Boston University Medical Center

Radiation Protection Office
88 East Newton Street, D-604
Boston, Massachusetts 02118-2394
617 638-7052

030-01845

USNRC
475 Allendale Rd.
King of Prussia, PA 19406

February 19, 1993

Gentlemen:

Boston University Medical Center (BUMC) would like to amend its broad medical license # 20-02215-01 with regards to incineration. Radioactive incineration is a valuable technology for volume reduction of radioactive waste as enumerated in NRC document NUREG-1393. A fee of $390. is enclosed.

History

For over 20 years, BUMC has been incinerating radioactive animals under the conditions of our NRC license. In addition we have another incinerator that burns only non-radioactive waste. We have notified the Commonwealth of Massachusetts that we intend to replace our two incinerators with state-of-the-art incinerators in a new research facility at 700 Albany St. that is currently under construction. This facility is across the street from our present incinerator facility. It is our hope that both incinerators will be operational by the fall of 1993. Enclosed is a copy of the permit from the Massachusetts Department of Environmental Protection (DEP) for the operation of a radioactive and a non-radioactive incinerator at this facility.

In order for NRC to evaluate this amendment for incineration, we will address the items as described in the January 1991 NRC incinerator information request.

1) We have been approved from DEP to incinerate radioactive animal carcasses and laboratory trash. Pending NRC approval we propose to incinerate radioactive carcasses and solid waste (paper, plastic, glass) contaminated with radionuclides.

Radioactive Carcasses

Over the years we have incinerated radioactive carcasses that contained the following isotopes: ^{14}C, ^{3}H, ^{125}I, ^{35}S, ^{51}Cr and selected gamma emitting microspheres. The annual quantities of isotopes burned in the carcasses range from small microcurie amounts (microspheres, ^{125}I) to millicuries quantities (^{3}H, ^{14}C, ^{35}S). From our long history of incinerating radioactive carcasses containing trace quantities of radioactivity, we are well within NRC MPC's and the spirit of ALARA even without pollution controls. In 1992, the concentration for carcasses containing radionuclides varied from .02 MPC-hrs to 10^{-5} MPC-hrs.

We expect that similar radioactive carcass incineration and the addition of solid radwaste incineration will not pose a regulatory problem for us or you.

Radioactive Solid Waste

Although we may incinerate any solid waste contaminated with radionuclides, we intend to selectively incinerate solid waste with half-lives greater than 90 days namely ^{3}H and/or ^{14}C. The estimated activity in a typical 55 gallon drum that we commercially dispose for this long-lived waste is in the low microcurie activity range. We estimate that we ship for burial one long-lived radioactive 55 gallon barrel a month.

2) We are enclosing information on:

a) Description of Incineration System **Attachment I**

b) Building Drawings **Attachment II**

c) Important Characteristics of Radiological Incinerator
Boston University Medical Center is located in the South End of Boston. A map (Attachment III) indicates the 700 Albany St. address where the Center for Biomedical Research (CABR) is nearing completion. The incinerators will be located in the penthouse of this building. The South End area is predominantly hospital/medical buildings, industry and some low income housing. Low income housing is situated 2 blocks away in the Harrison Ave./E. Brookline St. area. This represents the nearest continuously occupied areas from the incinerators.

a) Height of incinerator stack top above ground	184' 4"
b) Height of stack top above roof	12'
c) Stack exit size	20"
d) Discharge direction	Vertical
e) Range of stack gas volume	4000 - 7000 CFM
f) Stack gas exit temperature	140 - 160^{0} F
g) Stack proximity to intake ducts	130'

Radiological Monitoring:
A commercial company EERC prepared a report for the EPA and the California Air Resources board (Contracts no. 68-03-3365 and A832-155) regarding the percentage of radioactivity retained in ash. Tritium, ^{14}C, ^{35}S, and ^{125}I were essentially 100% volatized with no radioactivity remaining in the incinerator ash. On the other hand, gamma microspheres had the majority of radioactivity remaining in the ash (range 41-95%). Therefore we would expect the volatiles to pass through the bag house and be removed by the liquid scrubber to sanitary sewerage. The bag house however would contain a small fraction of the gamma microspheres because of particulate removal. Because we are held accountable for not

disposing of radioactive materials to unrestricted areas, we will assess the ash, the bag house ash, and liquid scrubber effluent for radioactivity. The cleaning and handling of this material will be as potentially contaminated radioactive materials. We will initially incinerate radioactive waste under controlled conditions to assess radioactive waste content. This will be by measurement. We will need to know what radioactivity we can expect in the ash, pollution filtration, the stack and in the penthouse air. If we can demonstrate by repeated measurements (isokinetic and anisokinetic air sampling) certain concentrations of radionuclides in all these media, then we can utilize conservative assumptions in the future to demonstrate we are within regulatory limits for radionuclide concentrations.

3) Ash Handling:

a) As fly ash is collected on the bag house filter bags, the pressure drop across each bag increases. When the pressure drop reaches a preset level in a particular filter bag compartment, the bags are automatically cleaned of collected fly ash by reversing the direction of air flow through the bags for a few seconds. The fly ash on the bags falls by gravity into an enclosed collection hopper beneath the bag house. This is a completely closed system. Sampling ports are located in this system so that its radioactive content can be measured.

Based on operating conditions, but at least once each day, the fly ash cart if below regulatory radioactive concentrations will be wheeled over to the bottom ash wet collection system where the fly ash is manually added into a wheeled cart which is continuously collecting dewatered bottom ash from the larger non-radioactive waste incinerator. The large incinerator will produce approximately 150 lb/hr or 0.07 cu yd/hr of dewatered bottom ash.

Manually removed bottom ash from the small radioactive waste incinerator, if below regulatory radioactive concentrations, will be moved in a wheeled cart to the wet ash collection system, and in a similar manner to fly ash handling, will be manually added into the wheeled cart which is continuously collecting dewatered bottom ash from the larger non-radioactive incinerator.

Over a 24 hour period of continuous operation, approximately 5200 lbs of the fly ash and bottom ash from both incinerators will be collected for disposal to a licensed sanitary landfill. As each 1 cu yd wheel cart is filled with a mixture of fly and bottom ash it is wheeled to the shipping/receiving area of the building and dumped into a solid waste collection truck along with other solid waste from the building for disposal at an area landfill.

b) radioactive solid waste containing trace amounts of long-lived contaminants e.g. ^3H, should be completely volatized, removed by scrubbing and thus leave the incinerator ash residue at concentrations that could be disposed of as normal waste. Currently we are shipping to a commercial radwaste company all our ash from radioactive incineration by assuming 100% of activity burned is left behind in the ash. The U.S. crisis in low-level radwaste management and the potential for long-term storage of long-lived waste on site necessitates we explore ash disposal to common trash. Radioactive ash from incineration of carcasses containing microspheres may require shipping this ash as radioactive and not common trash, decaying short-lived microsphere ash on site or eliminating certain long-lived microspheres from being used in research. This will depend on the availability of a low-level radwaste site in the future.

Based on the descriptions of the incinerator in item #2, we would run the radioactive incinerator during the same time the non-radioactive incinerator is running. Because it is likely that the licensing and operation of this radioactive incinerator will be close to the required implementation date of January 1, 1994 for the new part 10 CFR 20, we are submitting calculations to be in compliance with DAC.

4) Calculations

<u>Impact of incinerating solid radwaste (H-3 and C-14)</u>

Assumptions:

Flow rate of incinerator 4000 ft^3/min (minimum)
(2) 8 hr burns/week totaling 16 hrs/week
Burns made 52 weeks/year
Assume no removal by pollution equipment

Calculations for the volume of air going up stack in 1 year.

$$4000 \frac{ft^3}{min} \times 28.32 \frac{L}{ft^3} \times \frac{1000\ mL}{1\ L} \times \frac{60\ min}{hr} \times 16 \frac{hrs}{wks} \times 52 \frac{wks}{yr}$$

$$= 5.6549\ E12\ mL/yr.$$

a) For ^3H for 1992, an estimate of 250 mCi of ^3H shipped out from BUMC to commercial licensed radwaste vendor. To obtain a conservative value the 250 mCi will be doubled and the calculation made for 500 mCi of ^3H

Average yearly concentration $= \frac{500{,}000\ uCi}{5.6549E\ 12\ mL/yr} = 8.84E\text{-}8\ uCi/mL$
(without pollution controls)

Proposed 10 CFR part 20 average yearly concentration

$$1\ E - 7\ uCi/mL$$

b) ^{14}C Assume dioxide form which has concentration value at 3E-7 uCi/mL

For 1992, 13.43 mCi of solid ^{14}C sent out as commercial waste.

Multiplying this value by 2 in order to be conservative yields 27 mCi.

$\frac{27000\ \text{uCi}}{5.6549\ \text{E}\ 12\text{mL}}$ = 4.7 E-9 uCi/mL Average yearly concentration

5) We anticipate a maximum of 2 burns a week to a maximum of 16 hours a day and a maximum of 100 burns a year. From a review of the last 2 years of radioactive incineration and commercial barrel waste records, we anticipate the highest amount of activity incinerated per burn.

^{3}H	-	8 millicuries
^{14}C	-	500 microcuries
^{35}S	-	1 millicurie
^{51}Cr	-	20 microcuries
^{125}I	-	10 microcuries
gamma microspheres each (6 possible at one time)	-	100 microcuries

However the average activity incinerated per burn would be considerably less.

The maximum amount of activity allowed is governed currently by the MPC and in the future by the new part 10 CFR 20 effluent limits. For example, one MPC for ^{3}H would be 98.8 millicuries per burn under conditions stated in our calculation . Our current controls require that radioactive materials be labeled by isotope, quantity, etc. and held until our office releases the material to the incinerator operator for burning. We control the release of radioactive materials that we allow to burn in accordance with known maximum MPC quantities burned per day. Even without pollution controls, the trace amounts of radioisotopes burned are ALARA since they are a fraction of the MPC's. Pollution controls will significantly reduce effluents to deminimis levels.

6) We will need to initially establish measurement procedures for the ash residue, radioactivity removed by pollution equipment as well as radioactive stack effluents to insure compliance with all regulations. For beta emitter analysis, we would add samples in liquid scintillation cocktail for counting in a liquid

scintillation counter. We can easily measure picocurie levels in a counting vial. Gamma emitters will be identified and counted by a multichannel analyzer with sodium iodide and/or GeLi detectors. We also can measure picocurie levels with gamma counting. Because of the complexity of spill over for multiple radionuclides with beta and gamma emitters, we may have to selectively burn and remove the ash from weak beta solid waste before incinerating radioactive carcass gamma emitters and/or beta emitters.

Utilizing worst possible assumptions as we do now i.e. 100% retention of activity in the ash residue, would be another method to assure compliance with radioactive concentration limits in the ash residue. We anticipate that we would like to develop measurement data first before we proceed to estimation of the concentrations. Periodic measurements will be taken of representative samples of the ash to assure that all assumptions are still valid.

7) We will have trained dedicated incinerator operators at this new facility as required by the State of Massachusetts. We have trained our present incinerator operators to assess exposure and contamination potential from combustibles and the radioactive ash, as we have been performing radioactive incineration for over 20 years at BUMC with an excellent NRC safety record. We anticipate adding no significant radiological controls other than are employed now. We have determined that the exposure potential from handling radioactive carcasses is minimal since the operators over the years have never received a measurable exposure on their film badges. Adding weak beta emitting solid trash to this waste stream will not affect the exposure potential at all. There is contamination potential from the shoveling of the ash from the incinerator. We have not found our incinerator operators or current facility to be contaminated because of employing contamination control and radiation protection surveillance. The potential for inhalation of suspended ash residue is also unlikely since air sampling and bioassays in the past have not demonstrated this potential. We will continue to evaluate exposure, inhalation and contamination potential from the radioactive ash at the new facility. There is also no risk of significant quantities of hazardous materials in the ash.

<u>Other</u>

We are requesting also to incinerate radioactive waste from 2 affiliated institutions: Boston University license no. 20-00805-11 and Boston City Hospital license no. 20-00275-08. The new research building where the incinerators are located is owned by Boston University. Boston City Hospital is a major teaching hospital of Boston University Medical Center and located across the street from this facility in the South End. In fact many of the staff are similar for both institutions. We are asking these 2 affiliated institutions be added to our license for radioactive incineration of their radwaste. We do not feel the addition of these facilities changes the scope or reflects commercialization of this incinerator. However each institution will be responsible for amending its NRC license for change in their radwaste operations if they desire to have our institution provide radwaste incineration.

We anticipate that the amount of radwaste emanating from both affiliated institutions for incineration at BUMC is small. Both institutions generate almost no radioactive animals. We anticipate that combined solid long-lived radwaste from both institutions amounts to 60 f^3 a year principally ^3H and ^{14}C with activity levels comparable to ours and other institutions performing medical research.

Transportation and packaging of radwaste would be in accordance with DOT regulations and be licensed by NRC.

We feel we have demonstrated a long history of a successful and conscientious radiation protection program of which radioactive incineration has been an integral part. In summary, we feel approval of this amendment represents optimizing a current technology that will significantly reduce our low level radioactive waste as we pursue our mission of performing top quality medical research using radioisotopes during a time of radwaste crisis in the United States.

Sincerely,

cc: enclosures
fee

Victor Evdokimoff, CHP
Director Radiation Protection, BUMC
Assistant Clinical Professor Oral
Radiology and Environmental Health

A T T A C H M E N T   I

DESCRIPTION OF INCINERATION SYSTEM

The proposed Boston University medical and radioactive waste incineration system consists of four main components:

- general waste incinerator
  - 1000 lb/hr capacity
  - non-radioactive wastes
  - 24 hr/day operation
- radioactive waste incinerator
  - 140 lb/hr capacity
  - low level radioactive waste
  - non-radioactive animal tissue and bedding material
  - up to 16 hr/day operation
  - manual bottom ash removal
- waste heat recovery boiler
  - generates up to 5000 lb/hr of steam from heat recovered from waste combustion
- air pollution control system
  - flue gas conditioning with lime injection
  - bag house for particulate removal
  - packed tower absorber for acid gas removal
  - +99.9% particulate removal
    +98% acid gas removal
  - main exhaust stack and emergency by-pass stack

The two incinerators are connected to a single emissions control system through a waste heat boiler. The main incinerator is designed to handle 1000 lb/hr of 10,000 Btu/lb waste on a continuous basis. The second incinerator is a small unit designed for one or two shift charging of low level radioactive waste and other non-radioactive wastes and has a rating of 140 lb/hr of 10,000 Btu/lb waste. Each unit employs a mechanical loader and each unit has a secondary combustion chamber designed for a maximum of 2 seconds retention time at 1900 degrees F at the maximum burning rate.

A plan view of the entire incineration system showing all major equipment as it will exist within the Boston University research building is shown on Drawings D-04C-0123. A description of the major components of the system, excluding the waste heat recovery boiler, is described below.

DESCRIPTION OF GENERAL WASTE INCINERATOR

The general waste incinerator is a Consumat System, Inc. Model CS-550-2 modular unit. The system is designed to but Type 0 through Type 4 wastes. No radioactive waste will be burned in this unit. The maximum rating of the system is 1,000 lbs/hr of 10,000 Btu/lb waste.

The primary chamber operates in the substoichiometric, controlled-air mode. Waste is fed into the primary chamber with an automatic loader. A double door arrangement is used with the feed system to minimize air infiltration during loading and to protect personnel. A stepped hearth configuration is used in conjunction with water cooled, ash transfer rams to move the bottom ash within the chamber. Bottom ash is ejected from the primary chamber, on a programmed basis, through a water seal into a quench tank. The ash removal system is designed for 24 hr/day operation. A conveyor drags the wet ash from the quench tank. The ash is dewatered on the conveyor and discharged into a 1 cu yd wheeled cart.

Products from the primary chamber are mixed with air in the secondary chamber to complete the combustion reaction. Temperature is automatically controlled to a pre-set number by modulating the auxiliary burner and the combustion air. Interlocks are provided to the primary chamber to protect from over temperature and to prevent charging if the temperature is below set point. The secondary chamber has a minimum retention time of two seconds for the combustion products at 1900 degrees F when burning waste at the maximum charging rate.

Flue gas exits from the secondary chamber into a duct common with the radiological waste incinerator. The flue gas is then trucked to a York-Shipley Model HRH-1250 boiler. Flue gas exits from the boiler into the emission control system, which is described elsewhere. An emergency vent stack is provided for safety reasons to automatically vent the system under certain emergency conditions. The loaders are disabled during such conditions.

The overall combustion system is operated at a negative pressure to prevent gas leakage into the room.

DESCRIPTION OF RADIOLOGICAL WASTE INCINERATOR

The radiological waste incinerator is a Consumat System, Inc. Model C-75P-2 modular unit. The system is designed to burn Type 0 through Type 4 wastes. The principal purpose of the radiological incinerator will be to burn low level radioactive wastes and non-radioactive waste including animal tissue, animal bedding, pathological waste and some red bag medical waste. The maximum rating of the system is 140 lbs/hr of 10,000 Btu/lb waste, 16 hours per day. Specifications of this incinerator are included at the end of this section.

The primary chamber is approximately 54 inches high and has a 51 inch inside diameter. The internal volume is approximately 64 cubic feet. The primary chamber operates in the substoichiometric, controlled-air mode. Waste is fed into the primary chamber with an automatic loader. A double door arrangement is used with the feed system to minimize air infiltration during loading and to protect personnel. Bottom ash is manually removed from the primary chamber after a burn down - cool down period and loaded into 1 cu yd wheeled cart. Typically, start-up, waste combustion and burn down will be accomplished over an 8 to 16 hour period.

The secondary chamber has a 39-5/8 inch diameter and a 12 foot long inside dimension. Products from the primary chamber are mixed with air in the secondary chamber to complete the combustion reaction. Temperature is automatically controlled to a pre-set number by modulating the auxiliary burner and controlling the combustion air. Interlocks are provided to the primary chamber if the temperature is below set point. The secondary chamber has a total effective volume of 102 cubic feet which provides a minimum retention time of two seconds for the combustion products at 1900 degrees F when burning waste at the maximum charging rate.

Flue gas exits from the secondary chamber into a duct common with the general waste incinerator. The flue gas is then trucked to a York-Shipley Model HRH-1250 boiler. Flue gas exits from the boiler into the emission control system, which is described elsewhere. An emergency vent stack is provided for safety reasons to automatically vent the system under certain emergency conditions. The loader is disabled during such conditions.

The overall combustion system is operated at a negative pressure to prevent gas leakage into the room.

DESCRIPTION OF EMISSIONS CONTROL SYSTEM

AIR EMISSION CONTROL

Flue gas from the waste heat recovery boiler exits into a conditioning chamber. Water and lime are added to the conditioning chamber. The purpose of the conditioning chamber is to reduce the flue gas temperature into the bag house to protect the filter bag and to inject lime for acid gas removal. The lime forms a cake on the filter bags, and in addition to removing particulate matter on the bags, a significant amount of the acid gases are neutralized as they pass through the lime cake. Approximately 90% of the HCl and more than 99% of the dry particulate matter will be removed by the fabric filter. The fabric filter technology represents the lowest achievable emission rate for particulate matter for incinerators.

Flue gas from the fabric filter exits into damper/induced draft (ID) fan assembly. The fan is designed to maintain a pre-set (draft) pressure in the combustor.

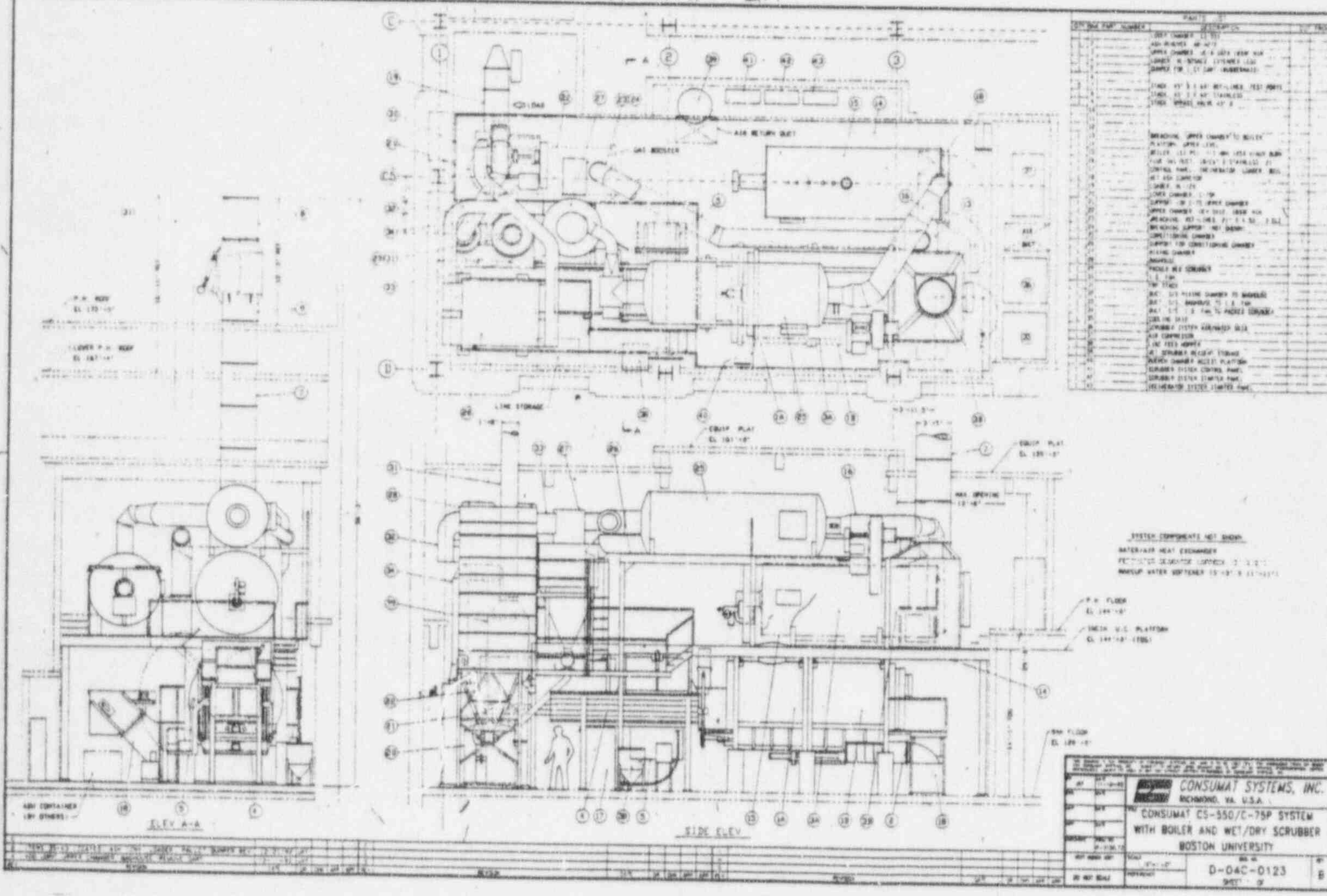
Flue gas from the ID fan exits into a quench/packed tower absorber. The packed tower is designed to remove most of the remaining acid gases from the flue gas stream. The overall system will remove a minimum of 98% of the HCl. The packed tower absorber represents the lowest achievable emission rate for HCl for incinerators.

The packed tower is filled with an inert packing material with a high surface area. Flue gas from the bag house is passed upwards through the packing as a scrubber solution flows downward over the packing material. The scrubber solution is a mixture of water and sodium hydroxide controlled to a pH of 10. Acid gases are neutralized by the elevated pH scrubber solution as they pass upwards through the packed tower.

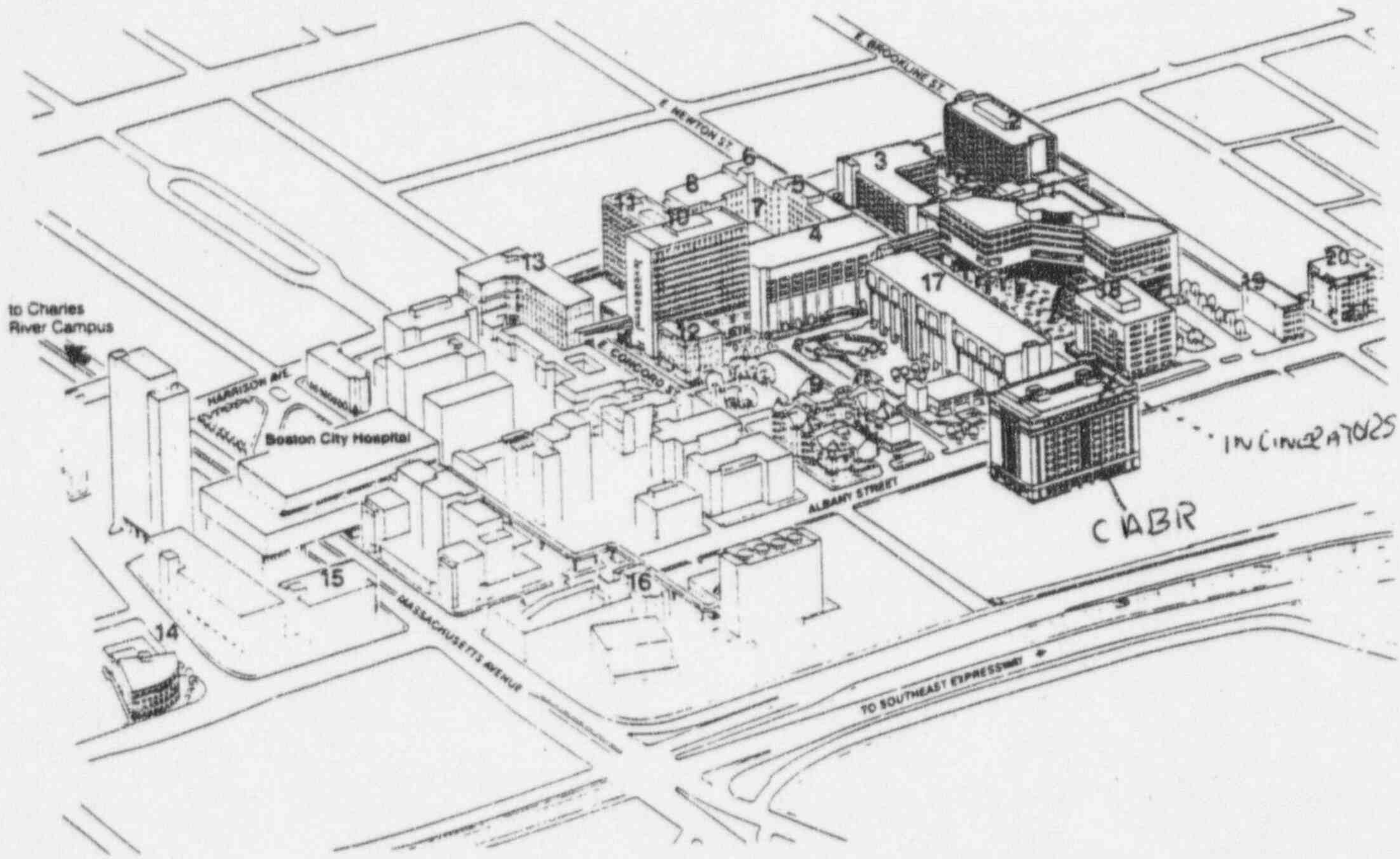
The scrubber solution is stored in an enclosed reservoir beneath the packed tower and is continuously recirculated though the tower by a pump. A pH measurement probe is installed in the reservoir and the pH of the scrubber solution is continuously measured and recorded. As the pH of the solution drops due to acid gas neutralization, a solution of sodium hydroxide is added to maintain a pH of 10. At full operation, approximately 1 gallon per minute of scrubber solution in continuously drained from the reservoir and piped to the City's sewer via the buildings wastewater collection and discharge system. A solution level control within the reservoir automatically adds make-up water to the reservoir on an as needed basis. A sampling port is installed in the reservoir tank so that samples of the scrubber solution can be taken for analysis.

Saturated flue gas from the packed tower exits into an FRP stack at the top of the packed tower. The stack, which is equipped with test ports, will be 12 feet above roof cover. Sampling ports are located in the stack for air emissions sampling and measurement.

ATTACH 2.1


LIME STORAGE
GAS BOOSTER
AIR RETURN DUCT
SYSTEM COMPONENTS NOT SHOWN
ELEV A-A
SIDE ELEV
CONSUMAT SYSTEMS, INC.
RICHMOND, VA. U.S.A.
CONSUMAT CS-550/C-75P SYSTEM
WITH BOILER AND WET/DRY SCRUBBER
BOSTON UNIVERSITY
D-04C-0123

▶ Medical Center



1 **Atrium Pavilion**
Main Entrance – The University Hospital

2 **Doctors Office Building**

3 **Preston Family Building**

4 **Evans Building**

5 **Old Evans Building**

6 **Collamore Building**

7 **Vose Hall**

8 **Robinson Building**
BUMC Administrative Building

9 **Talbot Building**

10 **School of Medicine**

11 **Housman Medical Research Center**

12 **School of Public Health**

13 **Silvio O. Conte Medical Research Center**

14 **801 Albany Street**

15 **Nurses Education Building**

16 **Maxwell Finland Laboratory**

17 **Solomon Carter Fuller Mental Health Ce**

18 **Goldman School of Graduate Dentistry**

19 **Naval Blood Research Center**

20 **609 Albany Street**

Located in Boston's South End, 2.3 miles from the Charles River Campus

35

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection
Metro Boston/Northeast Regional Office

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

FEB 16 1993

Mr. Craig Lazenby
Boston University
80 E. Concord Street
Boston, MA 02118

RE: BOSTON - Metropolitan
Boston/Northeast Region
310 CMR 7.02 - Plans Approval
Application No. MBR-92-INC-004
Transmittal No. 50276
CONDITIONAL APPROVAL

Dear Mr. Lazenby:

The Metropolitan Boston/Northeast Region of the Department of Environmental Protection, Division of Air Quality Control, has completed its review of the Comprehensive Plans Application for the proposed installation and operation of an incineration system at your 700 Albany Street facility, known as the Boston University Medical Research Building in Boston, Massachusetts. The submittal bears the seal and signature of Mr. Leo R. Larochelle, Massachusetts P.E. No. 24318.

This review by Department engineers indicates that the Boston University ("BU") facility will contain two new Consumat Systems incinerators. Unit 1 will be a Model CS-550-2 infectious waste incinerator, which will be capable of handling 1000 pounds per hour of general infectious waste. This waste will include non-radioactive infectious waste such as syringes, blood, and bedding and office and laboratory trash. Unit 2 will be a Consumat Systems Model C-75P-2 infectious waste incinerator, which will combust primarily low-level radioactive waste such as animal tissue and contaminated non-metallic laboratory and operating room equipment and supplies. Unit 2 will have a maximum charging rate of 140 pounds per hour. Both Unit 1 and Unit 2 will use ram feeders and hopper loaders.

The primary chamber for Unit 1 will have the following dimensions: a length of 15 feet, a width of 7.8 feet, and a height of 8.8 feet. It will be equipped with two Eclipse Model WC-6 burners which will combust natural gas at a combined maximum firing rate of 3000 cubic feet per hour to give a maximum energy input of 3,000,000 B.t.u. per hour.

The primary chamber for Unit 2 will have the following dimensions: a length of 5 feet, a width of 5 feet, and a height of 6.17 feet. It will be equipped with an Eclipse Model WC-6 burner which will combust natural gas at a maximum firing rate of 750 cubic feet per hour to give a maximum energy input of 750,000 B.t.u. per hour.

Both primary chambers will operate at starved-air conditions with approximately 60 to 70 percent theoretical air being supplied for waste combustion. Unit 1 will have an automatic ash removal system, which will sweep the primary chamber's ashes into a separate compartment while the incineration system is operating. The primary chamber ashes will be quenched in a water trap that also prevents air infiltration into the ash removal system. The ash in Unit 2 will be removed manually after the unit has finished the burndown cycle and the ash has cooled.

Both Unit 1 and Unit 2 were evaluated assuming a "worst-case" waste having a waste composition of 70 percent dry combustibles, 20 percent water, and 10 percent ash. The secondary chambers of Unit 1 and Unit 2 is the location where the substoichiometric combustion products from the primary chambers combine with additional ambient air equal to 100 to 360 percent of the theoretical air requirements. The secondary chamber of Unit 1 will be equipped with an Eclipse Model No. 248 MVTA-SP gas burner, which will have a maximum firing rate of 6,500 cubic feet of natural gas per hour to provide a maximum energy input to the chamber of 6,500,000 B.t.u. per hour. This secondary chamber will have a total effective volume of 779 cubic feet. This volume will provide a retention time in excess of two seconds for the combustion gases at 1900 degrees F. The secondary chamber of Unit 2 will be equipped with an Eclipse Model WC-8 gas burner, which will have a maximum firing rate of 2,500 cubic feet of natural gas per hour to provide a maximum energy input to the chamber of 2,500,000 B.t.u. per hour. This secondary chamber will have a total effective volume of 102 cubic feet. This volume will provide a retention time in excess of two seconds for the combustion gases at 1900 degrees F. Units 1 and 2 exhaust to a common heat-recovery boiler and to add-on air pollution control equipment.

Under normal operating conditions the incinerator exhaust from Units 1 and 2 will be used to produce steam via a York-Shipley Model HR-1250 heat recovery boiler, which will be equipped with a York-Shipley Model 576 gas-fired burner. This burner has a maximum fuel firing rate of 9,450 cubic feet per hour to give a maximum energy input rating of 9.45 million B.t.u per hour. The exhaust gases will pass through this boiler and will then enter a dry scrubber unit.

The dry scrubber unit is a Consumat Systems Dry Scrubber Model DS-2180-S consisting of a conditioning chamber followed by a mixing chamber. The conditioning chamber adjusts the temperature and humidity of the exhaust stream in order to enhance the acid conversion reactions, which will occur in the mixing chamber. The acid gases are neutralized in the mixing chamber by injecting calcium hydroxide sorbent into the gas stream. The dry scrubber will have an acid gas removal efficiency of 90 percent by weight (measured as hydrochloric acid). The operating parameters for this dry scrubber unit are listed in Table I below.

Table I. Dry Scrubber Operating Conditions

OPERATING CONDITIONS	VALUE
AVERAGE INLET GAS FLOW (acfm,wet)	8,240
AVERAGE INLET TEMPERATURE (degrees F)	500
AVERAGE WATER INJECTION RATE (lbs/hr)	866
AVERAGE OUTLET TEMPERATURE (degrees F)	350
AVERAGE SORBENT INJECTION RATE (lbs/hr)	47

The exhaust from the dry scrubber will then pass into a DCE Dalamatic 2-7-15 baghouse unit which will have a maximum air handling capacity of 8,000 actual cubic feet per minute at 340 degrees F. The maximum pressure drop across the unit will be 6 inches of water column. The baghouse has one compartment containing 140 Teflon filter tubes. The filter tubes are rated for a maximum operating temperature of 482 degrees F and are resistant to mild acids. Each filter tube has an effective surface area of 16.1 square feet, yielding a total surface area of 2,254 square feet. Thus, the air-to cloth ratio will be 3.5 to 1. The filter tubes will be pulse jet cleaned in groups of fourteen every twenty seconds. Particulate matter from pulse jet cleanings will be collected in an enclosed hopper.

The baghouse will exhaust into a Twin City Model 921 RBO blower, and thence into a Tri-Mer quench section, and thence into a Tri-Mer packed bed wet scrubber unit. The dry scrubber unit previously described together with the quench section and packed-bed scrubber unit, will capture and neutralize acid gas an overall removal efficiency of equal to or greater than 97.5 percent by weight (measured as hydrochloric acid removal) (See Proviso No. 6). The scrubbing liquid will be recirculated through the packed-bed scrubber at a rate of 120 gallons per minute (GPM) at 148 degrees F. Approximately, 6.5 gallons per minute of make-up liquid will be required. The scrubbing liquid overflow will be held in a sump tank that is pH controlled to maintain the pH level between 7 and 10.

After exiting the scrubber, the combustion products will enter a new fiberglass-reinforced plastic stack having an exit height of 184 feet above the ground and 12 feet above the roof. This stack will have an inside exit diameter of 20 inches and will provide a minimum stack gas exit velocity of 30 feet per second at 140 degrees F.

During emergencies a bypass stack, located downstream of Units 1 and 2 and upstream of the heat recovery boiler, will be opened to allow the incinerator exhaust gas to escape to the atmosphere. Bypass stack usage is interlocked with the unit's ram feeder to prevent waste charging during an emergency. All emergency procedures will be incorporated into the system's final Stanadard Operating and Maintenance Procedures. When the bypass stack is opened, the incinerator exhaust gases will vent through it at a velocity of 45 feet per second at 1800 degrees F. The bypass stack has an inside exit diameter of 36 inches and an exit height of 184 feet above the ground and 12 feet above the roof.

The Department is of the opinion that your application is administratively complete and that the plans, specifications, and the Standard Operating and Maintenance Procedures pertinent to the submittal are in conformance with current air pollution control engineering practice, and hereby grants **CONDITIONAL APPROVAL** for the proposed installation, as submitted, with the following provisos:

1. That the Metropolitan Boston/Northeast Regional Office shall be notified in writing when the modifications are complete, and the incineration system is ready for initial start-up.

2. That should any nuisance condition(s) be generated by the operation of this facility, then appropriate steps shall immediately be taken by BU to abate the nuisance condition(s).

3. That a copy of this approval letter shall be affixed on or adjacent to the subject incineration system.

4. That an opacity meter shall continuously monitor and record the incineration system stack's exhaust gas opacity with a circular day chart recorder (time and date) that is equipped with an audible alarm which is located in a manned area of the facility.

5. That the opacity of all emissions from this incineration system shall be five percent or less except for two minutes in any one hour when the visible emissions may

have an opacity ranging from five to ten percent. At no time shall the emissions from the incineration system exceed ten percent opacity.

6. That this incineration system's particulate emission rate shall not exceed 0.015 grains per dry standard cubic foot adjusted to 7 percent oxygen. The acid-gas scrubber shall have at least a 97.5 percent overall acid gas removal efficiency (as measured by hydrochloric acid (HCl) removal) or have a maximum outlet HCl concentration 30 parts per million (by volume) or less adjusted to 7 percent oxygen, whichever is less stringent.

7. That the incineration system shall be constructed to accommodate emissions testing requirements, as specified by Federal Regulations 40 CFR 60, Appendix A, Method 1.

8. That within 90 days after incineration system start-up, BU must complete emissions testing of the incineration system. The emissions testing program shall include testing for total non-condensible and condensible particulates, PM10, hydrogen chloride, dioxins/furans (in accordance with Department guidelines), metals (antimony, arsenic, beryllium, cadmium, chromium III, chromium VI, copper, lead, manganese, mercury, molybdenum, nickel, selenium, tin, vanadium, and zinc), carbon monoxide, and pathogens. Appropriate US EPA approved UNAMAP dispersion modeling of metals and dioxins/furans emissions shall be run to verify compliance with Department policy guidelines. At least 30 days prior to the emissions testing program a written pretest protocol outlining the test methodology shall be submitted to the Department for review and written Department approval.

9. That within 90 days of completion of emissions testing, an emissions test report must be submitted by BU to this Office, Attention Air Quality Section Chief.

10. That the secondary chamber in Unit 1 and 2 must provide for a combustion gas retention time of two seconds or greater and a minimum temperature of 1900 degrees F during the entire burn cycle, burndown cycle, and afterburn cycle. (The afterburn cycle is that period during which the secondary chamber burners continue to operate after the primary chamber burners have been shut down for the day.)

11. That during the afterburn cycle, the secondary chamber shall maintain a minimum temperature of 1900 degrees F until the primary chamber temperature falls below 500 degrees F. or until the primary burner has been shut-off

for a four hour period, whichever occurs first.

12. That the thermocouple in the incinerator's secondary chamber must be located at the end of the "effective" chamber volume. The "effective" chamber volume is the volume used to determine the retention time in the secondary chamber.

13. That both the primary and secondary chambers shall be equipped with temperature monitoring equipment using a circular chart recorder that has a one day chart for ease of inspection. The temperature records shall be maintained on-site for the most recent three years of operation and shall be available for inspection by the Department personnel upon request.

14. That electronic interlocks shall be installed to prevent the charging of waste if the secondary chamber temperature falls below 1900 degrees F, and to prevent the charging of waste during the start-up cycle until the secondary chamber has reached a temperature of 1900 degrees F.

15. That all waste charged into the incineration system must be pre-packaged into sealed boxes that have plastic linings to prevent the leakage of any fluids contained in the waste.

16. That one or more digital scales shall be installed for weighing the waste boxes to verify a maximum waste feed rate of 1000 pounds per hour for Unit 1 and 140 pounds per hour for Unit 2. A maximum of 250 pounds of waste will be fed every 15 minutes for Unit 1 and a maximum of 35 pounds of waste will be fed every 15 minutes for Unit 2. In the instance when a whole animal is charged into Unit 2, a maximum of 70 pounds will be fed every 30 minutes. Smaller feed weights can have proportionately shorter lock-out times, but in no case shall the lock-out time be less than six (6) minutes. An electronic interlock between the digital scale(s) and the ram feeder shall prevent overloading. The digital scale(s) should be connected to a recorder to record the weight of the charge and the date and time the weighing was performed.

17. That the manufacture's start-up specifications shall be incorporated into the Final Standard Operating and Mainteance Procedures (SOMP), and the Final SOMP shall be submitted to this Office by BU within 30 days of the issuance of a **FINAL APPROVAL** by the Department.

18. That the Final SOMP shall be posted on or near the incineration system. The system shall operate and be maintained in compliance with these approved Standard Operating and Maintenance Procedures at all times.

19. That the Final SOMP shall specify that the primary chamber temperature during the burn cycle will be kept in the same range as that which was recorded during the above required emissions testing.

20. That BU shall develop an incineration system operator training program which shall include but not be limited to the following categories: waste handling, incinerator operation, air pollution control equipment operation, systems failure, fire safety, ash handling/disposal, and recordkeeping. An operator must complete the training program prior to operation of the incineration system; furthermore, a trained operator must complete a refresher training program every six months after the initial training program. BU shall submit a copy of the training program to the Department for review prior to system start-up. Should a professional operator training certification program become available, the Department shall require BU personnel to become appropriately certified.

21. That properly trained personnel only will operate the incineration system.

22. That the pH of the packed-bed's scrubbing liquid shall be monitored and recorded continuously (date and time). The pH of the scrubbing liquid shall be maintained in the range of 7.0 to 10.0.

23. That BU shall submit to the Department, prior to incineration system start-up, an incinerator ash management/disposal plan. The plan shall include but not be limited to the following: analytical testing of the ash (if necessary), controlling and maintaining ash quality such as a "complete" burnout of combustibles, means of disposal, disposal agent, landfill destination, storage capacity of incinerator ash on-site, number of shipments of ash to landfill terminus per month, quantity of ash disposed of per month, and any other such pertinent information concerning ash management/disposal.

24. That BU shall have readily accessible at all times a minimum of twenty replacement filter tubes for the baghouse.

25. That BU shall conduct a test (visulite, or equivalent

method) to determine the baghouse filter tubes' integrity at least once every three months. A maintenance log should document baghouse testing along with any other maintenance activities performed on the baghouse, including immediate replacement of leaking filter tubes.

26. That bypass stack usage shall be interlocked to the unit's ram feeder to prevent waste charging during emergencies.

27. That the bypass stack usage shall be automatically monitored to record the time and duration of each bypass stack usage. BU shall notify the Department by FAX at (617) 935-6393 immediately upon bypass stack usage indicating reason(s) for usage and projected time of usage. Within seven days of each bypass stack usage, BU shall provide this Office, in writing, the date and time of usage, extent of usage, reason(s) for usage, steps taken to remediate the situation, and all SOMP modifications taken to eliminate the cause of bypass stack usage in the future.

28. That should asbestos removal be required as part of the removal project for the existing incineration units then BU shall comply with Regulation CMR 310 7.15 (Asbestos) in its entirety for said asbestos removal work.

29. That BU shall not incinerate low level radioactive waste at the subject facility's Unit 2 until BU obtains written approval from the Federal Nuclear Regulatory Commission (NRC), under 10 CFR Part 20, to incinerate low level radioactive wastes and to handle and dispose of ashes generated by said incinerator. BU shall incinerate low level radioactive waste in Unit 2 only and shall only do so in complete compliance with said NRC approvals. Copies of the NRC approval shall be submitted to this office, attention Air Quality Section Chief, within seven days of their receipt by BU.

Failure to comply with any of the above stated provisions will constitute a violation of the "Regulations", and can result in the revocation of the approval granted herein to operate the described facility. The Department may also revoke this approval if the construction is not begun within 2 years from the date of issuance of this approval, or if the construction work is suspended for 1 year or more.

This plan approval is an action of the Department. If you are aggrieved by this action, you may request an adjudicatory hearing. A request for a hearing must be made in writing and postmarked within twenty-one (21) days of the date you received this plan approval.

Under 310 CMR 1.01(6)(b), the request must state clearly and concisely the facts which are the grounds for the request, and the relief sought. Additionally, the request must state why the plan approval is not consistent with applicable laws and regulations.

The hearing request along with a valid check payable to the Commonwealth of Massachusetts in the amount of one hundred dollars ($100.00) must be mailed to:

Commonwealth of Massachusetts
Department of Environmental Protection
P.O. Box 4062
Boston, Massachusetts 02211

The request will be dismissed if the filing fee is not paid unless the appellant is exempt or granted a waiver as described below.

The filing fee is not required if the appellant is a city or town (or municipal agency), county, or district of the Commonwealth of Massachusetts, or a municipal housing authority.

The Department may waive the adjudicatory hearing filing fee for a person who shows that paying the fee will create an undue financial hardship. A person seeking a waiver must file, together with the hearing request as provided above, an affidavit setting forth the facts believed to support the claim of undue financial hardship.

For Air Quality Control purposes, an Environmental Notification Form is not required to be submitted for this project since it is categorically exempt pursuant to the Regulations Governing the Preparation of Environmental Impact Reports as adopted by the Secretary of Environmental Affairs.

Please be advised that this approval does not negate the responsibility of BU to comply with this or any other applicable federal, state, or local regulations in the future. Nor does this approval imply compliance with any other applicable federal, state, or local regulations now or in the future.

Should you have any questions concerning this matter, please do not hesitate to contact Mr. James E. Belsky, Air Quality Section Chief, Metropolitan Boston/Northeast Region, 10 Commerce Way, Woburn, Massachusetts 01801.

Very truly yours,

E.H. MacDonald

Edward H. MacDonald
Regional Engineer
for Waste Prevention

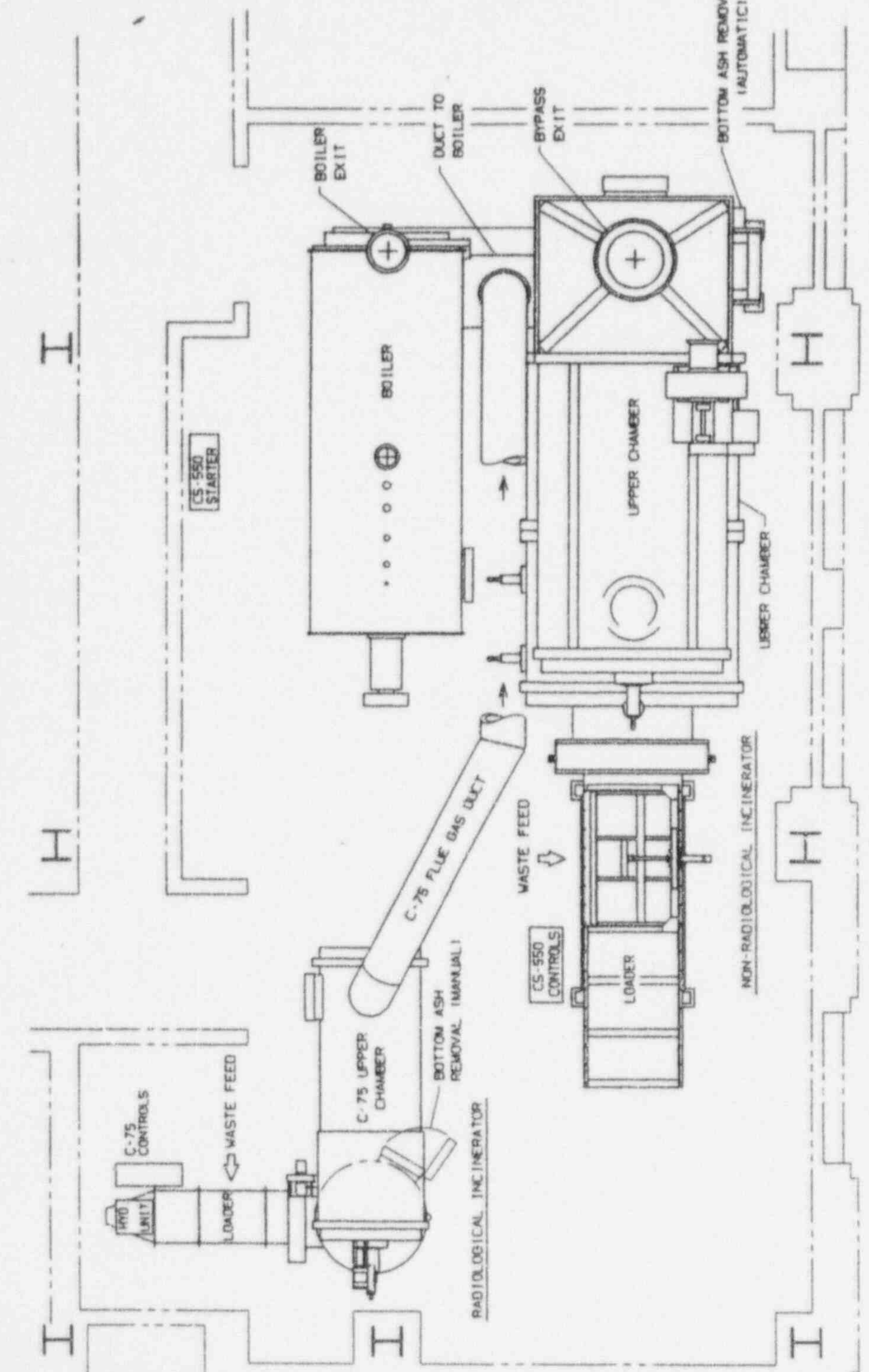
EHM/Ejs

cc: Board of Health & Hospitals, 818 Harrison Ave., Boston, MA 02118
Fire Headquarters, 115 Southhampton Street, Boston, MA 02118
DEP, One Winter Street, Boston, MA - 8th Floor, 02108
Attn: Mr. Walter Sullivan

NEWTEC, P.O. Box 1126, South Lancaster, MA 01561
Attn: Mr. Howard Harper

DEP NERO
Attn: Tom Parks
K. Mahoney

ATTAC



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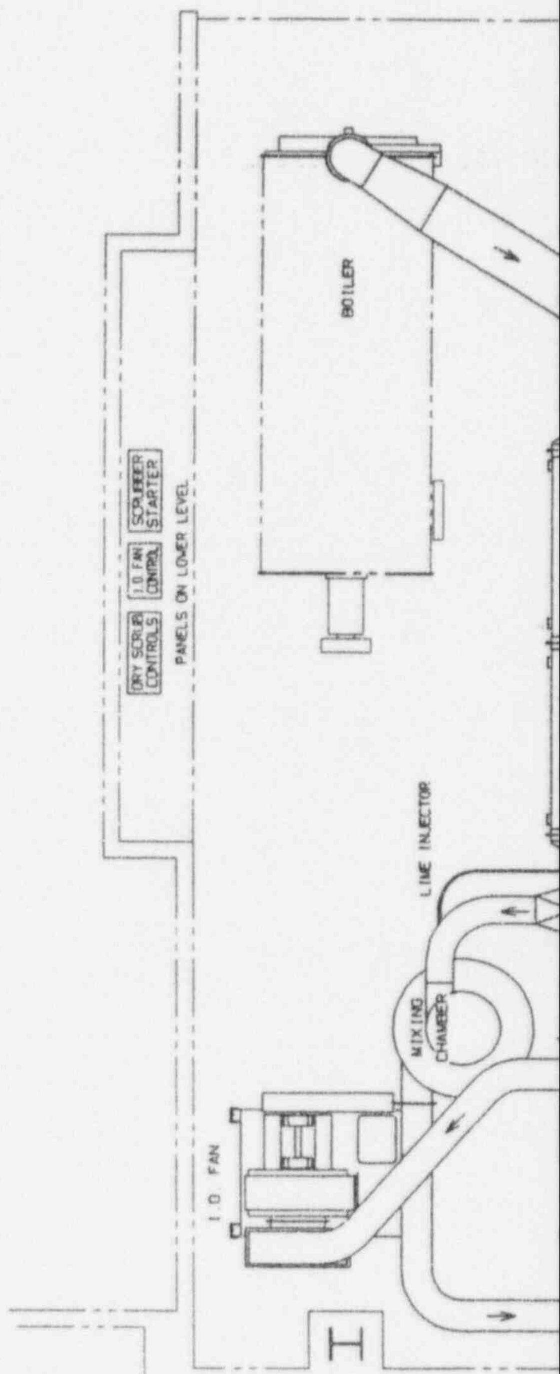

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SYSTEM

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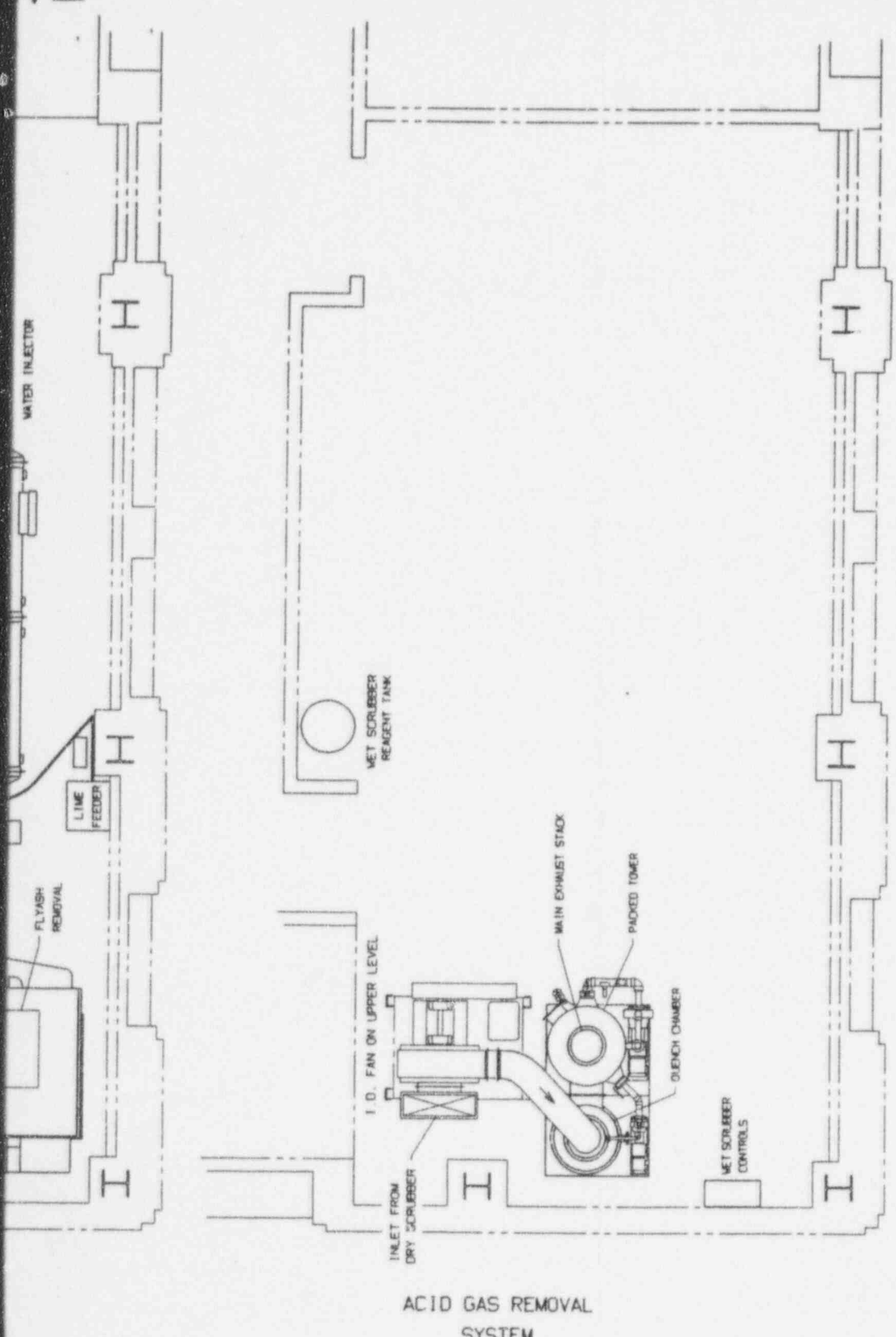

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CHK	DATE
APP	DATE
APP	DATE
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WITH BOILER AND WET/DRY SCRUBBER
BOSTON UNIVERSITY

SCALE 1/4" = 1'
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