichannel analyzer.

Experimental

Five commonly used radiolabeled plastic microspheres were employed in this research: ^{113}Sn, ^{153}Gd, ^{57}Co, ^{95}Nb and ^{103}Ru. A typical experimental incinerator burn load consisted of approximately 150 lb of large animal carcasses spiked with microspheres containing a particular radionuclide. In most cases the microspheres, contained in small plastic packets, were placed in crevices of frozen carcasses. In one burn, the carcasses were allowed to thaw, and the microspheres were injected at different locations throughout the carcasses. The variation in spiking procedure was performed in order to see if the mode of spiking had any influence on the amount of radioactivity released during

the incineration process. All samples were assayed with the Ge(Li) detector prior to spiking. In addition, reference filters were prepared and assayed prior to spiking and retained as relative standards for assaying the sample filters after the respective burns.

All burns were for 5 h, and sampling was conducted over the entire burn period. In most of the burns the only material incinerated was animal carcasses. In one set of burns common laboratory trash was placed in the incinerator along with the carcasses. This trash was primarily paper products such as towels and absorbent paper with some rubber gloves and plastic material. The purpose of this set of burns was to see if the combination of material being incinerated influenced the emission of radioactivity.

Upon completion of a burn, the glass fiber filter was removed and placed in a petri dish. In addition, all parts of the probe upstream of the filter assembly were backwashed with an acetone solution which was then passed through a Millipore filter. The contents of each impinger were transferred to 1 l polyethylene bottles for analysis. The sample filters were analyzed with the Ge(Li) detector and compared with a count of the previously prepared filter paper reference standard. Because all counting was related to the count rate of the reference standard, it was not necessary to correct for decay or to determine absolute counting efficiencies.

Results

Table 1 is a listing of the mean percentage release an standard deviations for the five radiolabelled microspheres tested. Application of the Student's t statistical test on the data indicated that there was no significant difference bet een the ^{153}Gd, ^{95}Nb and ^{57}Co percentage releases, nor was there any significant difference between the ^{113}Sn and ^{103}Ru release . However, the ^{113}Sn and ^{103}Ru releases were significantly g eater than the releases of ^{153}Gd, ^{95}Nb and ^{57}Co. These results, which show a release of only a few percent for ^{57}Co and ^{95}Nb, compare favorably with the retention of over 95% reported for these two radionuclides by Shearer et al. (Sh80) for a study using a kiln to dispose of the carcasses. The elevated release observed for ^{103}Ru also agrees with the results of Shearer et al. and with the results presented by Barish et al. (Ba83) using in vitro conditions in a laboratory furnace. This elevated release is possibly due to the fact that RuO_4, which would be formed during incineration, has a volatilization temperature considerably below the 1,200 C burn temperature of the primary chamber. The mean release for ^{113}Sn of 12.3 ± 4.9% is somewhat higher than releases reported by both of the authors mentioned. The reason for this higher release of ^{113}Sn is not readily evident.

All of the radioactivity released during the burns was associated with the particulate fraction of the sample rather than the gas phase fraction. This conclusion was based upon the fact that all of the radioactivity measured was on the glass fiber filter and no radioactivity was found in the impingers. Consequently, the radioactivity was either physically carried out

of the incinerator as intact microspheres by the turbulence of the effluent, or else the radioactivity was volatilized and then became attached to particulate combustion products as they moved through the stack.

It can also be seen from Table 1 that adding laboratory trash to the animal carcasses containing ^{95}Nb did not cause a difference in the amount of ^{96}Nb released when compared to the burns containing carcasses only. The results of the two ^{103}Ru studies indicated that spiking the carcasses with radioactive microspheres by the two different modes made no difference on the amount of ^{103}Ru released during incineration.

References

La83 Landolt, R. R., Barton, T. P., Born, G. S., Morris, V. R., Vetter, R. J. and Zimmerman, N. J., 1983, "Evaluation of a Small, Inexpensive Incinerator for Institutional Radioactive Waste," Health Phys. 44, 671.

Ba83 Barish, E. L., Gilchrist, J. R., Berk, H. W., and Allen, R. O., 1983, "Radioactive Waste Management at Biomedical and Academic Institutions," Proceedings of the International Conference on Radioactive Waste Managment," Seattle, IAEA-CN-43/320.

Sh80 Shearer, D. R. and DeVona, T., 1980, "Disposal of Radioactive Animals," Proceedings of the 25th Annual Meeting of the Health Physics Society, Seattle Paper P/72.

Fe77 Federal Register 1977, Vol. 42, No. 160.

Table 1. Radioactivity Released During Incineration of Animal Carcasses Containing Radiolabelled Microspheres.

Radionuclide	Number of Burns	Percentage Released[a]
^{113}Sn	3	12.3 ± 4.9%
^{153}Gd	4	5.0 ± 2.5%
^{57}Co	5	3.8 ± 3.0%
^{95}Nb	4	4.8 ± 1.1%
^{95}Nb[b]	4	4.7 ± 5.6%
^{103}Ru	3	16.1 ± 6.0%
^{103}Ru[c]	1	16.5 ± 5.0%

[a]Mean ± S.D.

[b]Carcasses plus laboratory trash

[c]Microspheres injected throughout thawed carcasses

1327[illegible]

Medical Center

508 Fulton Street
Durham NC 27705

Veterans
Administration

In Reply Refer To: 558/138

July 30, 1984

U.S. Nuclear Regulatory Commission
Suite 2900
101 Marietta Street, NW
Atlanta, GA 30323

Gentlemen:

It is requested that our License Number 32-01134-01 be amended to allow the incineration of animal carcasses containing radioactive material in microspheres and other waste material contaminated with Hydrogen 3 and Carbon 14. This request is being made due to the increasing cost and complexity of radioactive waste disposal and the low total radioactivity contained in this waste.

Other radioactive waste will be disposed of by sorting, packing, and storing for decay in 55-gallon steel barrels and/or through commercial disposal. Storage for decay will require holding the steel barrels for approximately 10 half-lives. Ashes containing radioactive materials will be packaged for disposal at an approved commercial site.

Information to support this request is provided as an enclosure. The "Incineration Guidelines for Medical/Academic Licenses" was used as a guide for the preparation of this request for incineration of radioactive wastes.

B.F. BROWN
Medical Center Director

Enclosure: Amendment of License No. 32-01134-01
Vicinity Plan of VA Medical Center
Incinerator Information
VA Medical Center Building and Location Plan
Local Climatological Data for the Raleigh-Durham Area
Measurement of Effluent Radioactivity during the incineration of carcasses containing radioactive microspheres

cc: NC Department of Natural Resources and Community Development

ENCLOSURE 1

AMENDMENT TO LICENSE NO. 32-01134-01 ALLOWING FOR INCINERATION OF RADIOACTIVE MATERIALS

VA MEDICAL CENTER
DURHAM, NORTH CAROLINA

1. CHARACTERISTICS OF INCINERATOR

A. The Veterans Administration Medical Center in Durham, NC is using a Sunbeam Equipment Corporation, Comtro Division, two-chamber incinerator which is currently being used to incinerate only pathological waste, (Type 4). Normal operating temperatures range from 1500°F. to 1800°F., and will incinerate the waste completely. The incinerator is located on the VA grounds as indicated on the enclosed sketches (Enclosure No. 2).

B. The incinerator has been inspected by the State of North Carolina for general operation. The State of North Carolina accepted the Sunbeam-Comtro A-22P stack test performed on July 24, 1975, by Stephen Upshor Associates of Buffalo, New York. The stack test was satisfied with .08 grains per standard CF of dry flue gas corrected to 12% CO_2 when burning 290 pounds of type 4 waste. A copy of this test is on file at the North Carolina Department of Natural Resources and Community Development in Raleigh, NC. The State of North Carolina has complete control of the regulation of the incinerator. Permit No. 5439 has been granted by the NC Environmental Commission, Department of Natural Resources and Community Development to operate this natural gas-fired incinerator, identified as ID No. 1.

C. Incinerator information is listed below:

(1) Manufacturer's name - Sunbeam-Comtro

(2) Model Number - A22P

(3) Rated Capacity - 290 lbs/hr

(4) Type Waste - No. 4

(5) Incinerator stack data

(a) Height - 50'above ground

(b) Exit diameter - 1.25'

(c) Exit gas velocity - 2275FPM

(d) Exit gas volume - 2800CFM

(e) Exit gas temperature - 1500°F.

(f) Stack dimensions - ID - 15"
OD - 19.5"
(See Enclosure No. 3)

(6) Proximity to air intake duct:

(a) Building 14, Animal House (N) - 30' horizontal, 50' vertical (below stack), 2810 CFM

(b) Building 14, Animal House (S) - 100' horizontal, 40' vertical (below stack), 4126 CFM

(c) Building 6, Supply Service - 200' horizontal, 10' vertical (below stack), 1824 CFM

(d) Building 6, Linen Service - 225' horizontal, 10' vertical (below stack), 4500 CFM

(e) Building 6, Engineering Service - 250' horizontal, 20' vertical (below stack) 327 CFM

D. Height of and distance to buildings in surrounding areas are noted on Enclosure No. 4.

E. The room for storage of radioactive ash until disposal at an approved commercial site is located adjacent to the incinerator. The ash will be retained for limited periods of time and will be monitored by the Duke University Medical Center Radiation Safety staff.

F. Local climatological data for the Raleigh-Durham area is contained in Enclosure No. 5.

2. ISOTOPES WE PFOPOSE TO INCINERATE ARE AS FOLLOWS:

A. Radioactive Microspheres

(1) Isotopes to be incinerated are microspheres contained in animal carcasses. A typical animal contains:

Element	MicroCuries
Cobalt 57	20
Niobium 95	16
Ruthenium 103	22
Chromium 51	77
Tin 113	21

(2) Manufacturer states that the exit gas volume is $2800 ft^3/minute$ and assuming a 4 hour burn time, total effluent:

$$\frac{2800\ ft^3/min.}{3.53 \times 10^{-5} ft^3/cc} \times 60\ min/hr \times 4\ hr = 1.9 \times 10^{10} cc$$

(3) From Appendix B, Table II, 10CFR20:

Element	Allowable Concentration uCi/cc)
Cobalt 57 (I)	6×10^{-9}
Niobium 95 (I)	3×10^{-9}
Ruthenium 103 (I)	3×10^{-9}
Chromium 51 (I)	8×10^{-8}
Tin 113 (I)	2×10^{-9}
Gadolinium 153 (I)*	2×10^{-9}

(4) Permissible quantity burned in 4 hours:

Co 57: 1.9×10^{10}cc X 6×10^{-9}uCi/cc = 114 uCi

Nb 95, Gd 153, Ru 103: 1.9×10^{10}cc X 3×10^{-9}uCi/cc = 57 uCi

Cr 51: 1.9×10^{10}cc X 8×10^{-8}uCi/cc = 1520 uCi

Sn 113: 1.9×10^{10}cc X 2×10^{-9}uCi/cc = 38 uCi

(5) Reference is made to a prepublication paper by R.R. Landolt, et al, "Measurements of Effluent Radioactivity During the Incineration of Carcasses Containing Radioactive Microspheres" (Enclosure No. 6). Stack measurements of incinerated microspheres show that a large percentage of the activity remains in the ash. Of the data presented, the following are applicable to this proposal:

Element	% Released
Co 57	3.8 ± 3.0
Nb 95	4.8 ± 1.1
Ru 103	16.1 ± 6.0
Sn 113	12.3 ± 4.9
Gd 153	5.0 ± 2.5

(5) ALARA considerations. Assume incinerator operates 8 hours per day, 5 days per week, with one and one-half days dedicated for animal disposal; then total remaining effluent per year is:

$28 \text{ hrs/wk} \times 50 \text{ wks/yr} \times 7.9 \times 10^{7} \text{cc/min} * 60 \text{ min/hr} = 6.66 \times 10^{12} \text{cc/yr}$

(a) Permissible activity per year:

H3: $6.66 \times 10^{12} \text{cc/yr} \times 2 \times 10^{-7} \text{uCi/cc} = 1332$ mCi
C14: $6.66 \times 10^{12} \text{cc/yr} \times 1 \times 10^{-7} \text{uCi/cc} = 666$ mCi

(b) To comply with ALARA considerations, actual quantities of above elements to be incinerated will be restricted to 10% of the annual allowable. Therefore:

H3 not to exceed 133 mCi in one year.
C14 not to exceed 66 mCi in one year.

3. RADIOACTIVE MATERIALS REMAINING IN ASH RESIDUE:

a. Determination of radioactive material concentration in ash will be performed by calculation using data contained herein.

b. Contaminated ash will be placed directly into a shipping barrel by personnel wearing coveralls, gloves, headcover, and full-face respirator. Individuals will be monitored upon completion of ash removal and removal of protective clothing. Ash from all burns involving microspheres will be collected for commercial disposal. The ash will be stored in the room adjacent to the incinerator until the shipping barrels are full.

4. PROCEDURES:

Procedures to minimize exposure of personnel during all phases of the operation:

Personnel handling the combustibles must wear coveralls and gloves. In addition, personnel handling the ash must wear a full-face respirator.

6. NOTIFICATION:

The State of North Carolina Environmental Commission, Department of Natural Resources and Community Development, is notified of our plans by a copy of this letter with all enclosures.