Ash Recycling in Nashville, TN

Presented by

Gianni B. Arcaini
Chairman and CEO of
Environmental Capital Holdings, Inc.
And
American Ash Recycling Corp.

NAWTEC Conference in Nashville, TN

May 22, - 24, 2000

I. Metropolitan Government of Nashville's Alternatives

When Metro Nashville's monofill reached the end of its capacity in 1991, the City issued an RFP for the disposal of its annual 85,000 tons of Municipal Waste Combustion (MWC) ash generated at Nashville's Thermal Transfer Incinerator.

The lowest bid for transportation and disposal at the time was $65/ton.

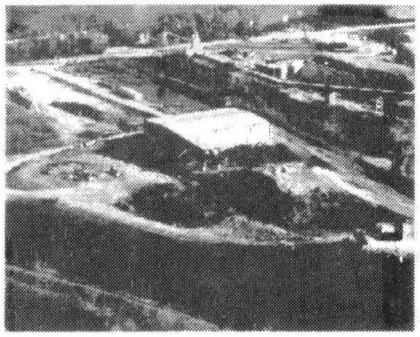
At the request of American Ash Recycling Corp. (AAR), the Metro Government amended the RFP to include metals recovery and later ash recycling.

Parallel to AAR's effort to secure the ash recycling contract, American Ash also pursued beneficial re-use permits at the Tennessee Department of Environmental Conservation (TNDEC).

Following contract negotiation and TNDEC's issuance of a permit by rule, AAR constructed its first large-scale commercial MWC ash recycling facility, which commenced operation in August of 1993.

The initial contract was signed in January of 1993 and expired in 1998 at which point Metro issued a renewed RFP. The RFP process was extensive and again re-visited all available disposal and recycling alternatives. As a result of the extensive RFP process, Metro contracted American Ash Recycling in October of 1998 for an additional 5-year period.

II. The Facility.



The facility is located on Metro's monofill. A fully enclosed 15,400 square foot building houses the process (13,150 square foot) and Fe metal storage (2,250 square foot). An additional paved and covered area of approximately 4,050 square foot is used for material storage. The MWC ash is mined from the adjacent monofill cells and stored daily under cover for processing during the following day.

III. The Process.

The process is designed to recycle mixed Municipal Waste Combustion ash at a rate of 60 tons per hour or approximately 90,000 tons per year in a single shift operation.

The first step in the process is a size separation that results in three material streams e.g. A) 4 inches and greater, B) 2 to 4 inches, and C) smaller than 2 inches.

Stream A, the course material containing approximately 50% metals, is first subjected to metals separation. The separated metals are subsequently hand picked for contaminants (especially rags and copper containing motors) and then conveyed to a ferrous washing station. The remainder of this course stream is discharged and collected in the unburned (UBC) materials bin.

Stream B, first passes magnetic separation and is directed subsequently to a size reduction unit. The resulting material is joined with stream C (< 2"). The combined material stream passes magnetic separation and is conveyed to a fine

screen. The fine screen segregates material 0.375 inches or less in size, which is conveyed to a Wes-PHix® treatment station and subsequently discharged to a storage area for beneficial re-use. The material not passing the fine screen is directed to an Eddy Current Non-Fe metal separator. The Non-Fe metals are washed and subsequently hand picked to separate brass, copper and coins from the aluminum and finally stored until transported to the market. The ash stream is conveyed to the WindZifter, a proprietary device that separates unburned materials (such as plastic, wood and paper) and is thereafter re-introduced to the size reduction equipment discussed above. This material continues in that loop until it is discharged from the fine screen. The unburned material is discharged to the UBC storage bin.

All ferrous metals collected at the various magnetic separation points are directed to a combined washing and size classification station. There, the ferrous metals are first washed and then separated in three sizes. This size classification is done for maximum flexibility in marketing the metals.

IV. The Products

On average, AAR has recovered the following materials from the ash stream:

Aggregate	84.5%
Ferrous Metals	7.5%
Non-Fe Metals	0.6%
UBC	6.5%
Moisture	0.9%
Total Ash Recycled	**100.0%**

The aggregate is marketed under the trade name **AggRite** (formerly known as TAA) and is used as structural fill and as high quality road base material. The statistics for ash recycling in Nashville are quite impressive.

	Total Ash Recycled	Aggregate Recovered	Ferrous Recovered	Non-Fe Recovered	Unburned	Moisture
1993	18,446	15,410	1,943	130	833	130
1994	107,392	91,997	9,598	730	4,383	684
1995	87,720	74,830	6,034	458	5,534	864
1996	81,077	67,000	5,935	557	6,561	1,024
1997	79,888	68,201	5,527	488	4,907	765
1998	49,407	41,371	3,537	321	3,615	564
1999	86,918	73,145	5,632	498	7,666	352
2000YTD	22,947	19,225	1,630	145	1,164	407
Total	**533,795**	**451,179**	**39,836**	**3,327**	**34,663**	**4,790**

V. Beneficial Use Applications

Given its exceptional physical engineering characteristics, **AggRite** is used in many different applications. Average Proctor Density is 108.9 lb/ft^3, Average Moisture Content is 10.1%, Permeability is 2.5 x 10^{-6} cm/sec, and Material Swelling is 0%. Material particle size distribution is uniform and direct shear behavior is considered excellent.

Dry Basis

	[illegible]	[illegible]
1/2 Inch	0.09	99.91
3/8 Inch	1.95	97.97
#4	28.25	69.72
#8	21.98	47.74
#16	14.70	33.04
#30	9.77	23.27
#50	7.91	15.36
#100	6.38	8.98
#200	4.11	4.88
<#200	4.80	0.08
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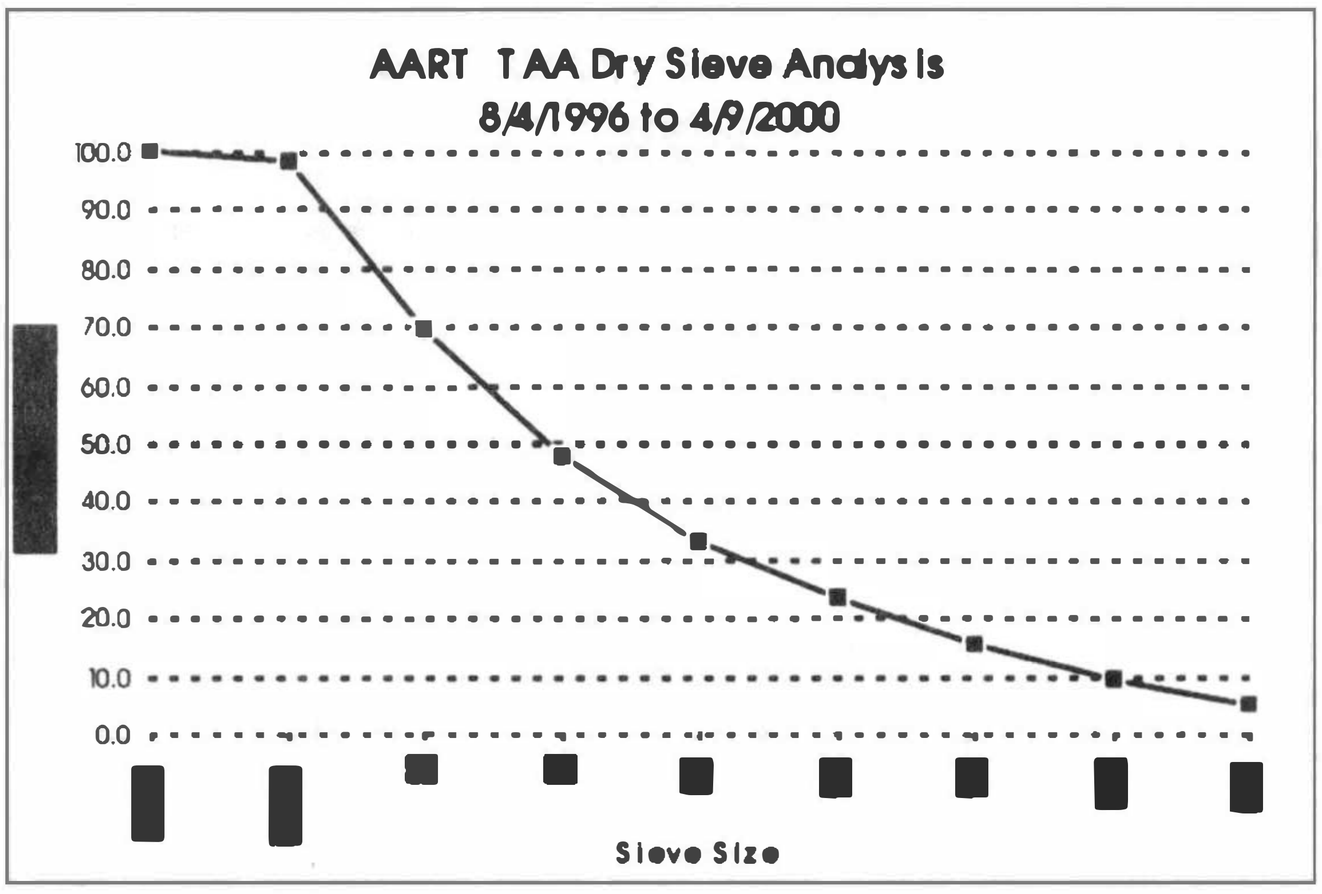
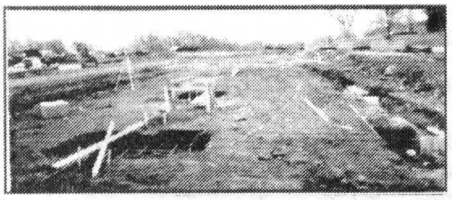
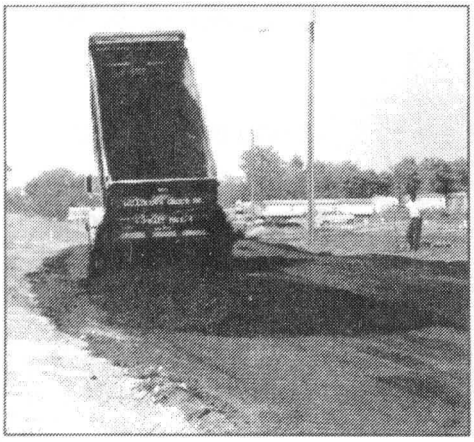


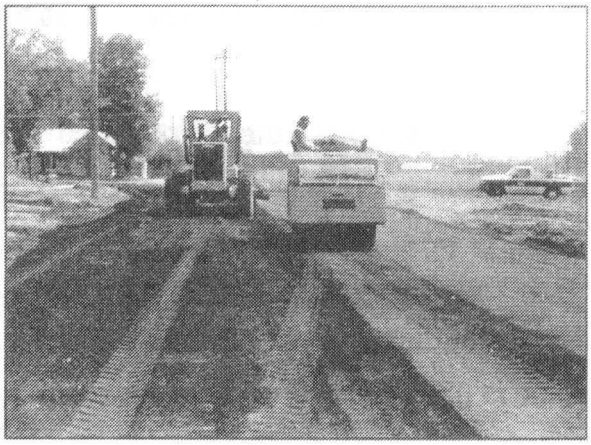
AggRite As Base Material



The high internal shear strength, free draining characteristics, exceptionally favorable compaction density, uniform and consistent gradation of AAR's processed ash aggregate make it an excellent structural fill material.

AggRite in Road Construction





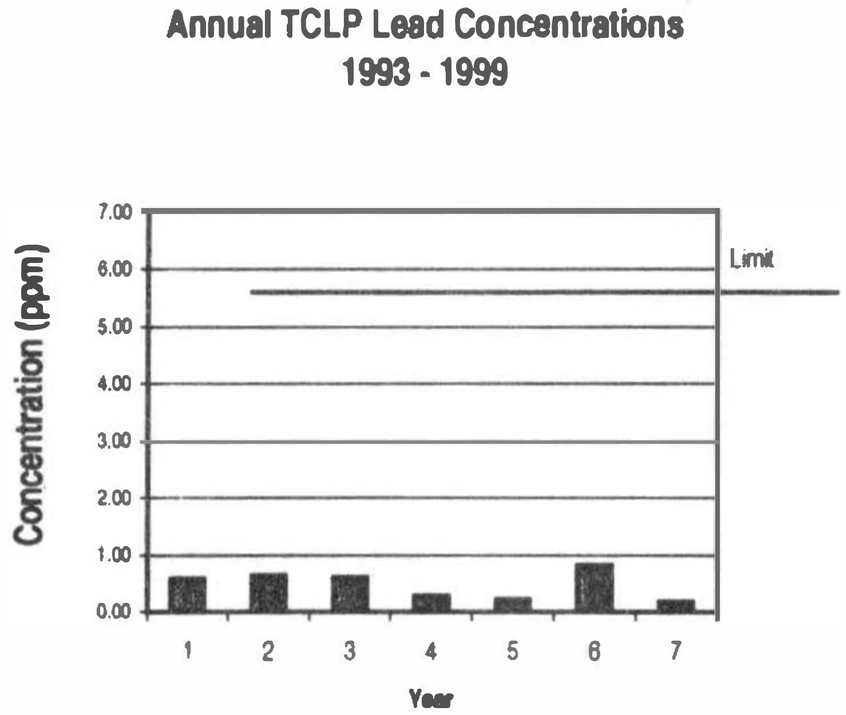
VI. Environmental Issues

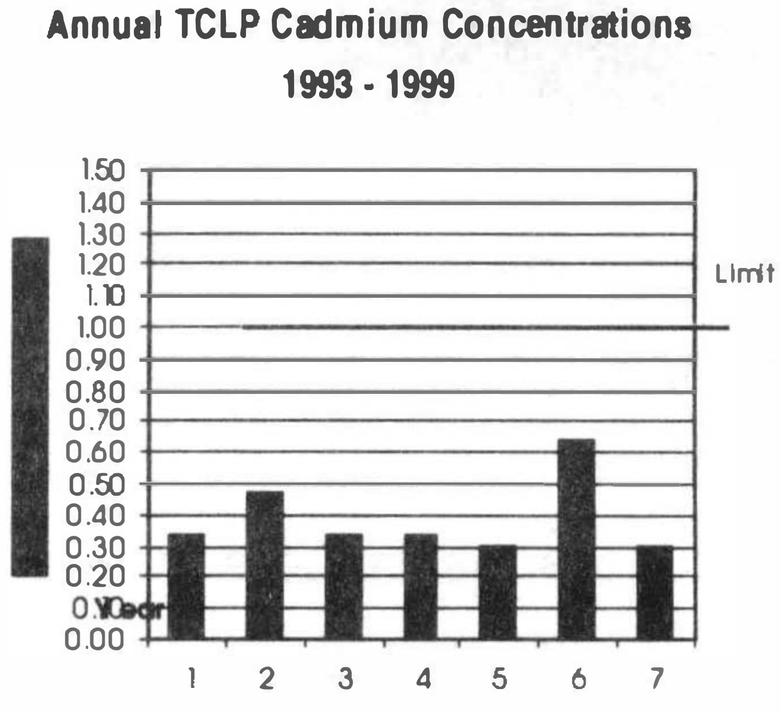
Since the beginning of operation **AggRite** samples have been taken twice daily. A total of 3,400 single samples and more than 1,130 composite samples have been analyzed for a diverse aray of chemical constituents.

Test results have consistently shown that heavy metals of concern are well below all regulatory limits and often below instrument detection limits.

A comprehensive QA/QC program has been established and has been vigorously enforced since start up of the facility. The QA/QC program is multi-

dimensional and includes daily, weekly, quarterly and annual testing of **AggRite** both for physical and environmental characteristics.

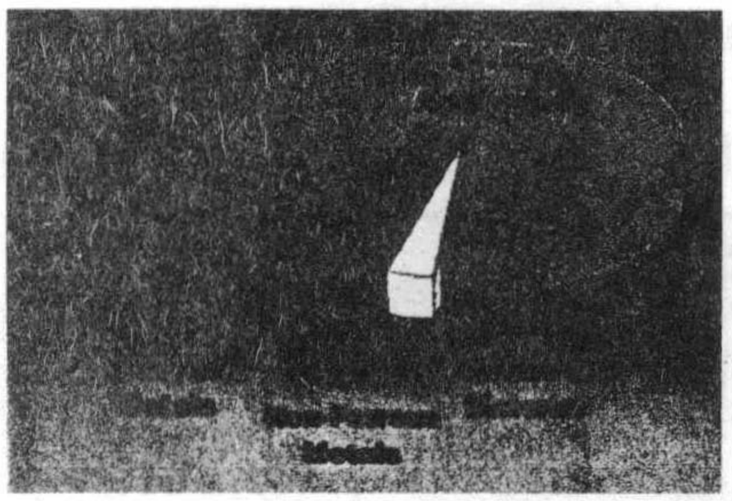




To evaluate the safety of **AggRite**, the company enlisted prominent independent scientists such as Dr. Haia Roffman and Dr. Frank Roethel to perform several life cycle human health risk assessments (HRA). The HRA's evaluated 47 different potential exposure scenarios. All studies conclude that the potential carcinogenic and non-carcinogenic risks in connection with the use and the application of **AggRite** are well below EPA and TNDEC regulatory limits. Multiple state regulatory agencies have independently reviewed the HRA's and have concurred with the findings of AAR's own team of experts and have concluded that **AggRite** does not pose a risk to human health and the environment.

VII. Closing the Loop and Conclusion

The Metropolitan Government of Nashville and Davidson County had originally planned to close the monofill by April 1994. AAR's MWC ash reycling activity extended the life of this monofill in to perpetuity. In addition, the City's cost of MWC ash management over the past 7 years that AAR's facility has operated



was less than half of the expense that it would have incurred had the ash been disposed of in a off site location.

It should be noted that the Metropolitan Government of Nashville and Davidson County was the first administration in the United States that achieved virtually 100% of recycling through their municipal solid waste management program. The incineration reduces the volume of MSW to 30% and AAR's ash recycling process reduces that volume to zero. The recycling facility has now operated for over 7 years with what is considered the most successful ash reycling activity in the history of the United States.