SPECIAL MEETING

AUGUST 8, 1989

1. Call to Order and Roll Call:

A Special meeting of the Metropolitan Sewerage District Board was held in the Boardroom of MSD's Administration Building at 2 p.m. on Tuesday, August 8, 1989, the purpose of which was to hear a presentation from Black & Veatch/Engineering Science on the District's Sludge Management Alternatives. Chairman Smith called the meeting to order at 2:00 p.m.

Chairman Smith and the following members were present: Aceto, Dent, Edwards, Ivey, Maas, McDonald, Pope, Waddey and Williams. Others present were W. H. Mull, Engineer-Manager, William H. Clarke, Esquire, representing General Counsel for the District, Bob Holbrook, Bill Morris, and Jim Brewer of Hendon Engineering Associates, Dave Oerke, Patti Psaris, and Andrew Petkash representing Black & Veatch, Craig Coker and Dr. Tim Shea representing Engineering Science, Dr. Gene Rainey, Chairman, Buncombe County Commissioners, Mr. Tom Sobol and Mrs. Doris Giezentanner representing the Buncombe County Commissioners, and other concerned citizens as listed on the attached sign-up sheets.

2. Presentation of Black & Veatch/Engineering Science Joint Study of Sludge Handling Alternatives - Mr. Dick Kuchenrither, Black & Veatch and, Dr. Tim Shea, Engineering Science:

Chairman Smith stated the purpose of the Special Meeting was to hear a presentation from Black & Veatch/Engineering Science of the District's Sludge Handling Alternatives. Chairman Smith introduced Mr. Dick Kuchenrither, Director of Residuals Management for Black & Veatch, and turned the floor over to Mr. Kuchenrither.

Mr. Kuchenrither thanked the District Board for allowing Black & Veatch/Engineering Science the opportunity to talk about sludge management plans. At this time Mr. Kuchenrither introduced other representatives from Black & Veatch and Engineering Science who worked on the project, and gave a brief background on each. They are: Dr. Tim Shea and Mr. Craig Coker representing Engineering Science; Mrs. Patti Psaris and Mr. Dave Oerke representing Black & Veatch. Mrs. Patti Psaris, Mr. Dave Oerke, Mr. Craig Coker, Dr. Tim Shea and Mr. Dick Kuchenrither reviewed the attached evaluation of Sludge Management Alternatives of the District with the Board. After Dr. Shea reviewed the Summary of Evaluations of Sludge Management Alternatives, Chairman Smith thanked the Engineering firms for the presentation.

3. Comments and Questions by Board Members:

Chairman Smith asked for questions and/or comments from the Board. After the question and comment period, Chairman Smith asked for questions from the public. After many questions and comments, Chairman Smith declared the question and comment period closed.

4. Board Action:

Dr. Maas moved that the Engineers do further evaluation of the incineration process, taking into account the costs associated with obtaining a 31% solids sludge, what the costs might be if only 22% solids could be obtained and what the cost of air pollution control equipment necessary to meet new State air toxic standards would be, and that the Engineers talk with N-Viro and N-Viro Gro and come to some kind of agreement about what the actual costs of their processes are and incorporate those back into the final report. Dr. Maas further moved that the Board consider the costs of a single-lined dedicated landfill for the incinerator. Mrs. McDonald seconded the motion and discussion followed. Voice vote carried

unanimously in favor of the motion.

Chairman Smith directed Dr. Maas to, as much as possible, ethically interact with the work that these Engineers do, in order to get the questions answered which Dr. Maas addressed, so that these questions don't arise again at the next Board meeting.

5. Adjournment:

Chairman Smith thanked the Consulting Engineering Firms for a job well done, and adjourned the meeting at 4:10 p.m.

SECRETARY

SIGN-IN SHEET

Special Board

MSD BOARD MEETING: August 8, 1989

DATE: 8-8-89 **TIME:** 2:00 p.m.

NAME	COMPANY	OR	REPRESENTING
DAVE OERKE	BLACK & VEATCH		
Pat. Psaris	"		
JAMES O. BREWER	Hendon Engineering Assoc.		
Bill Morris	Hendon Engineering Assoc.		
CRAIG COKER	ENGINEERING - SCIENCE, INC.		
TIM SHEA	"		
BOB HOLBROOK	HENDON ENG'G		
Susan Ruhl			
Randy Simpson			
Leah R Karpen			League of Women Voters
Lynnette James	WCQS		
Jis Miller			Citizens for Clean Air
April Eaton	WLOS-TV		
Doris Guyatauner			— City Comm.
Tom Sobol			City Commission
Andrew V. Petkash	Black & Veatch		
Monty Payne	MSD		
Charlie Patton	— Env. Affairs Board		
Marjorie P. Lockwood	Water quality Committee of EAB		

SIGN-IN SHEET

MSD BOARD MEETING: August 8, 1989

DATE: 8-8-89 **TIME:** 2:00 p.m.

NAME	COMPANY	OR REPRESENTING
Chad O'Shea	Unity Center	SANITY
Victoria Maddux	Women	Common Sense
Edith Hetland		LWVAB
Melvin Hetland		UU Social Concerns
Autumn Earth-Hansen		Concerned citizen
Howard Hansen		self
Denise Kenney	Board of Commissioners	
Mary Anne Bowen		My family
Jim LoPresti	Bed + Breakfast	Montford Bed + Breakfasts Against Sludge Incin.
Jacky Williamson	WNC Alliance	
Dalen Kucken	U.N.C.A.	Environmental Studies
Marc Fender	MSD	
Palma Urvina	Concerned citizen	
Marie Louise Eaton - humanity -		life & Sierra Club
Meg MacLeod	The EARTH	
Kathryn Warner	Warner Photography	

ES
ENGINEERING-SCIENCE, INC.

TWO FLINT HILL
10521 ROSEHAVEN ST.
FAIRFAX, VA 22030
Tel: (703) 691-7575 Fax: (703) 591-1305

August 18, 1989

Mr. W. H. Mull, P.E.
Engineer-Manager
Metropolitan Sewerage District of
Buncombe County, NC
P. O. Box 8969
Asheville, NC 28814

RE: Evaluation of Sludge Management Alternatives - Summary of Response to Board of Directors Comments on Draft Report

Dear Mr. Mull:

This letter report is submitted in completion of our response as above, the initial component of which was transmitted on August 17, 1989. This letter contains a summary of cost estimates for the alternatives or combinations thereof that are now of interest, as well as additional comments on the proposed program.

SUMMARY OF COST ESTIMATES

The summary table (Table 8) contains cost information for the following cases:

- The original incineration system (base case), for which grant eligibility has been established ($7,974,000), an air permit to construct issued, and on-site lagoon disposal of ash planned.
- The modified incineration system, including a wet electrostatic precipitator that in our judgment would be required at a future date to meet the "probable" air toxics regulations, but is not required at present.
- The modified incineration system with an off-site landfill, as the worst case,incineration again not required at present. (We note that we have assumed that the entire 20-year landfill would be constructed at the start of the project life; however in practice the facility would be built in say four 5-year phases).
- A dual utilization alternative incorporating the base case incineration system plus a basic N-Viro type system as explained in our August 17 letter report.
- The modified N-Viro System, incorporating cost adjustments reflecting our discussions with N-Viro.

08. 18. 89 03:24 PM *ES—S FAIRFAX P02

- A modified N-Viro System with of-site sanitary landfill disposal of the product, assuming the worst case of no market for the product for the initial three to five years of operation. (We note however that the state has yet to approve this method of disposal).

In terms of grant eligibility, we have assumed that the present grant offer would apply to the alternatives that incorporate incineration alone or in combination, but not to the chemical stabilization-alone alternatives. In the latter case this is because cost-effectiveness must be demonstrated before grant eligibility can be obtained. However, the format of the table allows comparisons among the alternatives presented on either basis.

We also note that a shift by the MSD from incineration alone to chemical stabilization alone would result in an estimated $1,000,000 in grant-ineligible costs, for the redirection of the project and for the then-unneeded design of the incineration system. These are equivalent to $1 million in added capital cost and $12/DT in added unit cost, items that are not shown for the chemical stabilization-alone alternatives in Table 8.

The results indicate that:

(1) The unit costs for the base-case incineration system and the modified N-Viro System are equal at $314/DT before consideration of the grant and redirection and lost design costs. For the latter, the costs are $221/DT for base case incineration vs $326/DT for the modified N-Viro System.

(2) The modified incineration system has a capital cost that is $874,000 (not $4 million) greater than the base case, and a unit cost of $324/DT vs $314/DT for the base case.

(4) If an off site ash landfill were to be added to the incineration project, it would increase the capital cost by $8,408,000 relative to the base case, and the unit cost by $153/DT from $314/DT to $467/DT. However, we emphasize that there is no requirement for the construction of an off-site ash landfill to justify this expenditure.

(5) The modified N-Viro System with off-site disposal has a unit cost of $413/DT vs $314/DT for the modified N-Viro System assuming 100% beneficial reuse of the product. (However, the landfill disposal of this product has yet to receive state approval).

(6) In comparison the dual alternative has a capital cost that is $2,264,000 greater than for the base incineration system, and a unit cost of $351/DT vs $314/DT before the grant is considered.

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In consideration of the preceding it is apparent that the base case incineration and base case N-Viro System alternative have a common unit cost of $314/DT before the extenuating circumstances are considered. These are grant eligibility, disposal of residuals, time required to develop product acceptance, and operational flexibility. The grant eligibility for a chemical stabilization system is unlikely to be greater than the $7,974,000 for base case incineration, and will not include the $1,000,000 in redirection and lost design costs.

In terms of off-site disposal, it is realistic and prudent for MSD to assume that off-site disposal of the N-Viro material will be required for three to five years (until the market is firm). On the other hand we have seen no reason to assume that the incinerator ash should be disposed off-site. Clearly a decision by the Board to support the latter would be preferential as opposed to mandatory, and would also mandate (for consistency) that the Board provide funds for the off-site disposal of chemically stabilized sludge until the markets develop.

From a pragmatic viewpoint it is our recommendation that the Board consider the dual utilization alternative, with or without the addition of a wet electrostatic precipitator, for its long-term facilities. This alternative provides the flexibility necessary to allow time for market development and changing future regulations, while providing a proven and reliable disposal method from the onset.

Thank you for this opportunity to be of service. In behalf of Mr. Kuchenrither of Black and Veatch and our team members, I remain,

Sincerely,

ENGINEERING-SCIENCE, INC.

Timothy G. Shea, Ph.D., P.E.
Vice President-Technical

Attachment: Table 8

cc w/attch: D. Kuchenrither, B&V
P. Psaris, B&V
D. Oerke, B&V
C. Coker, ES

TGS:sab
DE\FTS2304F.LTR

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TABLE 8

SUMMARY OF COST ESTIMATES BY ALTERNATIVE

COST ($1,000 UNITS) BY ALTERNATIVE

Cost Item	Original Incineration System (Base Case)	Modified Incineration System (with WESP)	Modified Incineration System and Offsite Landfill	Dual Utilization Alternative	Modified N-Viro System	Modified N-Viro System with Offsite Disposal
Total Capital Cost	15,573	16,447	23,981	17,837	12,000	12,000[b]
Equiv. Ann. Cost	1,587	1,676	2,444	1,818	1,222	1,222
Ann. O&M Cost	1,163	1,163	1,644	1,256[a]	1,533	2,397
Total Ann. Cost	2,750	2,839	4,088	3,074	2,755	3,619
Unit Cost ($/DT)	314	324	467	351	314[c]	413[c]
Grant Eligibility	7,974	7,974	7,974	7,974	?	?
Adj. Tot. Cap Cost	7,599	8,473	16,007	9,863	?	?
Adj. Tot. Ann. Cost	1,937	2,026	3,275	2,261	?	?
Adj. Unit Cost ($/DT)	221	231	374	258	?	?
Impact of Grant ($/DT)	93	93	93	93	?	?

Notes:
[a] Assumes 75% and 25% incineration and chemical stabilization, respectively.
[b] Excludes $500,000 each (total $1,000,000) for redirection and lost design costs
[c] Excludes $12/DT for redirection and lost design costs.
[d] Incineration and N-Viro system combination.

AUGUST 22, 1989

1. Call to Order and Roll Call:

The regular meeting of the Metropolitan Sewerage District Board was held in the Boardroom of MSD's Administration Building at 2 p.m. on Tuesday, August 22, 1989. Chairman Smith called the meeting to order at 2:00 p.m.

Chairman Smith and the following members were present: Aceto, Dent, Dyson, Edwards, Ivey, Maas, McDonald, Pope, Waddey and Williams. Others present were: W.H. Mull, Engineer-Manager, Mr. Gwynn Radeker, Attorney, representing General Counsel, Dean Huber, Bob Holbrook and Bill Morris, of Hendon Engineering Associates, Mr. Dick Kuchenrither, Mrs. Patti Psaris and Mr. Dave Oerke with Black & Veatch, Dr. Tim Shea with Engineering Science, Inc., Ms. Judy Williamson of the Buncombe County Commissioners Office, Bob Ensley of MSD Staff, and others as listed on the attached "Sign-In Sheet."

2. Minutes of July 18, 1989:

Mrs. Pope moved that the Board minutes of July 18, 1989 be adopted as written. Mr. Williams seconded the motion, and voice vote was unanimous in favor of the motion.

Minutes of August 8, 1989 Special Board Meeting:

Chairman Smith stated the Minutes of August 8th were placed in each folder for review, and these minutes will be acted upon at the September meeting.

3. REPORT OF ENGINEER-MANAGER:

a. Status of Sludge Disposal Facilities - Letter from Environmental Protection Agency Dated July 20, 1989 Approving Time Extension to Accept/Reject Grant Offer for Sludge Incineration Facilities, and Letter from State Department of Natural Resources & Community Development, Division of Environmental Management, Dated July 25, 1989, Denying 30-Day Time Extension for Advertising for Bids on Phase IV; Letter from State Dated August 15, 1989; Updated Black & Veatch/ Engineering Science Report;

Mr. Mull referred to the above letters as being in the file and stated that Black & Veatch/Engineering Science were present to make their final report to the Board on Sludge Management Alternatives for the District. At this time Mr. Mull turned the floor over to Mr. Dick Kuchenrither with Black & Veatch. Mr. Kuchenrither introduced Dave Oerke and Patti Psaris with Black and Veatch, and Dr. Tim Shea with Engineering Science, and turned the floor over to Patti Psaris to make the presentation to the Board.

Patti Psaris reviewed the additional work which had been done by Black & Veatch/Engineering Science, which included a new alternative of dual utilization. This is two sludge management alternatives and incorporates chemical stabilization and incineration. It is the recommendation of Black & Veatch/Engineering Science that the District pursue dual utilization incorporating chemical stabilization and incineration as its sludge management alternative. Black & Veatch also stated that there will be a need for development of an ash disposal plan, some kind of management plan as to how the ash should be disposed of in the lagoon; some document prepared which addresses air issues both present and future. These recommendations will be included in a letter to the District. After extensive discussion, comments and questions from the Board, Dr. Maas presented a Resolution to the Board, and moved

that the MSD accept the current grant offer with the intent of pursuing a dual sludge utilization system of Advanced Alkaline Stabilization and Incineration under the following conditions: 1) that the MSD retain a private firm to market the stabilized soil produced by the Advanced Alkaline Stabilization process; 2) that the facility engineering and construction be conducted using a timetable that brings both facilities on-line at the same time, and 3) that the MSD adopt a policy of giving first priority to the beneficial reuse of sludge with incineration used as a back-up measure only when necessary. Mr. Aceto seconded the motion. Extensive discussion followed. Dr. Maas suggested a financial incentive be set-up to pay the marketing contractor for every ton of sludge hauled off. Mr. Dent expressed a concern of the District tying itself down to chemical stabilization when there in fact may be other ways of composting the sludge. Dave Oerke with Black & Veatch reiterated that Black & Veatch's costs assumed a chemical stabilization process, not necessarily one in particular. Black & Veatch also assumed that the facilities up through the end product are built and operated by MSD, and the marketing and only the marketing is done by a private firm. After discussion by the Board Dr. Maas amended his Resolution as follows: That the MSD accept the current grant offer with the intent of pursuing a dual sludge utilization system of chemical stabilization and incineration under the following conditions: 1) That the MSD retain a private firm to market the stabilized soil produced by the chemical stabilization; 2) that facility engineering and construction be conducted using a timetable that brings both facilities on-line at the same time; and 3) that the MSD adopt a policy of giving first priority to the beneficial reuse of sludge with incineration used as a back-up measure only when necessary. Mr. Aceto seconded. Roll call vote was as follows: 11 yeas - 0 No's.

Mr. Dent moved that the District accept the grant offer contingent upon the fact that the EPA allow the District a 90 day time extension to go out for bids, in order to allow for redesign to add the chemical stabilization process to the plans and specifications, and moved that this be reflected in Dr. Maas' Resolution. Mr. Waddey seconded and roll call vote was as follows: 11 yeas - 0 No's.

b. Ratification of Board's Decision to Accept Joint Engineering Proposal of Black & Veatch/Engineering Science;

Mr. Mull stated that the decision to accept the joint Engineering Proposal from Black & Veatch/Engineering Science was conducted via telephone poll, and recommended that the Board ratify this decision. Mr. Waddey so moved and Mr. Edwards seconded. Roll call vote was: 11 yeas - 0 No's.

c. Status of Phase III Plant Expansion Contracts;

Mr. Mull reported the Status Report is in each file for information purposes, and requested that the Plant Expansion Committee members get with him after the meeting today to set-up a meeting date for this Committee.

d. Letter Dated July 17, 1989, From Transylvania County Health Department Concerning Expiration of MSD and Transylvania County Temporary Agreements to Accept Sludge;

Mr. Mull reported that for over a year the District has been accepting sludge from Transylvania County, and stated that Transylvania County has now completed construction of a septage treatment facility and are no longer hauling septage to the District.

5. Report of Committees:

b. Sewer System Consolidation Committee - Mr. Aceto:

Mr. Aceto reported that as of the last meeting of the Sewer System Consolidation Implementation Committee, the Managers of Buncombe County and City of Asheville had composed a consensus plan they felt could be recommended in good conscience to their Boards. The basic outline of this plan is to allow MSD full consolidation with full responsibility for rehabilitation system wide, full control of the system, and a 65-35 sharing between the municipalities and the District with respect to certain extensions of the sewer system. This plan is now subject to scrutiny because of the effect on the rates, not the extensions, but the rehabilitation program is proving to have a very significant impact on the industrial rates. Mr. Aceto reviewed a letter from the Asheville Chamber of Commerce along with a Resolution from the Chamber, supporting Sewer System Consolidation, encouraging prompt implementation of Consolidation, but expressing the Chamber's concern on behalf of its members, that a program of financing the sewer system rehabilitation solely on user fees is going to be unfair. The Chamber is suggesting that the municipalities and District explore other methods to finance including an Ad Valorem tax. Mr. Aceto expanded on the Ad Valorem tax at length, and stated that the Board may be called upon to consider whether or not this Board would be willing to impose an Ad Valorem tax on its District to aid in financing sewer system rehabilitation. The ball is still primarily in the court of the City and County. The District does not have a firm proposal from anyone, and must do so in order to proceed. General discussion followed. Mr. Mull stated the next Sewer System Consolidation Implementation Committee meeting will be August 30, 1989.

a. Hydro Committee - Mr. Dyson:

Mr. Dyson reported the Hydro Committee met last week to discuss the continuous problems with the U.S. Fish and Wildlife Service, and the flows they are mandating the District maintain over the dam in the French Broad River. Mr. Mull has had several phone conversations with Mike Gantt, and has received some additional flow information from the U.S. Fish and Wildlife Service. General discussion followed. Mr. Dyson stated the Hydro Committee recommends that the Board allow the Engineer-Manager and Sharon Kane of Hendon Engineering Associates, Inc. authorization to negotiate the latest flows with the U.S. Fish and Wildlife Service. It was the consensus of the Board that this recommendation stand.

4. Report of Officers:

None.

6. Unfinished Business:

Mr. Mull recommended that the Board authorize the necessary expenditures for redesign of the sludge facilities. Mr. Waddey so moved and Mrs. Pope seconded. Roll call vote was as follows: 11 yeas - 0 No's.

7. New Business:

None.

8. Date of Next Regular Meeting - September 19, 1989

9. Adjournment:

There being no further business, the Board meeting was adjourned at 4:00 p.m.

Secretary

56.

ASHEVILLE CHAMBER

ASHEVILLE AREA CHAMBER OF COMMERCE

RECEIVED
AUG 21 1989
Metropolitan Sewerage District
of Buncombe County

August 17, 1989

William H. Mull
Metropolitan Sewerage District
P. O. Box 8969
Asheville, NC 28814

Dear Bill:

The Board of Directors of the Asheville Area Chamber of Commerce at its August meeting unanimously endorsed the enclosed resolution supporting the consolidation of the sewer systems presently maintained by the political entities who are members of the Metropolitan Sewerage District. The resolution urges those governing bodies and the MSD to move forward expeditiously with the consolidation and rehabilitation program.

I also point out that the Board, in passing the resolution, expresses its concern on behalf of the business community and residential users of the system as to the anticipated immediate and substantial rate increases in user fees. It is our understanding that the funding for the rehabilitation program is to be financed solely from user fees on a pay-as-you-go basis. This philosophy will place a tremendous financial burden on our community, both business and residents.

The Chamber strongly encourages the MSD to carefully consider additional means of financing the desperately needed system improvements by the issuance of MSD bonds and/or the levying of reasonable increases in the ad valorem tax on assessable property within the District, together with more moderate increases in user fees.

Again, the Chamber fully supports the consolidation of sewerage systems and commends all involved entities for their diligence during the negotiations that have taken place.

Sincerely.

George W. Beverly, Jr.
President

GWBjr:jg

enclosure

151 HAYWOOD STREET
POST OFFICE BOX 1010
ASHEVILLE, NC 28802
704/258-3858 FAX 704/251-0926 TELEX 7407796 AVCC UC

ACCREDITED CHAMBER OF COMMERCE

ASHEVILLE CHAMBER

ASHEVILLE AREA CHAMBER OF COMMERCE

RESOLUTION

WHEREAS, important maintenance on the various sewerage systems operating in Buncombe County has been delayed for a significant period; and

WHEREAS, significant pollution has and continues to occur in the Swannanoa and French Broad Rivers as a result of the deteriorated sewerage systems; and

WHEREAS, the French Broad River receives tremendous discharges of raw sewerage during periods of heavy rain as a result of rainwater inflow many times reaching 10 times the normal capacity of the system and causing a by-pass of the treatment plant; and

WHEREAS, the State of North Carolina has indicated that it will no longer tolerate such discharges and will consider the institution of a moratorium on new connections if action is not taken to resolve the problem; and

WHEREAS, effective correction and rehabilitation of problems that exist within all sewerage systems in the County will require a coordinated effort; and

WHEREAS, consolidation of all sewerage systems in the County will provide for a cost effective and efficient system while providing for orderly facilities planning in the future;

NOW, THEREFORE, the Board of Directors of the Asheville Area Chamber of Commerce, Inc. hereby endorses the concept of consolidating the sewer systems presently maintained by the political entities who are members of the Metropolitan Sewerage District under the ownership and management of the Metropolitan Sewerage District of Buncombe County (the "MSD") and encourages those bodies and the MSD's Board of Directors to move forward expeditiously with such a consolidation and the rehabilitation program proposed to be accomplished by the MSD.

FURTHER, RESOLVED, that the Chamber's Board of Directors hereby expresses its concern on behalf of current industrial, commercial and residential users of the sewer system as to the anticipated immediate and substantial rate increases in user fees if the proposed sewer rehabilitation program is financed solely from user fees on a pay-as-you-go basis during the early years of said improvement program and, therefore, urges said bodies and the Board of Directors of the MSD to carefully consider additional means of financing said improvements by

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704/258-3858 FAX 704/251-0926 TELEX 7407796 AVCC UC

ACCREDITED CHAMBER OF COMMERCE

the issuance of MSD bonds and/or the levying of reasonable increases in the ad valorem tax on assessable property within the MSD District, as authorized by N.C.G.S. 162A-71, together with more moderate increases in user fees.

READ and **ADOPTED** this the 14th day of August, 1989.

George W. Beverly, Jr.
President

SIGN-IN SHEET

MSD BOARD MEETING: ______________________

DATE: 8-22-89 TIME: 9:00 a.m.

NAME	COMPANY OR REPRESENTING
Anne Craig	Ash. Citizens for Responsive Gov't
Melvin Hetland	self
Leni Sitnick	
Ron Lambe	WNC Alliance
Clara Sitnick	
Caitlin Wallace	
George Oake	WNC Alliance
[illegible] H. Miller	Self. WNC Alliance
Chad [illegible]	Unity Center League of Women Voters
Bob Carvell	Carolina N-Viro
FRANK POST	AMSCO INC.
[illegible]	Student
PAUL BALLIMORE	LONG BRANCH ENVIRO. ED. CTR.
DEAN HUBER	HENDON ENGINEERING
DAVID S. SHOWN	N-VIRO ENERGY SYSTEMS, INC.
Dick Kuchenrither	Black & Veatch
Christine Lassiter	Asheville Citizens for Responsive Gov't
Cynthia Danes	Asheville Citizens for Responsive Gov't
Lynnette James	WCQS
Carolyn R. Wallace	
Judy Williamson	County Commissioners' office

ENGINEERING-SCIENCE, INC.

TWO FLINT HILL
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FAIRFAX, VA 22030
Tel: (703) 591-7575 Fax: (703) 591-1305

August 17, 1989

RECEIVED
AUG 18 1989
Metropolitan Sewerage District
of Buncombe County

Mr. W.H. Mull, P.E.
Engineer-Manager
Metropolitan Sewerage District of
Buncombe County, NC
P.O. Box 8969
Asheville, NC 28814

RE: Evaluation of Sludge Management Alternatives
Response to Board of Directors Comments on Draft Report

Dear Mr. Mull:

As requested, we have investigated the comments and issues on the draft report raised by MSD's Board at their meeting on August 8. We have reviewed and refined the capital and O & M costs for all three alternatives, developed a new alternative involving a combination of incineration and chemical stabilization, and evaluated the costs associated with ash landfilling. All costs are stated on a before-grant basis. At this date, a grant offer in the amount of $7,974,000 has been extended only to the incineration alternative. An offer in this amount has the effect of reducing the cost per dry ton of that alternative by $93 from what is stated below.

It is our assessment that to meet "probable" air toxics regulations, a wet electrostatic precipitator (WESP) would be required at a future date. The costs for the incineration alternative with and without such are presented in Table 1. The estimated cost of $2,400,000 for the fluid bed system is reasonably accurate for planning purposes. An additional cost of $676,000 for a WESP was included. It should be noted that it is very difficult to determine metal removal efficiencies required by "probable" air toxics regulations and to consequently estimate the cost of such air pollution control equipment. With the addition of a WESP, the resulting capital cost estimate increases from $15,573,000 to $16,447,000 before the grant, and the cost per dry ton is $324 rather than $314 (a difference of $10). It was determined that an afterburner would most likely not be needed due to the sludge quality and operating temperature of the incinerator.

The preceding cost estimates for incineration include equipment to dewater the sludge to 31% solids, in the amount of about $665,000. Also evaluated was the impact of burning sludge at 22% solids versus 31% solids. The results from this evaluation are shown in Table 2. Based on the capacity of the proposed incinerator and the sludge characteristics, a heat balance was performed (see "Heat and Material Balance Summary"). The difference in fuel consumption between 31% and 22% dry solids was calculated to be 49 gallons per dry ton (64 gpdt-15 gpdt). This results in an additional cost of approximately $430,000 per year if 22% dry solids are burned. If, however, the anaerobic digesters were out of service and the sludge feed to the incinerator were 22% solids, there would not be adequate capacity in the incinerator to burn the design sludge production of 4,000 lb/hr (80,000 lb per 20 hour day).

Revised costs for the Enviro-Gro Technology (EGT) Heat Drying Process are given in Table 3. The cost for additional area previously reported as $1,755,000 was revised and was taken into account in the air pollution control equipment cost. The revised cost for the process train reflects the cost for two process trains instead of the previous cost which assumed three trains providing 50% redundancy. The resulting annual cost per dry ton is $369, a decrease of $76 per dry ton from the original cost.

Table 4 represents the cost modifications for the N-Viro Soil Chemical Stabilization Process. Clarification of the cost differences from the vendor are summarized in the following key points:

- The assumption of 5 percent lime and 25 percent cement kiln dust (CKD) chemical addition was changed to 31 percent CKD addition provided that N-Viro furnish MSD with a written guarantee for a minimum 30 percent CaO concentration in the supplied CKD. MSD will have the right to sample and reject any CKD delivery that does not meet this requirement. The mass balance used for equipment sizing will remain the same. Average annual CKD use was increased from 9,710 to 11,700 tons but lime addition was eliminated. Chemical costs were modified to reflect this change. However, chemical handling equipment capital cost was not changed because of the need for additional CKD storage (three versus two bulk storage bins). If a written guarantee is not provided, we recommend both lime and CKD for chemical addition.

- Hydraulic cake pumps were replaced with enclosed and vented belt conveyors to transport the sludge/chemical mixture from the pug mills to the loading area. This change was made to provide a more granular, rather than plastic, material to the accelerated drying process.

- Transportation of the sludge/chemical mixture to the drying building on the ridge site would be provided by portable 22 cubic yard capacity roll-off dumpster containers rather than truck trailers. In addition, the cost for the 12-hour enclosed storage hoppers could be eliminated as the dumpsters may also be used for this purpose. Onsite product storage was reduced from six to four months. Thus, the storage area was reduced from 56,000 to 37,500 square feet. Odor control costs were reduced to reflect the elimination of the storage hoppers.

- The unit building cost was decreased from $30 to $20 per square foot because it would not be necessary to insulate the accelerated drying building.

- Contingency costs were reduced from 25 to 12 percent for thickening and dewatering equipment in the solids handling building to be consistent with the incineration cost estimates. However, a 25 percent contingency will be used for the remaining equipment. This assumption was also changed for the EGT heat drying alternative (Table 3).

A new alternative involving a combination of incineration and chemical stabilization was also evaluated. Using this alternative, the MSD would be able to develop an operational beneficial land application program with N-Viro Soil while

maintaining incineration. Should problems surrounding air emissions or ash disposal become acute or changes occur in the regulatory environment, operational costs, public sentiment, or if a consistent market does not develop for the N-Viro soil product, the MSD will be well positioned to shift operations as appropriate.

In the same regard, this alternative eliminates the need for onsite product storage facilites for land application because the incinerator can be used as a backup. Also, land application is not strictly limited to three months per year. Should weather and other conditions permit, land application could occur for a greater portion of the year to recycle more sludge nutrients.

Another reason to consider this dual utilization alternative now is that implementation of land application will require several years to develop a reliable agricultural and forest market, gain regulatory and public acceptance, and to obtain the necessary operating experience. During this period of time, the incineration option could provide the operations staff with a reliable method of sludge processing.

The MSD may be able to use the EPA grant to build both the incineration and chemical stabilization facilities. The cost of a dual utilization alternative is far less than the cost of two separate alternatives. Capital costs do not need to include 100% redundancy within the process. Smaller facilities with only one train of equipment would be used in the dual utilization alternative. Table 5 shows the additional cost in adding N-Viro soil chemical stabilization process as a alternative or backup to the recommended incineration process.

This dual utilization concept is similar to the recommended incineration sludge management plan. However, post-chemical addition in dry form after dewatering is used rather than pre-chemical addition in liquid form before dewatering. Post-chemical stabilization has many advantages including potential reduced chemical requirements, better reliability, less maintenance and easier operation. The dry chemical equipment can be installed in the proposed solids handling building.

For a minimum of three to four months of the year, the dewatered sludge would be stabilized by cement kiln dust addition and then transferred by truck to distribution and marketing for application to agricultural, forest or highway median sites. During the remainder of the year, the dewatered sludge would be incinerated at the MSD plant in the fluid-bed furnace.

Further, it is recommended that the MSD begin an interim solids management operation. A successful land application/distribution and marketing program must be proceeded by an interim program that includes sound agricultural and forest demonstration projects, extension service participation, quality farmer contacts and a public education program. The interim solids management program would allow for a small-scale, chemically-stabilized sludge production at the MSD plant. MSD could also start the interim program sooner by using the present anaerobically digested sludge to establish a market.

The MSD would also have the opportunity to pilot test trailer mounted small-scale dewatering equipment to verify 201 Facility Plan assumptions, such as loading rates, cake

solids, sidestream quantity and quality, polymer usage, etc. The pilot dewatering study should include gravity belt thickeners, first stage belt filter presses and second stage belt filter presses (Ultrapress) at a minimum.

If, for some unforeseeable reason, it is not possible to dispose of the ash in the existing onsite lagoon, an ash landfill would be necessary. The costs for construction of an ash landfill are given in Tables 6 and 7. Although a detailed geological investigation has not been performed, it is unlikely that sufficient land suitable for siting an ash landfill could be found on site. The North Carolina Department of Natural Resources and Community Development (NCDNR & CD) Regulations require a minimum of three feet from the groundwater table and four feet from the bedrock surface. Because groundwater tables are commonly very shallow and soil layers are generally thin in mountainous terrain, the amount of suitable land necessary for ash disposal for the design period of 20 years is limited. It cannot be overemphasized that the siting and design of an ash landfill is dependent on the location characteristics and requires an in-depth geological investigation. Revisions to 40 CFR Part 258 Subtitle D, to be finalized December 1989, may require new landfills to include double liners, leachate collection and treatment systems, monitoring wells, and gas ventilation, if necessary. The capital costs were estimated to be $7,263,700 (Table 6) with this in mind, for a unit cost impact of $143 per dry ton. This compares with a unit cost of $98 per dry ton from our prior work for the landfill disposal of the N-Viro soil production, assuming permission could be obtained for the same.

A summary cost table comparing the aforementioned alternatives and modifications will be sent via facsimile tomorrow morning (August 18th) for your review.

Mr. Kuchenrither, Dr. Shea, and our team trust that this letter will clarify the issues at hand and hopefully resolve any discrepancies previously addressed. We appreciate this opportunity to serve the Buncombe County Metropolitan Sewerage District. We are available, at your convenience, to discuss our findings in greater detail.

Sincerely,

ENGINEERING-SCIENCE, INC.

Craig S. Coker

Craig S. Coker by LAS
Manager, Municipal Studies
Department

cc: D. Kuchenrither, B&V
P. Psaris, B&V
D. Oerke, B&V
T. Shea, ES

LS:jd

DE/FA403/FLS2287A.LTR

TABLE 1

COST UPDATE-INCINERATION
($1,000)

Cost Element	Original Cost Draft Report	Modified Incinerator (with WESP)	Cost Difference
Sludge Dewatering[a]			
Subtotal	$5,798	$5,798	$0
Sludge Incineration[b]	4,545	4,545	0
Wet ESP	—	676	676
Incineration Subtotal			
Misc. Subtotal	1,700	1,700	0
Subtotal 1	12,043	12,719	676
Contractor Overhead, and Profit	3,372	3,561	189
Subtotal 2	15,415	16,280	865
Adjusted Local Cost (ACC) @0.82 Subtotal 2	12,640	13,350	710
Contingencies @ 12% ACC	1,517	1,602	85
Est. Constr.Cost	14,157	14,952	795
Eng., Legal & Admin. @10% ECC	1,416	1,495	79
TOTAL CAPITAL COST	$15,573	$16,447	$874
Equivalent Annual Cost (8%-20 year financing)	1,587	1,676	
Annual O&M Costs	1,163	1,163	0
TOTAL ANNUAL COSTS	$2,750	$2,839	$89
COST PER DRY TON[c] (24 DTPD)	$314	$324	$10

[a]Sludge dewatering to 31% solids using second stage belt filter presses.
[b]Incinerator cost includes Venturi scrubber and cooling tray array.
[c]Actual cost per dry ton, not $K per year.

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TABLE 2

AUXILIARY FUEL COSTS*

Incinerator Feed	Auxiliary Fuel Usage (gal/dry ton)	(gal/hr)	Annual Fuel Costs
@ 22% Total Solids	64	80[a]	$560,640
@ 31% Total Solids	15	29[b]	$131,400

*Assuming 48,000 lb/day at 64% volatile solids
[a]Operating 19 hours per day
[b]Operating 12 hours per day
[c]Assuming No.2 fuel oil at $1.00 per gallon

TABLE 3

COST ESTIMATE
EGT HEAT DRYING PROCESS

Element of Cost	Original Cost Draft Report	Revised Cost	Cost Difference
Upstream sludge processing system with original bldg.	$5,271,000	$5,271,000	0
Additional Building Area	1,755,000	—[a]	(1,755,000)
Process trains	7,500,000[b]	5,000,000[c]	(2,500,000)
Air pollution control train plus stack	4,276,000	4,276,000	0
Subtotal 1	$18,802,000	$14,547,000	($4,255,000)
Contingency[d]	4,701,000	2,952,000	
Subtotal 2	23,503,000	17,499,000	
Eng., Legal & Admin. @10% of Subtotal 2	2,350,000	1,750,000	
TOTAL ESTIMATED CAPITAL COSTS	$25,853,300	$19,249,000	($6,604,000)
Equivalent Annual Capital Cost (8%-20 year financing)	2,634,451	1,961,500	
Annual O&M Cost	1,268,000	1,268,000	0
TOTAL ANNUAL COST	$3,902,451	$3,229,500	
COST PER DRY TON (24 DTPD)	$445	$369	($76)

[a]Additional building area included in air pollution control cost.
[b]Three process trains with 50% redundancy at peak processing rate.
[c]Two process trains at $2.5 million per train.
[d]Assumes 12% contingency for thickening and dewatering equipment to be consistent with incineration. However, 25% will be used for the remaining equipment.

TABLE 4

N-VIRO SOIL CHEMICAL STABILIZATION PROCESS
SUMMARY OF COST MODIFICATIONS

Item Description	Original Cost in Draft Report	Modified Cost	Cost Difference
Solids Handling Building And Equipment	$5,271,000	$5,271,000	0
Solids Handling Equipment	1,129,000	378,000	(751,000)
Chemical Handling Equipment	588,000	588,000	0
Accelerated Drying and Onsite Sludge Storage Area	2,601,000	1,479,000	(1,122,000)
Odor Control Equipment	314,000	269,000	(45,000)
Mobile Equipment	1,430,000	1,290,000	(140,000)
Total Capital Costs	$11,333,000	$9,275,000	(2,058,000)
Contingency[1]	2,833,000	1,634,000	
Subtotal	14,166,000	10,909,000	
Engineering @ 10%	1,417,000	1,1091,000	
Total	$15,583,000	$12,000,000	(3,583,000)
Equivalent Annual Cost	1,587,100	1,222,000	
Annual O & M Cost	1,797,400	1,707,700	(89,700)[2]
Less Income From Power Sales	(175,200)	(175,200)	
Total Annual Cost	$3,209,200	$2,754,500	
Cost Per Dry Ton	$366	$314	($52)

[1]Assumes 12% contingency for thickening and dewatering equipment to be consistent with incineration. However 25% will be used for the remaining equipment.
[2]Annual chemical costs adjustment.

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TABLE 5

DUAL UTILIZATION ALTERNATIVE PRELIMINARY COST ESTIMATE
BACKUP N-VIRO SOIL CHEMICAL STABILIZATION PROCESS
TO RECOMMENDED INCINERATION ALTERNATIVE
SUMMARY OF ADDITIONAL CAPITAL COST

Item Description	Total Cost ($)
Solids Handling Equipment	212,000
Lime and CKD Handling Equipment	381,000
Accelerated Drying	923,000
Odor Control Equipment	269,000
Mobile Equipment	479,000
TOTAL	$2,264,000
Equivalent Annual Cost Of Additional Capital Cost	$230,600

TABLE 6

ESTIMATED LANDFILL COSTS
(1989 DOLLARS)

Cost Item	Comment	Approximate Cost
Landfill Site[1]	20 acres @ $10,000	$200,000
Buffer Zone	10 acres @ $10,000	100,000
Site Preparation	To include double HDPE liners (60 mil.), leachate collection, gas ventilation, groundwater monitoring wells (min.5) drainage and piping to treatment lagoon @$250K per acre	5,000,000
Leachate Treatment Lagoon		100,000
Landfill Equipment	Service vehicle, hauling trucks (2), track loaders (2), D4-dozers (2)	715,000
Office & Materials Building	2,400 sf @ $65/sf	156,000
Septic Tank & Well		7,500
Subtotal Capital Cost		6,278,500
Contingencies	@10% (excluding land)	597,850
Est. Constr. Cost		6,876,350
Eng., Legal & Admin.	@10% (excluding land)	657,635
Total Capital Cost		$7,534,000 (rounded up)
Equivalent Annual Capital Costs (8% - 20 year financing)		767,700
Annual O & M Costs (See Table 7)		481,200
Total Annual Costs		$1,248,900
Cost Per Dry Ton		$143

[1]Assumes depths to groundwater and bedrock are 15 and 20 feet, respectivcly. Ash volume of 895 cubic feet per day for 20 year period to be landfilled.

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TABLE 7

ESTIMATED LANDFILL OPERATING COSTS
(1990 DOLLARS)

Cost Item	Annual Cost
Personnel	$136,000
Equipment Operation and Maintenance	200,000
Utilities	5,000
Monitoring	60,000
Subtotal	401,000
Administration/Overhead (20%)	80,200
Total Annual Operating Costs	$481,200

****
CARLSON ASSOCIATES TECNICAL SERVICES
****

FLUIDIZED BED MODEL
****

'NCOMBE COUNTY - NORTH CAROLINA

:SIGN AT 80,000 LB/DAY-20 HR/DAY

PROCESS SUMMARY

FLUID BED FREEBOARD ID FT.....	17.75135
FRBD SUPERFICIAL GAS VEL FT/SEC....	2.5
BED DIA FT.....	13.47177
BED SUPERFICIAL BED VEL FT/SEC.....	2.5
PREHEATED AIR TEMPERATURE.....	1200
WET WASTE FEED LB/HR.....	1290 3.23
SOLID CONTENT PERCENT:.....	31
SOLID WASTE FEED LB/HR.....	4000
COMBUSTIBLE CONTENT PERCENT:.....	64
HEATING VALUE BTU/LB COMBUSTIBLE...	8500
FURNACE EXHAUST GAS TEMPERATURE F..	1550
FREEBOARD PRESSURE INC WC.....	45
STACK TEMPERATURE DEG F.....	100
AFTER COOLER WATER TEMP F.....	70
AUXILIARY FUEL.....	NO 2 FUEL OIL
HEATING VALUE OF AUX FUEL BTU/GAL..	135000

FUEL CHARACTERISTICS

SLUDGE COMBUSTIBLES ULTIMATE ANALYSIS:

C.....	.546
H.....	7.900001E-02
N.....	.045
O.....	.33
S.....	0

FUEL COMBUSTIBLES ULTIMATE ANALYSIS:

C.....	.8560001
H.....	.12
N.....	.007
O.....	.007
S.....	.01

BUNCOMBE COUNTY - NORTH CAROLINA
****
DESIGN AT 8Ø,ØØØ LB/DAY-2Ø HR/DAY

HEAT BALANCE SUMMARY

(BTU/HR)

HEAT OUT

WATER IN SLUDGE:	16Ø1782Ø
ASH:	429120
RADIATION:	173413Ø
COMBUSTION PRODUCTS:	1136765Ø
EXCESS AIR;	3Ø68266
HEAT OF CALCINATION:	Ø
CAO DUST:	Ø
COMBUSTION PRODUCS FM FUEL	2Ø666Ø3
TOTAL	34683590

HEAT IN

WASTE FEED:	21760ØØØ
PREHEATED AIR	9ØØ3218
FUEL:	3920369
TOTAL	34683590

BUNCOMBE COUNTY - NORTH CAROLINA
****
SIGN AT 80,000 LB/DAY-20 HR/DAY

MATERIAL BALANCE SUMMARY

(LB/HR)

MATERIAL IN

SLUDGE COMBUSTIBLES	2560
SLUDGE INERTS	1440
SLUDGE MOISTURE	8903
FUEL	212
STOIC AIR FOR SLUDGE	19399
EXCESS AIR FOR SLUDGE	7759
STOIC AIR FOR FUEL	2966
EXCESS AIR FOR FUEL	1186
MOISTURE IN AIR	313
TOTAL	44738

MATERIAL OUT

DRY GASES	32033
MOISTURE IN GAS	11265
SLUDGE INERTS	1440
TOTAL	44738

BUNCOMBE COUNTY - NORTH CAROLINA
****
DESIGN AT 8Ø,ØØØ LB/DAY-2Ø HR/DAY

GENERAL INFORMATION
****

NET HEAT REQUIRED BTU/HR:	2938916
FUEL REQUIRED GPH :	29.Ø3977
AIR REQUIRED FOR FLUIDIZATION SCFM:	6957.799
AUX FUEL AVAIL FACTOR :	74.96529
BTU/LB H2Ø EVAPORATED :	3895.621
EXCESS AIR REQD ON SLUDGE % :	4Ø
TOTAL GAS FROM FURNACE LB/HR :	43298.42
ACFM :	37123.Ø6
ENTHALPHY AT EXHAUST BTU/LB DG:	799.3864
HUM RATIO AT EXHAUST:	.3516825
ADIABATIC SAT TEMP F :	181
ENTHALPHY AT SATURATION: BTU/LB DG	818.78
HUM RATIO AT SATURATION:	.6878
ADIABATIC SAT VOLUME SCFM :	18Ø6Ø.73
ENTHALPHY AT STACK BTU/LB DG:	63.98ØØ1
HUMIDITY RATIO AT STACK:	.Ø4312
STACK VOLUME ACFM:	8Ø52.556
TOTAL HEAT AVAIL BTU/HR :	1.59636E+Ø7
WATER EVAPORATION GPM:	21.51648
PRECOOLER WATER GPM:	43.Ø3296
VENTURI WATER GPM:	135.4554
AFTERCOOLER WATER GPM:	53Ø.97Ø6
TOTAL SCRUBBER WATER GPM:	7Ø9.4591

BUNCOMBE COUNTY - NORTH CAROLINA
****
DESIGN AT 80,000 LB/DAY-20 HR/DAY

SPECIFIC HEAT CO2 BTU/LB/F: .2639886

SPECIFIC HEAT N2 BTU/LB/F: .2652067

SPECIFIC HEAT SO2 BTU/LB/F: .1872919

SPECIFIC HEAT H2O BTU/LB/F: .4996575

SPECIFIC HEAT O2 BTU/LB/F: .2444371

COMBUSTOR EXHAUST GAS COMPOSITION:

	MOL/MIN	LB/HR	% VOLUME
CO2:	2.193366	5790.488	7.808626
N2:	14.38264	24162.84	51.2038
SO2:	1.104116E-03	4.239807	3.930776E-03
O2:	1.080944	2075.412	3.84828
H2O:	10.43096	11265.44	37.13537
TOT:	28.08902	43298.42	99.99999

PERCENT O2 IN EXHAUST BY WEIGHT (dry): 6.478987

HEAT EXCHANGER GAS OUT TEMP F : 852.2876

HEAT AVAILABLE FOR BOILER : 6681931

STEAM AT 450 PSIG 100 F SUPERHEAT: 5787.067

POWER GENERATION KW/HR : 311.1853

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Ok

****
CARLSON ASSOCIATES TECNICAL SERVICES
****

FLUIDIZED BED MODEL
****

NCOMBE COUNTY - NORTH CAROLINA

ESIGN AT 48,ØØØ LB/DAY

PROCESS SUMMARY

FLUID BED FREEBOARD ID FT.....	17.Ø8594
FRBD SUPERFICIAL GAS VEL FT/SEC....	2.5
BED DIA FT.....	12.82945
BED SUPERFICIAL BED VEL FT/SEC.....	2.5
PREHEATED AIR TEMPERATURE.....	12ØØ
WET WASTE FEED LB/HR.....	11363.64
SOLID CONTENT PERCENT:.....	22
SOLID WASTE FEED LB/HR.....	25ØØ
COMBUSTIBLE CONTENT PERCENT:.....	64
HEATING VALUE BTU/LB COMBUSTIBLE...	85ØØ
FURNACE EXHAUST GAS TEMPERATURE F..	155Ø
FREEBOARD PRESSURE INC WC.....	45
STACK TEMPERATURE DEG F.....	1ØØ
AFTER COOLER WATER TEMP F.....	7Ø
AUXILIARY FUEL.....	NO 2 FUEL OIL
HEATING VALUE OF AUX FUEL BTU/GAL..	135ØØØ

FUEL CHARACTERISTICS

SLUDGE COMBUSTIBLES ULTIMATE ANALYSIS:

C.....	.546
H.....	7.9ØØØØ1E-Ø2
N.....	.Ø45
O.....	.33
S.....	Ø

FUEL COMBUSTIBLES ULTIMATE ANALYSIS:

C.....	.8560ØØ1
H.....	.12
N.....	.ØØ7
O.....	.ØØ7
S.....	.Ø1

UNCOMBE COUNTY - NORTH CAROLINA
****
ESIGN AT 48,ØØØ LB/DAY

HEAT BALANCE SUMMARY

(BTU/HR)

HEAT OUT

WATER IN SLUDGE:	15946ØØ
ASH:	268ØØ
RADIATION:	1627439
COMBUSTION PRODUCTS:	71Ø4778
EXCESS AIR;	1917666
HEAT OF CALCINATION:	Ø
CAO DUST:	Ø
COMBUSTION PRODUCS FM FUEL	5685Ø19
TOTAL	32549ØØ

HEAT IN

WASTE FEED:	136ØØØØ
PREHEATED AIR	8165155
FUEL:	1Ø784550
TOTAL	32549ØØ

BUNCOMBE COUNTY - NORTH CAROLINA
****
DESIGN AT 48,000 LB/DAY

MATERIAL BALANCE SUMMARY

(LB/HR)

MATERIAL IN

SLUDGE COMBUSTIBLES	1600
SLUDGE INERTS	900
SLUDGE MOISTURE	8864
FUEL	583
STOIC AIR FOR SLUDGE	12124
EXCESS AIR FOR SLUDGE	4850
STOIC AIR FOR FUEL	8158
EXCESS AIR FOR FUEL	3263
MOISTURE IN AIR	284
TOTAL	40626

MATERIAL OUT

DRY GASES	28811
MOISTURE IN GAS	10915
SLUDGE INERTS	900
TOTAL	40626

UNCOMBE COUNTY - NORTH CAROLINA
****
ESIGN AT 48,000 LB/DAY

GENERAL INFORMATION
****

NET HEAT REQUIRED BTU/HR:	8084666
FUEL REQUIRED GPH :	79.88553
AIR REQUIRED FOR FLUIDIZATION SCFM:	6310.133
AUX FUEL AVAIL FACTOR :	74.96529
BTU/LB H20 EVAPORATED :	3672.274
EXCESS AIR REQD ON SLUDGE % :	40
TOTAL GAS FROM FURNACE LB/HR :	39726.36
ACFM :	34392.1
ENTHALPHY AT EXHAUST BTU/LB DG:	842.4321
HUM RATIO AT EXHAUST:	.3788441
ADIABATIC SAT TEMP F :	181
ENTHALPHY AT SATURATION: BTU/LB DG	818.78
HUM RATIO AT SATURATION:	.6878
ADIABATIC SAT VOLUME SCFM :	16244.32
ENTHALPHY AT STACK BTU/LB DG:	63.98001
HUMIDITY RATIO AT STACK:	.04312
STACK VOLUME ACFM:	7242.693
TOTAL HEAT AVAIL BTU/HR :	1.479947E+07
WATER EVAPORATION GPM:	17.78864
PRECOOLER WATER GPM:	35.57728
VENTURI WATER GPM:	121.8324
AFTERCOOLER WATER GPM:	477.5697
TOTAL SCRUBBER WATER GPM:	634.9794

BUNCOMBE COUNTY - NORTH CAROLINA
****
DESIGN AT 48,000 LB/DAY

SPECIFIC HEAT CO2 BTU/LB/F: .2639886

SPECIFIC HEAT N2 BTU/LB/F: .2652067

SPECIFIC HEAT SO2 BTU/LB/F: .1872919

SPECIFIC HEAT H2O BTU/LB/F: .4996575

SPECIFIC HEAT O2 BTU/LB/F: .2444371

COMBUSTOR EXHAUST GAS COMPOSITION:

	MOL/MIN	LB/HR	% VOLUME
CO2:	1.906651	5033.558	7.326894
N2:	13.02613	21883.9	50.05694
SO2:	3.037315E-03	11.66329	1.167182E-02
O2:	.9803244	1882.223	3.767199
H2O:	10.10649	10915.01	38.8373
TOT:	26.02264	39726.36	100

PERCENT O2 IN EXHAUST BY WEIGHT (dry): 6.532922

HEAT EXCHANGER GAS OUT TEMP F : 867.4605

HEAT AVAILABLE FOR BOILER : 6381784

STEAM AT 450 PSIG 100 F SUPERHEAT: 5527.117

POWER GENERATION KW/HR : 297.2071

FB-BUN5
Ok