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Jerry Costello

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460



JUN - 8 1993

OFFICE OF
RESEARCH AND DEVELOPMENT

Honorable Jerry F. Costello
House of Representatives
Washington, D.C. 20515

Dear Congressman Costello:

Thank you for your letter of April 26, 1993, concerning your constituent, Mr. Don Brown of Abdelmalek Associates, Inc. of St. Louis. Abdelmalek Associates has a process which may be able to clean boiler flue gases, increase power production and liquefy sulfur dioxide and carbon dioxide for resale.

The Environmental Protection Agency (EPA) has communicated with Mr. Brown and we have taken the liberty of enclosing our correspondence. We have evaluated his process as discussed in letters dated June 3, 1992 and September 2, 1992, from Frank Princiotta, Director of the Air and Energy Engineering Research Laboratory (enclosed). The major findings of the evaluation were: 1) the system is very complex and costs are likely to be unacceptable to potential users; 2) markets for the by-products to offset the high cost would be difficult to find; and 3) the system requires technology whose operation raises questions of practicality and scientific validity.

We have outlined why EPA cannot fund his project, and suggested other possible sources of government funding and private sector assistance. Presently, we can offer nothing further. We wish Mr. Brown success as he attempts to optimize and commercialize his process.

Your continued interest in the mitigation of air pollution is appreciated.

Sincerely yours,

A handwritten signature in cursive script, reading "Gary J. Foley", is written over the typed name.

Gary J. Foley
Acting Assistant Administrator
for Research and Development

Enclosure



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MAR 30 1993

Mr. Don Brown
Abdelmalek Associates, Inc.
13610 Barrett Office Drive, Suite 200
Saint Louis, Missouri 63021

Dear Mr. Brown:

Thank you for your letter of February 23, 1993, to the Administrator, requesting funding to construct a prototype model to demonstrate the feasibility of your new patented invention to clean boiler flue gases.

You should be aware that the Environmental Protection Agency (EPA) does not normally support the commercialization of privately developed technologies. However, because we are aware of the difficulties entrepreneurs face, EPA has helped to establish the National Environmental Technology Applications Corporation (NETAC), a non-profit corporation devoted to facilitating commercialization of environmental technologies. On a fee-for-services basis, NETAC may be able to assist in accessing private sources of financing and help overcome impediments to commercialization. NETAC can also assist in business development, preparation of business plans, licensing and royalty agreements. Enclosed is a brochure describing NETAC's program.

We note that you have submitted your proposal to the Department of Energy. They have substantial programs in the area and may be interested. I also want to reiterate Mr. Princiotta's concerns with the practicality of your process as stated in his letters to you of June 3 and September 2, 1992. If you have not addressed these in detail I believe you should before proceeding further.

I wish you success in your endeavors. Your interest in the mitigation of air pollution is appreciated.

Sincerely yours,

Gary J. Foley
Acting Assistant Administrator
for Research and Development

Enclosure



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
AIR AND ENERGY ENGINEERING RESEARCH LABORATORY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

SEP 02 1992

Mr. Fawzy T. Abdelmalek, P.E.
President
Abdelmalek Associates, Inc.
13610 Barrett Office Drive, Suite 200
Saint Louis, Missouri 63021

Dear Mr. Abdelmalek:

My letter of June 3, 1992 contained analysis and comments concerning your invention, "Flue Gas Cleaning by Separation & Liquefaction of Sulfur Dioxide and Carbon Dioxide." I told you that I could not be encouraging about your invention for reasons which, boiled down to their essentials, were: 1) the system was so excessively complex and costly that it would be unacceptable to the potential users; 2) markets for the by-products to offset the high cost would be difficult to find; and 3) the system requires technology whose operation flies-in-the-face of science and reality.

In your letter of August 21, 1992 you provided some counter comments plus a copy of your newly issued Patent No. 5133190. Your comments do not alleviate the concerns expressed previously, and consequently leave us unswayed. The patent generally contains the same information previously submitted to us.

The August 21, 1992 letter invited us to become a member of a team to demonstrate and develop the invention. For the reasons and concerns previously stated we must decline.

Sincerely yours,

A handwritten signature in dark ink, appearing to read "Frank T. Princiotta".

Frank T. Princiotta
Director (MD-60)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
AIR AND ENERGY ENGINEERING RESEARCH LABORATORY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

JUN 3 1992

Mr. Don Brown
Business Development
Abdelmalek Associates, Inc.
13610 Barrett Office Drive, Suite 200
Saint Louis, Missouri 63021

Dear Mr. Brown:

My staff has reviewed the inventions disclosed under a confidential disclosure agreement that related to 1. Flue Gas Vapor Emission Reduction, and 2. Liquification of SO_2 and CO_2 . The material provided appears to have been extracted from applications made to the Patent and Trademark Office. The first description is of a process that operates by recovering additional energy from the flue gas before its discharge. Simultaneously the process collects some portion of the SO_2 in the flue gas and discharges it as part of the condensed water vapor stream. The second description, a continuation-in-part to the first process, is for an additional embodiment for liquefying and collecting, as useful by-products, SO_2 and CO_2 .

The material disclosed processes for which complete engineering, cost, and by-product marketing analysis would be very complex, time consuming, and costly. Instead, the evaluation drew upon years of experience with pollutant reducing processes for coal fired utility boilers. This enabled an examination of those key elements of the inventions that would determine, with reasonable accuracy, whether-or-not the processes had commercial and environmental viability. Using this approach, the evaluation performed upon the inventions does not allow me to be very encouraging in respect to their usefulness and acceptability.

I would like to share with you some thinking that went into the evaluation. Consideration of our comments might prove useful in development of the inventions.

In general, the process will recover some of the heat energy currently discharged to the atmosphere, and convert it into useful energy. Flue gas is usually discharged at a temperature above the acid dew point. This allows the use of lower cost, less corrosion resistant construction material. The lower operating temperature, from application of the invention, will require more expensive, acid-resistant materials for heat exchangers, centrifugal separators, pumps and blowers, pipes, tanks, and ducting. In addition the quantities of condensed dilute acidic waste water must be

neutralized before discharge to meet water treatment requirements. The intent to eliminate solid waste producing scrubbers, has instead created a waste water treatment requirement.

In return for the more complex process, expensive construction, and waste water treatment there is an impressive work-produced improvement of about 24%. This results from about 6% percent additional recovery by using an isentropic expansion engine instead of a isenthalpic throttling expansion for the refrigeration portion of the system. The additional 18% percent results from using some of the available refrigeration for cooling the low pressure turbine exhaust. However, the 24% work-produced improvement, which is from the illustrative example, is too optimistic. It was based upon a 450 °F flue gas temperature instead of the more usual 275-300 °F. In addition, the steam condensate temperature used was 180 °F, which is very much higher than the usual condensing temperature for the low pressure exhaust steam from a turbine. By using more representative temperatures the work-produced improvement would be considerably less, and would probably not be as impressive. Considering the cost, complexity, uncertain effect upon the reliability of the power plant, and questionable benefit it is unlikely that this invention would find acceptance in the industry.

The SO₂ and CO₂ liquification embodiment provides by-products whose sale would hopefully offset the increased cost and complexity of the additional equipment needed to produce them. It is not certain that there would be sufficient local markets for the by-products. Sulfur is shipped considerable distances, were most is converted to sulfuric acid to service local needs. With SO₂ the situation is different, along with the sulfur values it is necessary to ship an equal weight of oxygen. Not only is the shipment of SO₂ more difficult than shipment of sulfur, it is also necessary to have storage facilities at both terminals for the liquid. The ability to market the CO₂ is even less certain. Many potential uses involve the food industry. There is no indication that the CO₂ product would be sufficiently pure. One concern with the separation system would be the presence of detectable amounts of SO₂ as in impurity.

A key element and claim of the embodiment is a means for neutralizing and agglomerating the "charged particles and airborne gas molecules" exiting from the electrostatic precipitator thus helping their further collection to minimize corrosion and erosion of the equipment" and preventing their being "deposited on surfaces of nearby buildings." It is claimed that the "positively" charged particles and airborne gas molecules exiting the electrostatic precipitator immediately seek, deposit, and adhere to any grounded surface. The particles and airborne gas molecules receive additional positive charge by being caused to flow through a screen charged with high positive voltage. The particles then flow through a screen charged with a high frequency alternating current of about 177 kHz. The rapidly reversing alternating current will cause "half of the ions of the molecule (to) reverse its polarity, consequently the molecular charge is neutralized." Furthermore "the molecules having opposite polarity will collide to form larger particles."

The mechanism and description relating to the charged particles and airborne gas molecules do not represent actual facilities or the physics of electrostatics. Furthermore, it is possible that the system as described can do more harm than good. Most of the boilers to which the invention would be applied are meeting current particulate regulations, and consequently emit minor quantities of particle matter. The particles that do exit from the vast majority of electrostatic precipitators have a negative charge instead of a positive charge; only one electrostatic precipitator company, having a minute fraction of the market, operates with positive polarity and consequently places a positive charge upon the particles. Passing unipolar particles through a screen having the same polarity will have minimal effect upon the particle charge. Charging of particles is most effectively accomplished by exposing them in a strong electric field to ions generated by the corona process. The high frequency alternating electric field would have the effect of making the charged particles and airborne gas molecules, or ions, vibrate back and forth, subject to restraints imposed by viscosity and inertia. Any vibrational movement that does occur would be work that would make an energy demand upon the system. Agglomeration and additional collection will not be the expected results of such a system. For more particle collection, the simplest and most effective approach is to add additional electrostatic precipitator collecting area.

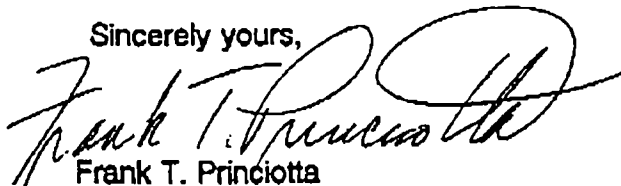
As the strength of the high frequency electric field increases, other unwanted effects may start to occur. This portion of the invention as described has the essentials of a device known as a silent corona reactor. The silent corona reactor is used for ozone generation. It is an inefficient device because of an excessively high power demand. If the device operates in the silent corona mode it could generate large amounts of ozone which would emit as a pollutant. The ozone could also form higher oxidation states of SO_x and NO_x .

With the employment of the embodiment the invention is considerably more complex, which relates to operability and reliability. The availability of uses for the liquids within the local marketing area is questionable. The potential benefits are not sufficiently strong to make the invention attractive to potential users.

Thank you for your interest in improving our ability to control pollution. I am sorry that I could not be more encouraging.

I am enclosing all of the material that you sent under the confidentiality agreement.

Sincerely yours,



Frank T. Princiotta
Director (MD-60)

Enclosure

THE WHITE HOUSE
WASHINGTON

April 29, 1993

The Honorable Jerry F. Costello
Congress of the United States
House of Representatives
Cannon House Office Building
Room 119
Washington, D.C. 20515

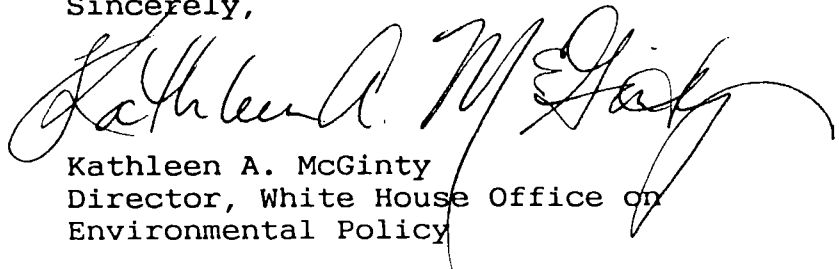
Dear Congressman Costello:

Thank you for contacting me regarding the work of Mr. Don Brown of Abdelmalek Associates, Inc. It was good to hear from you.

I certainly appreciate learning of Mr. Brown's efforts in creating a process to clean boiler flue gases. I have passed on the information to the Administrator Browner and Secretary O'Leary for their review.

Again, I appreciate hearing from you.

Sincerely,



Kathleen A. McGinty
Director, White House Office on
Environmental Policy

KAM/avl

cc: Administrator Carol Browner
Environmental Protection Agency
Secretary Hazel O'Leary
Department of Energy

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JERRY F. COSTELLO

21ST DISTRICT, ILLINOIS

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Congress of the United States

House of Representatives

Washington, DC 20515-1321

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ENERGY RESEARCH AND DEVELOPMENT
SCIENCE RESEARCH AND TECHNOLOGY
SELECT COMMITTEE ON AGING

April 26, 1993

Ms. Katie McGinty
Director
Office of Environmental Policy
Vice President Gore's Office
O E O B, Room 36
Washington, D.C. 20501

Dear Ms. McGinty:

I am writing to make you aware of an environmentally-beneficial project that Mr. Don Brown of Abdelmalek Associates, Inc. of St. Louis has shared with me. Mr. Brown's engineering firm has created a process which would clean boiler flue gases, increase power production and liquefy sodium dioxide and carbon dioxide. I have enclosed for your information copies of documentation he has given me relating to this project.

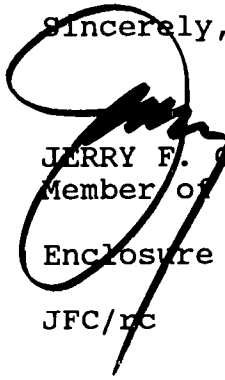
The flue gas cooling process will be capable of reducing the temperature of the boiler flue gas below its vapor dew point temperature to condense approximately 75 percent of the acid vapor and recover its heat of evaporation. Users will recover enough energy from flue moisture to increase their power production enough to recover their capital investment in five to six years or less.

This process can burn high sulfur coal without going to the use of an expensive scrubbing method and reduces coal consumption. The system will desulfurize gas and liquefy sodium dioxide and carbon dioxide which are marketable products in other industries. Several scientists and engineers in both Illinois and Missouri have reviewed the process and can endorse the process's benefits.

With coal being a major industry and energy source in my congressional district, I am supportive of technologies which will allow for cleaner burning coal and simultaneously be in compliance with federal and state clean air laws. I would ask that the Administration give this process full consideration for wide-scale implementation as a means of keeping in line with the nation's Clean Air Act guidelines.

A great amount of money and time have been invested in this process, and I would appreciate your sharing this information with the proper officials in the executive branch for further consideration. Please let me know your initial feelings on this matter. Thank you for your time and attention.

Sincerely,



JERRY F. COSTELLO
Member of Congress

Enclosure

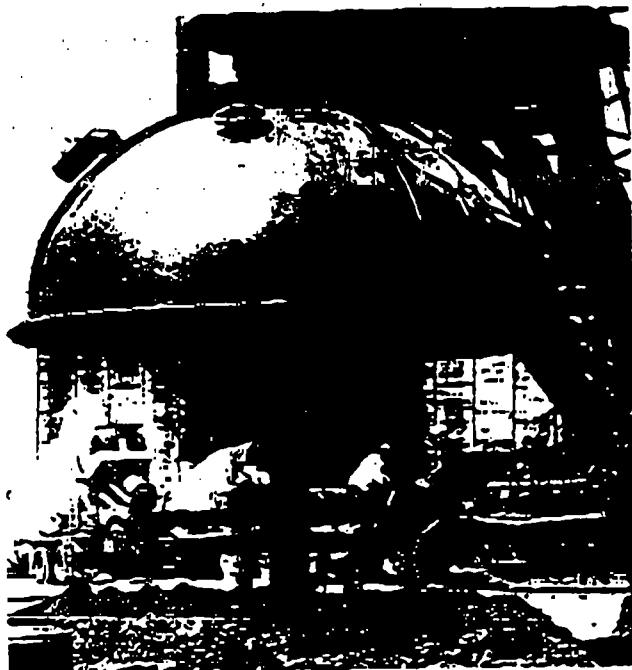
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POLLUTION ENGINEERING IDEA BANK



by Lori Nudo, Associate Editor

THE BOB HUNTER
PEABODY COAL
342-3422 FAX



Remediate Soil, Sludge on Site

MecTool and Aqua MecTool remediation systems are designed to treat contaminated soils and sludges in situ at production rates as high as 100 cubic yards per hour. Systems can treat a soil column up to 18 feet in diameter, to depths exceeding 100 feet in a single pass. As an injection/venting system, MecTool removed 96 percent of volatile organic compounds (VOCs) in a single pass. Systems feature soil boring tools capable of injecting gases, liquids and heavy grout and a mechanical shroud collection system that draws off vapors and other airborne contaminants during remediation

before they reach the atmosphere. The combined rotary and vertical movements of the system in the soil column create a highly uniform matrix for maximum contact between contaminants and remediation agents. Aqua MecTool is a high-volume underwater remediation system that uses an underwater containment mechanism to reduce turbidity and prevent the contamination of surrounding waters. Applications include bioremediation, solidification and stabilization, soil washing and soil vapor extraction and construction of subsurface site containment walls.

Circle No. 422

Clean Flue Gas By Condensing Acidic Vapors, Liquefying SO₂

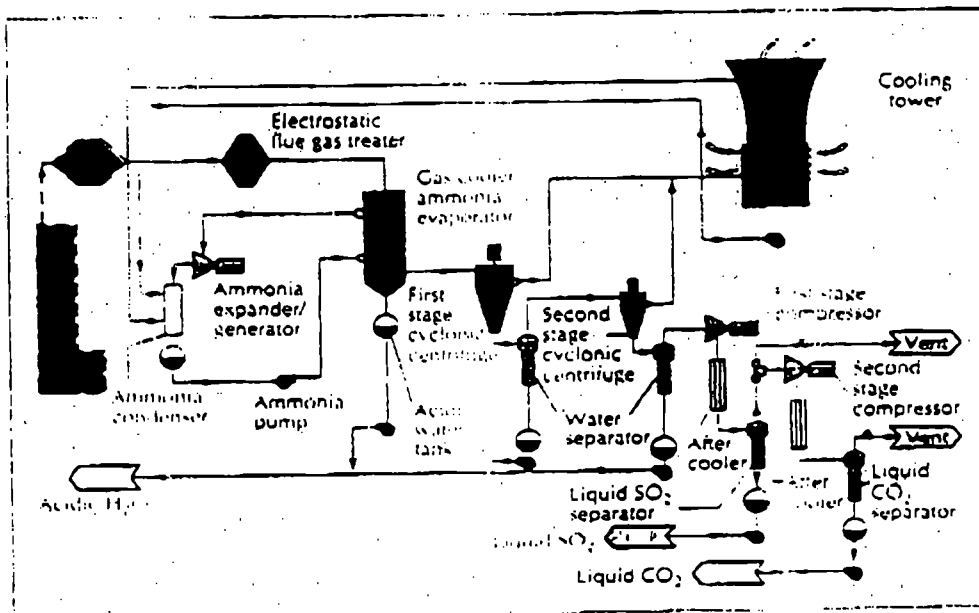
A patented process uses an ammonia power cycle to clean flue gases from power plants burning high sulfur coals. This closed-loop cycle generates electric power that is reused in the process, while cooling flue gases and condensing its acidic vapors. The electric power generated by the system amounts to about 3 percent of the net power produced by the plant and is used to remove 60 percent to 70 percent of acidic water vapors and to liquefy 40 percent to 99 percent of sulfur dioxide (SO₂) and a desired percent of carbon dioxide (CO₂). Once electricity is produced the flue gas is cooled to about ambient temperature. Gas cyclonic centrifuges then separate the flue gas into two streams — a light gas stream rich in nitrogen, and a heavier stream containing the SO₂ and CO₂.

SO₂ and CO₂ are liquefied by compression and further cooling processes. The cleaned flue gas is then diffused through a cooling tower, which creates a

strong air draft to carry the gases into the atmosphere. Liquefied SO₂ and CO₂ can be used in the manufacture of chemical products. This process is said

to dramatically reduce the costs of the raw materials such as lime and the volume of solid wastes for disposal.

Circle No. 420



'Scrubber' Project Is Halted; Illinois Coal Use Could Suffer

By Robert Goodrich
and Robert Kelly
Of the Post-Dispatch Staff

Illinois Power Co. announced Monday that it had halted work on anti-pollution "scrubbers" for the smokestacks at its Baldwin power plant after sinking about \$20 million into the \$350 million project.

Scrubbers would allow continued burning of high-sulfur Illinois coal without violating federal and state clean air laws.

Company officials said an Illinois Commerce Commission decision last month had led them to question whether they could recover the cost of the scrubbers.

They said the commission had disallowed a request to charge customers for some of the expenses and taxes incurred in building the company's nuclear generating plant in Clinton.

Larry D. Haab, Illinois Power Co. chief executive officer, said, "The current uncertainty of the regulatory and legal climate puts us in a position of having to review all of our plans for significant future investment."

But Gerald Hawkins, legislative director for the United Mine Workers,

said cost recovery of the scrubbers was guaranteed. He said the decision on the Clinton nuclear plant was a separate issue.

An Illinois law that was passed last year requires the scrubbers, Hawkins asserted. "We will urge the attorney general to seek an injunction to mandate that the company comply with the law."

Craig Nesbit, an Illinois Power Co. spokesman, said the scrubber law conflicts with another state law that requires utilities to choose the least expensive option in such situations.

The least costly option in this case is to switch from high-sulfur to medium-sulfur Illinois coal for the remainder of this decade, he said.

When the scrubber project was started, the state's own experts were claiming that the supply of medium-sulfur coal was inadequate, which later proved false, Nesbit said.

He said Illinois Power remains committed to using Illinois coal at Baldwin but will switch from high-sulfur coal supplied by Peabody Coal Co. and Arch Coal Sales to medium-sulfur coal to be supplied by a Consol Inc. mine at Sesser, Ill.

*THIS PROVES DOUBTS ABOUT
"SCRUBBERS"*

Coal & Synfuels Technology

Vol. 13, No. 42 - October 26, 1992

Plant to host research projects

An ultra-clean coal plant in Australia has been relocated and enlarged so that a wide range of research projects can be nurtured there.

Developed 10 years ago by the federal Commonwealth Scientific and Industrial Research Organization (CSIRO), the plant is a joint venture between the Australian Coal Industry Research Laboratories (ACIRL), White Mining Ltd. and the New South Wales energy office. ACIRL's facilities in Maitland, northwest of Sydney, now house the plant.

CSIRO researchers are identifying coals that could be used in making substitute fuels for diesel engines and direct-fired gas turbines.

The plant's partners see ultra-clean coal, with less than 1% ash, as a source of industrial carbon products and as the main ingredient in a new coal-water mixture capable of replacing heavy fuels Australia now imports.

Ultra-clean coal is created by chemical leaching with caustic soda before it is washed in diluted acid.

Japan holds clean coal day

Trying to show the public the coal industry is environmentally responsible, Japan recently held its first clean coal day, sponsored by the country's largest independent oil and energy company, Idemitsu Kosan Co. Ltd.

The company's senior managing director, Masao Suma, has been arguing that instead of limiting coal use, efforts should be made to burn it cleanly. He is a strong advocate of immediate worldwide acid rain counter-

measures. Idemitsu Kosan has been promoting itself as a clean coal company, especially since its laboratories have become involved in gasification, liquefaction and coal-water mixture research. It is also a member of a Japanese consortium trying to develop technology to convert Australian brown coal into oil.

Endorsed by Japan's coal users, the clean coal day was pushed by Suma, who launched the event after observing national coal week in Australia. Suma, planning to make clean coal day an annual Japanese event, would like to see it observed internationally.

Energy company strives for first contract

A small energy company in Masontown, Pa., is inching toward scale production of clean-burning coal pellets expected to bring in \$1 million in the company's first fuel contract.

Upon successful test burns at Ball State University in Muncie, Ind., this winter, Pellet Energy Inc. plans to churn out 36,000 tons/yr of low-sulfur pellets made from fine coal and dry paper waste taken from refuse incinerators. Indiana coal and lime also would be used in this application.

Muncie Indiana Municipal Waste Authority, supplying the waste, was the test site in line as the company's first fuel customer.

Herb Steinman, president of the newly formed Pellet Energy, says in addition to successful testing, full-scale production also depends on project financing. He said Muncie authorities "should have a bond in place by next month."

With more than 30 years of coal preparation experience, Steinman is a raw material engineer retired from Jones and Laughlin Steel Co. He heads a 15-employee company that, celebrating its first year in business this year, grosses \$4 million/yr. This revenue is derived from the company's consulting work.

(Continued on page 8)

Two utilities' clean air plans focus on scrubbers

Two utilities — one in the Midwest, the other in the East — are planning to scrub several of their coal-fired plants to meet Clean Air Act restrictions, with coal switching playing a more limited role in long-range plans.

Also generating interest, but still relegated to a wait-and-see mode, is the highly speculative SO₂ trading market.

Although most Phase 1 plans are completed, there is little Phase 2 activity in progress, observed a Babcock & Wilcox Co. official, who said that many Phase 1 decisions overlap and affect a post-2000 strategy.

That is certainly true as Indianapolis Power & Light and Baltimore & Electric Co. look at developing a flexible strategy that will offer ratepayers a least-cost approach to system-wide compliance. Both utilities have submitted to their state public service commissions clean air plans.

GEESI picked to supply scrubbers

For starters, General Electric Environmental Systems Inc. (GEE) has been selected to install two scrubbers at IP&L's Petersburg station, with construction set for May.

IP&L is tentatively planning to go the whole technological gamut and may incorporate fuel switching and flue gas desulfurization upgrades.

Inside

- Fuel switching highlighted in PEPCO plan p. 10
- Consumers irked by Gavin scrub p. 12
- Coal-fired MHD inches forward p. 14

- 1) FYI, MOST POPULAR DESULFURIZATION OF FLUE GAS OF POWER PLANT IS TO ABSORB AND NEUTRALIZE SO₂ WITH MILK OF LIME (CALCIUM HYDROXIDE), WHERE GYPSUM COMES OUT AS BY-PRODUCT STP THIS TECHNOLOGY IS WELL ESTABLISHED AND USED FOR MANY POWER PLANTS IN THE WORLD
- 2) ABDELMALEK'S IDEA IS INTERESTING BECAUSE OF CENTRIFUGAL GAS SEPARATION, LIQUIFICATION OF SEPARATED GAS WHERE THERE PRODUCES NO BY-PRODUCT
- 3) HWVR, EVEN IDEA ITSELF IS INTERESTING, CAPITAL COST AND OPERATION COST MUST BE COMPETITIVE IN ACTUAL USE VIS-A-VIS CONVENTIONAL METHOD STP IN THIS RESPECT MHI HAS BIG QUESTIONS WITH RESPECT TO ELECTRIC POWER USED FOR CENTRIFUGE AND CAPITAL COST, I.E., THEY SEEM TO BE EXTREMELY UNDERESTIMATED STP FOR EXAMPLE ELECTRIC POWER USED FOR FIRST STAGE CENTRIFUGE IS 3.5 MW BUT IT CANNOT BE SUCH LOW THINKING THAT ELECTRIC POWER USED FOR BLOWER OF FLUE GAS DE-SO₂ PLANT OF 500MW POWER PLANT IS MORE THAN TEN TIMES OF IT STP NORMALLY CENTRIFUGAL SEPARATION OF GASES, WHICH HAVE SMALL SPECIFIC GRAVITIES, NEEDS LOT OF ENERGY: FOR EXAMPLE URANIUM SEPARATION IS COMMERCIALY DONE BY CENTRIFUGAL SEPARATION OF URANIUM FLUORIDE WHICH IS GASEOUS FORM BUT THOUSANDS OF CENTRIFUGAL SEPARATORS ARE USED
- 4) THEREFORE, IN ORDER FOR US TO SEE IF THIS IDEA IS WORTHWHILE TO STUDY FURTHER, WE NEED PERSUASIVE EXPLANATION WHERE AND HOW THESE COSTS FIGURES ARE DERIVED FROM WHICH ABDELMALEK'S PAPER DOES NOT MENTION AT ALL

FROM MITSUBISHI INTERNATIONAL CORP

Global Warming May Ignite Disease

Scientists Point To Burning Of Fossil Fuels

• 1993, Reuters News Service

OAKBROOK, Ill. — Global warming may unleash a host of deadly diseases and other ailments on a larger, more vulnerable world population, scientists at a conference on global warming warned Wednesday.

Outbreaks of malaria, cholera, diseases borne by various parasites, dengue and yellow fever will likely strike if man's burning of fossil fuels speeds up the greenhouse effect and heats up the earth, the scientists warned.

The world's population will find itself more susceptible to disease because the loss of more of the protective ozone layer in the upper atmosphere will allow in more of the sun's harmful rays that weaken humans' immune systems.

"The brunt will probably be borne by the poorer countries," who may see food and water shortages, Andrew Haines, professor of primary health care at University College of London Medical School, wrote in a paper on the health effects of global warming.

"The wealthier countries will be impacted upon by potentially large numbers of environmental refugees," as food and water shortages caused by warming cause mass migrations.

The increase in a key greenhouse gas may benefit plant life and help increase food production in some developed countries and in areas of higher altitudes.

Other regions, particularly where the climate already strains

"The wealthier countries will be impacted upon by potentially large numbers of environmental refugees."

ANDREW HAINES,
professor

the limits of agriculture, may not fare so well.

Warmer oceans will be ideal for algal blooms associated with diseases afflicting wildlife and with human cholera epidemics in South America and Asia, Harvard Medical School researcher Paul Epstein wrote in his paper.

Malaria-carrying mosquitoes and other insects may multiply on a warmer planet, and infections previously killed by cold weather may be more likely to survive, Haines added.

Rising sea levels, as the icecaps and glaciers melt, could worsen seacoast flooding and salinate fresh water supplies.

Roughly 100 scientists, academics and policy-makers were attending the three-day Global Warming Conference at a hotel in Oakbrook, a suburb of Chicago, sponsored by the academic journal World Resource Review.

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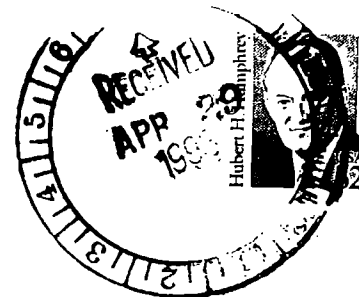
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THE WHITE HOUSE
WASHINGTON

The Honorable Carol Browner
Administrator, Environmental
Protection Agency
401 M Street, S.W.
Washington, D.C. 20460



THE WHITE HOUSE
WASHINGTON

The Honorable Carol Browner
Administrator, Environmental
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